MICHELE ACCIARO

Bundling Strategies in Global Supply Chains

Bundling Strategies in Global Supply Chains

Bundling Strategies in Global Supply Chains

Strategieën voor het bundelen van logistieke diensten
in wereldwijde toevoerketens

Thesis

to obtain the degree of Doctor from the
Erasmus University Rotterdam
by command of the
rector magnificus

Prof.dr. H.G. Schmidt

and in accordance with the decision of the Doctorate Board.

The public defence shall be held on

Thursday, 10th June 2010, 9.30 hours

By
Michele Acciaro
Born in Sassari, Italy

ERASMUS UNIVERSITEIT ROTTERDAM

Promotor:
Prof. dr. H.E.Haralambides

Overige leden:
Prof. dr. ir. R. Dekker
Prof. dr. P.B. Marlow
Prof. dr. S.L. Van de Velde

Erasmus Research Institute of Management – ERIM
Rotterdam School of Management (RSM)
Erasmus School of Economics (ESE)
Erasmus University Rotterdam
Internet: http://www.erim.eur.nl

ERIM Electronic Series Portal: http://hdl.handle.net/1765/1

ERIM PhD Series in Research in Management, 197
Reference number ERIM: EPS-2010-197-LIS
ISBN 978-90-5892-240-3

Cover Illustration: Rob Kemerink www.robkemerink.nl
Design: B&T Ontwerp en advies www.b-en-t.nl
Print: Haveka www.haveka.nl

To my Family and Friends,
for always believing in me,
especially when I could not myself.

ACKNOWLEDGEMENTS

Like many pieces of research, this thesis is the result a knowledge journey that lasted several years, but that has not ended yet. The nature of this journey brought me to interact with many people. I worked together with some of them on parts of this thesis, or on other publications and projects. Some of these people contributed to my effort, providing feedback or ideas, confronting my views with new perspectives or simply being the source of inspiration. Other people helped me sharing their knowledge and industry experience, providing data and information. Although I was never alone during this journey, a large part of it has been consumed on lonely nights at my desk, or long days in the silence of the University library. For this reasons, without the support of my family and friends, to whom this thesis is dedicated, I would have never been able to come so far. This paragraph is the attempt to thank those that have made this journey possible.

First I would like to thank Hercules Haralambides for having given me the opportunity to be part of MEL, pursue my doctoral research within it and develop together with MEL as a lecturer and researcher. My past six years at MEL have been the experience of a lifetime and although very demanding in a variety of ways, they have surely contributed in shaping me the way I am now. In particular I would like to thank him not only for his guidance as 'promotor' but also for having offered me the possibility of making use of his extensive network of contacts for my professional and academic development.

I would like also to thank the members of the Doctorate Committee: Peter Marlow, Rommert Dekker, Steef van de Velde, René de Koster, Enrico Musso and Bill Sjostrom for their insightful and useful comments and suggestions for improvement of this thesis. I would like also to thank the Beadle Office, the Dean of the Erasmus School of Economics, Philip-Hans Franses, and his office and the ERIM Offices for their support. I take the opportunity also to thank the various members of the academic community at Erasmus University Rotterdam and elsewhere that at different stages have read parts of the manuscript, the publications on which this thesis is based on or have provided feedback and comments during conferences and presentations. In particular I would like to acknowledge the discussion opportunities offered at the International Association of Maritime Economists (IAME) annual conferences where several parts of this thesis have been presented since 2005.

Similarly to many pieces of applied research, this thesis owns a lot to the members of the business community that have dedicated me their time to answer questions, fill in questionnaires and discuss, directly with me or indirectly through their lectures at MEL the ideas presented in the thesis. Without these people it would not have been possible to bridge the gap between theory and practice as I have attempted at doing in my research. Needless to say that the responsibility for eventual errors and omissions in the thesis remains mine and that not necessarily those mentioned below endorse the ideas and opinions expressed in the thesis.

In particular I would like to mention in no particular order Simon Kirton, Ian Claxton, Long Chu, S. Rajendran and Peter Jongepier of NOL/APL, Yvonne Yeo and Kar Loke Ng of APL Logistics, Tom Boardley of NYK, Junichi Narita of Mitsui O.S.K. Line, Maarten Tromp, Bert van Grieken, Tom Peter Blankestijn, Mark van Zon of Maersk Line, Kirry Mukherji and Fleur van Hellemond of Damco, Albert Thissen of Hapag-Lloyd, Chris Bourne and Kate Townsend of the European Liner Affairs Association, Ferdinand Kranenburg of the Dutch Shippers' Council and Nicolette van der Jagt of the European Shippers' Council, John Verschelden of APM Terminals, Jan Westerhoud of ECT, all the speakers of the Maersk Line Series in Maritime Economics and of the MEL Distinguished Lecture Series.

I would like also to thank Rachael White for allowing me to present in several occasions my ideas at the Terminal Operators Conference (TOC Europe). I would like to thank also the Members of the Hamburg Committee set up for the development of the CTQI, whose discussions contributed shaping some of concepts presented in the thesis. In particular I am most thankful to Kieran Ring of the Global Institute of Logistics and Gustaaf de Monie of IPC.

Furthermore I would like to acknowledge the support of the NOL Fellowship received in the context of the research project 'Bundling in the Liner and Logistics Industries' whose development mirrored those of this thesis. In this context I cannot avoid thanking all the people involved in the project, but in particular Roberto Mariano and Vincent Chua with whom I had the pleasure of working the most. I would like to acknowledge also the support of the Sardinian Region that has funded to some extent this research as part of my scholarship for four years.

I want also to thank for their support all my present and past colleagues at MEL and all MEL lecturers: especially and in no particular order Chantal Cheung-Tam-He, Enzo de Filippi, Andrea Judd, Kasia Kurek, Konstantina Roussou, Eelco van Asperen, Miaojia Liu, Girish Gujar, Vangelis Gkanatsas, Woo Jong Kyun, Avril Brady, Renée Slater, Kim Kontos, Joppe Bieffies. An important role has been played also by my students and the MEL Alumni, for the challenging questions, for the innovative ideas and the research done together, and in particular I would like to thank Alexandros Karydis, Thalía Ruiz Rugerio and Ioannis Parameritis. I own a lot to the student assistants that have worked with me at MEL: Remo Pfützner, Janis Bargsten and Achim Vogt. A word of thanks goes also to the Erasmus PhD Association (EPAR) members, in particular to Sandra Phlippen, Ward van den Berg, Elaine Mak and Sofie Loyens. The connection they provided with the rest of the PhD community at Erasmus has been very important to me.

Furthermore I would like to thank my friends whose support and understanding during the most difficult moments of my PhD research has been invaluable. I could have not succeeded without them. In particular I would like to mention in no particular order Arno Hölzken, Erik Leertouwer, Ruurd Heijting, Ulf Hackauf, Albert Siedenburg, Benjamin van der Helm, Fabio Scaravonati, Callum McMullen, Jorrit ten Berg, Ruud Horevoorts, Pieter Korst, Jaimee Tyrell and Maikel 'Tyrell', Jan-Pieter van IJzendoorn, Carl Vanspauwen and Frank Boeren, Arjan van Dal, Gianni di Stefano, Bernard Jan de Groot and Ruud Paauwe. I would like to thank also all the swimmers and members of *Ketelbinkie Rotterdam,* many of which I am happy to count now among my friends, and our trainers Karel Strack van Schijndel and Monique Jongenengel.

Last but not least, the greatest thank goes to my 'paraninfs' Arlette Geerlings and Peter Cox for always being there. It is of great comfort in life to know that there are people you can always count on, no matter what happens. I hope I can be for you the irreplaceable friend you have been for me.

Finally a sincere word of thanks goes to my family—and I apologise with the non-Italian speakers. Un grazie a tutti I membri della mia famiglia, ma in particolare per l'affetto incondizionato alle mie nonne, Miriam e Anna; a Ninuccia e Maria Piera; a Laura, Gabriella e Maria Antonietta; ad Annarita, e a tutta la sua famiglia; a Daniela e Maurizio, per avermi ricordato sempre di credere in me stesso. Ma il più profondo dei ringraziamenti va ai miei genitori: senza il vostro affetto e il vostro supporto non sarei mai potuto diventare chi sono, ed é con grande orgoglio che a testa alta anche grazie a voi ho raggiunto questo traguardo. *Etiamsi, ego non.*

Michele Acciaro,
Berlin, January 2010

TABLE OF CONTENTS

List of Tables and Figures

List of tables

List of figures

LIST OF ABBREVIATIONS AND ACRONYMS

3PL	Third party logistics service provider
4PL	Fourth party logistics service provider
APL	*American President Lines*
BAF	Bunker adjustment factor
BCO	Beneficial cargo owner
BSC	Balanced score cards
CA	California
CAF	Currency adjustment factor
CENSA	Council of European and Japanese National Shipowners' Association
CEO	Chief executive officer
CGM	*Compagnie Générale Maritime*
CI	*Containerization International*
CIF	Cost insurance and freight
CMA	*Compagnie Maritime d'Affrètement*
Co.	Company
COSCO	*China Ocean Shipping (Group) Company*
CSF	Chain system framework
CTQI	Container terminal quality index
DC	District of Columbia
DEA	Data envelopment analysis
DFE	Feeder transportation at destination
DOJ	Department of Justice
DRS	Delivery recovery stewardship
DTHC	Destination terminal handling charges
DWT	Deadweight tonne
EC	European Commission
EDI	Electronic data interchange
EEC	European Economic Community
ELAA	European Liner Affairs Association
EOF	Economies of fleet size
EON	Network economies
EOS	Economies of scale
EOSC	Economies of scope
ESC	European Shippers' Council
EU	European Union

EUR	Erasmus University Rotterdam
FAK	Freight all kinds
Fed	Federal
FEFC	Far East Freight Conference
FEU	Forty-foot equivalent unit
FMC	Federal Maritime Commission
FOB	Free on board
FOC	Flag of convenience
FTC	Federal Trade Commission
GBP	Pound sterling
GDP	Gross domestic product
GE	General Electric
GIL	*Global Institute of Logistics*
GRT	Gross registered ton
GT	Gross ton
GTO	Global terminal operators
H&S	Hub and spoke
IA	Independent action
IBM	*International Business Machines*
ICT	Information and communication technologies
ILO	International Labour Organisation
Inc	Incorporated
IPBCC	India, Pakistan, Bangladesh, Ceylon Conference
ISC	Indian subcontinent
ISTEA	Intermodal Surface Transport Efficiency Act
IT	Information technology
ITF	International Transport Forum
JIT	Just in time
KG	*Kommanditgesellschaft*, German for limited partnership
KPI	Key performance indicator
LSI	Liner shipping industry
LSP	Logistics service provider
M&A	Mergers and acquisitions
MOL	*Mitsui O.S.K. (Osaka Shosen Kaisha) Lines*
MRP	Materials resources planning
MSC	*Mediterranean Shipping Company*
NOL	*Neptune Orient Lines*
NVO	Non-vessel operator
NVOCC	Non-vessel operating common carriers
NYK	*Nippon Yusen Kabushiki*, Japanese for Japan Mail Shipping
OC	On-carriage (OC)
OECD	Organisation for Economic Cooperation and Development
OF	Ocean freight rate
OFE	Feeder transportation at origin
OOCL	*Orient Overseas Container Line*
OSRA	Ocean Shipping Reform Act
OTHC	Origin terminal handling charges
PC	Pre-carriage
PDCA	Plan do check act
R&D	Research and development
RBV	Resource based view
SC	Service contracts
SCM	Supply chain management
SFA	Stochastic frontier analysis
SMU	Singapore Management University

SSS	Short-sea shipping
TAA	Trans Atlantic Agreement
TACA	Trans Atlantic Conference Agreement
TCE	Transaction cost economics
TEU	Twenty-foot equivalent unit
THC	Terminal handling charges
TV	Television
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference for Trade and Development
USA	United Stated of America
VI	Vertical integration
vs	*Versus* in the title of a law suit to indicate the opposite position taken by the parties
VTMS	Vessel traffic management system

1 INTRODUCTION TO THE THESIS

1.1 Introduction

Consumers often purchase goods and services in bundles. All sort of package deals are on offer on the shelves of supermarkets; airplane tickets are offered with hotel sojourns as package holidays; bundles of financial services are proposed to bank customers on a regular basis; cable TV subscriptions comprise of collections of different channels and services, just to mentions some common examples. Notwithstanding the pervasiveness of bundling as a sale practice, consumers are rarely aware of what motivates producers and retailers to offer goods and services in packages. Questions such as: 'why is a specific detergent not available as a stand-alone product anymore and can only be purchased in combination with another product?' or: 'why is travelling from Amsterdam to St Petersburg via Rome a cheaper alternative than travelling directly?' may have occurred once in a while to the curious consumer, but in general they will not be the subject of extensive speculation.

Most consumers are aware of the fact that many of the goods they purchase have been produced in other countries, often entailing several weeks of deep-sea sailing, but they rarely show interest on the journey a particular product has gone through in terms of transportation, or on the complexity of the transport and handling operations that have taken place before the product reaches the shelves of a shop or the doorstep of our homes. This journey is sometimes the result of a large number of different activities that do not necessarily consist of simple transportation, but range from the storage of a product, to labelling, packaging or even assembly of the product on its way to the final consumer. Similarly to a holiday package, also the journey a product makes from its production plant to its final user along the global supply chains is a collection of different logistics activities that producers may perform directly or purchase from specialised logistics service providers and transport operators.

The development of logistics has offered a wide range of new business opportunities for transport operators. In order to come closer to their customers' demands, carriers have expanded their business scope beyond the movement of cargo, to include coordination among transport modes, route rationalisation and value added logistics services. Moreover, shipping lines are expanding their business scope by offering ocean transportation as part of supply chain integrated solutions in an attempt to provide a better service to their clients as well as improve their bottom lines. This appears to be a winning strategy since an increasing number of industry players are investing in logistics operations and infrastructure.

The greater attention of ocean carriers to logistics takes place in a market that has moved away from a collective pricing system, typical of an era dominated by the price setting agreements know as conferences, and increasingly focuses on tailor-made all-inclusive value propositions. The highly competitive nature of the ocean shipping business and the homogenous character of containerised ocean transportation have induced carriers to search for ways to differentiate their services from rivals. This has resulted in carriers having engaged in some form of vertical integration along the supply chain in order to better exploit possible economies of scale, scope, route density and network.

It seems that the joint provision of transportation and logistics services could provide a successful strategy for enhancing shipping lines' competitiveness and profitability. Only limited research though is available to better understand under what conditions such bundled sales are possible; what attitude shippers show towards this industry trend; how bundling strategies could be developed optimally; and how they could be priced.

1.2 Background to the study and definition of the research problem

This thesis aims at studying the viability and the benefits of *bundling*, defined as: "*the sale of two or more separate products in one package*" (Stremersch and Tellis, 2002: pg. 56)[1] in the container industry, and specifically with reference to the joint provision of ocean transportation and other logistics services. Bundling is: "*akin to a volume discount, but where the volume is based on aggregate sales across products. Instead of offering a discount for buying two apples rather than one, the customer is given a better price for buying an apple*

[1] In the same article the authors distinguish between *Product Bundling* and *Price Bundling*. The latter refers to the sale of two or more products in a package at a discount, without any integration of the bundle components. The former concept should be used instead when the creation of the bundle provides at least some of the consumers with an increase in value. The integration of logistics services and ocean transportation is a clear example of product bundles, as the provision of the two services as a package generates added value for the consumers in terms for example of better coordination and increased supply chain visibility.

and an orange together" (Nalebuff, 2008). Even if the practice of bundling is common in many consumer markets, in the case of ocean transportation and other logistics services it is still rare, and, in some circumstances, even forbidden by law (Marlow and Nair, 2008; Brooks, 2000).

Notwithstanding the general acceptance in the industry of the advantages delivered by logistics service integration, the reluctance of shippers to accept product bundling is still substantial (Acciaro and Haralambides, 2007; Haralambides and Acciaro, 2010; EUR and SMU, 2006; 2007). Besides, the legal restrictions on product bundling, the specific regulatory regime that governed the liner sector until recently and the debate that has animated the reform of its regulatory regime, have contributed to increase the diffidence towards this practice in the container sector (Haralambides, 2007).

The large existing *corpus* of economic theory and legal cases are often cited as the reasons for dismissing product bundling as an anticompetitive practice and terminating any discussions on its possible implementation in the container industry (Kobayashi, 2005*a*). In addition, product bundling has been regarded by container carriers as difficult to sell and its potential as a marketing and strategic tool has never been structurally assessed in the context of container transportation.

From the academic side, the analysis of the market structure effects of product bundling has animated the debate since the seventies, and, although scientific studies have tried to apply the findings of the literature to a large number of industries—the hotel and holiday industry; the software industry; the health-care industry and the automobile industry are well-known examples of successful applications of bundling—a very limited amount of research has been devoted to the topic in the context of container transportation, where bundling is so important to constitute in essence the backbone of what we refer nowadays as (maritime) logistics.

With the exception of some exploratory works (Acciaro and Haralambides, 2007; Acciaro, 2008*b*; Haralambides and Acciaro, 2010; EUR and SMU, 2006; 2007) and seminal papers (Haralambides, *et al.* 2002), and of the very specific literature resulting from the debate on the so-called *inland transportation clause* of the European Commission review process of Regulation 823/2000 and the TACA case[2], the discussion on product bundling has never been addressed systematically in the container industry.

As pointed out by Stremersch and Tellis (2002), the academic publications on bundling in general in the various streams of literature—industrial organization, applied economics, marketing and law—have been inconsistent in the use of terminology and have created ambiguity about the basic principles underlying pro-

[2] In 1998 the European Commission found that parties adhering to the TACA (Trans-Atlantic Conference Agreement) had abused their joint dominant position by inducing potential competitors to join TACA, thereby altering the competitive structure of the market.

duct bundling. Although the article of Stremersch and Tellis (2002), constitutes a substantial contribution to the creation of a uniform approach towards research in bundling, the use of bundling terminology and concepts in the context of logistics and container transportation is virtually entirely absent.

This short overview indicates in effect the lack of any application of bundling in the container sector. At least three shortcomings in the current literature applied to container transportation can be identified: firstly the lack of analysis of the potential and benefits of product bundling in the container industry for carriers; secondly the lack of a through discussion of the legal and antitrust implications of product bundling; and thirdly the analysis of the effects on shippers and logistics service providers.

Especially in view of the increasing importance of integrated logistics and the simplification in transactions that the use of a single pricing mechanism would offer carriers and shippers, the lack of theoretical investigation on the subject becomes obvious. In addition, the changes in the liner industry's regulatory regime, with the *de facto* abolition of the conference system in 2008 in trades to and from Europe, will likely increase the ability of the industry to make use of product bundling as it already happens in other industries.

As indicated by Kühn, Stillman and Caffarra (2005), the legal implications of bundling have become clearer and the approach of legal authorities towards this practice more consistent and in line with the findings of economic theory. A recent set of interviews done by Erasmus University Rotterdam and Singapore Management University (EUR and SMU, 2006), within a research framework promoted under the auspices of the NOL Foundation of Singapore, indicated a large interest of the industry on the possibilities offered by product bundling and solicits the question whether the attitude towards price bundling in the container industry is about to change.

1.3 Thesis objectives and research questions

<u>Main question</u>: Is bundling of logistics services together with ocean transportation a winning strategy for shipping lines, shippers and society at large?

In order to give an answer to the main research question, the research problem has been divided into secondary questions that will be discussed in the different chapters of the thesis. The secondary research questions can be grouped under the following headings.

i. *Analysis of existing bundling practices in the industry.* Logistics integration is a well-established trend in liner shipping as well as in all transportation industries, and refers to the tendency of transport operators and other logistics service providers to expand their scope of activities along the supply chain with the aim of offering differentiated logistics service packages. The analysis of the degree of integration that characterises the liner shipping industry and of the extent to which bundling takes place as an industry practice is a necessary part of this research.

ii. *Shipper's perception of bundled services.* The development of bundling proposition from the side of carriers is motivated, among other reasons, by shippers' demand. In order to substantiate this claim, further insight in shippers' demand is necessary. Furthermore the development of optimal bundling propositions cannot leave aside shipper demand considerations, since a successful bundle offer need to be dovetailed to customer requirements.

iii. *Definition of bundling strategies for ocean carriers and logistics service providers.* The development of integrated logistics allows for the provision of advanced supply chain solutions. The economies deriving from these solutions may be substantial for certain bundles and marginal for others. This research aims at quantifying these economies in order to determine which bundles should be provided and at what cost.

iv. *Application of the existing theory on bundling to the logistics and ocean transportation industry.* This research assesses the extent to which the findings from the industrial organisation and marketing management literature are applicable to the liner shipping industry. This would lead to the possibility of expanding the existing research on bundling with new insights obtainable from the ocean transportation sector.

v. *Competition issues and the impact of bundling strategies on entry/exit barriers.* Bundling has the potential to increase firm market power and affect competition. Although the literature evidence on this issue is not conclusive (see below), this research should assess and account for the possible strategic effects of bundling practices.

vi. *Assessment of the strategic value of other logistics activities for shipping lines.* In view of shipper preferences, cost economies deriving from bundle provision and market outcomes, the research should evaluate the strategic value of bundle propositions and how this value could be maximised.

1.4 Themes

The appearance of bundling in multiple forms in modern business practice and the far-reaching implications of this pricing strategy have generated a large set of interesting and important research issues. The strategic nature of bundling decisions in ocean transportation and the exploratory nature of a large part of this study call for a holistic and transdisciplinary approach to the research questions. For this reason the thesis can be connected to the following not exclusive research domains:

- Applied (Transport) Economics;
- Industrial Organisation;
- Marketing management;
- Supply Chain Management.

The current research aims at exploring, without the presumption of being exhaustive, some of these issues. Although throughout our research work and within the thesis itself a large number of issues emerged, six key themes can be traced as dominant in the thesis:

- Bundling impact on society and shippers;
- Bundling and carriers' competitive advantage;
- Transaction costs and bundling;
- Strategic bundling;
- Bundling and the supply chain;
- Competition issues and regulation.

The themes are related to the research questions as shown in the following diagram.

Table 1: Relation between research questions and themes.

Theme	*Research questions*					
	i	ii	iii	iv	v	vi
Bundling impact on society and shippers	●	●		●		
Bundling and carriers' competitive advantages	●			●		●
Transaction costs and bundling		●	●			
Strategic bundling				●	●	●
Bundling and the supply chain	●	●	●			●
Competition issues and regulation				●	●	●

The diagram below (table 2) aims at clarifying the relations among the various thesis chapters and the thesis themes.

Table 2: Relation between thesis chapters and thesis themes.

Theme	*Thesis chapter*										
	1	2	3	4	5	6	7	8	9	10	11
Bundling impact on society and shippers	-	■		■					■	■	■
Bundling and carriers' competitive advantages	-		■		■		■		■	■	■
Transaction costs and bundling	-		■			■		■			■
Strategic bundling	-	■					■		■		■
Bundling and the supply chain	-	■		■	■	■		■			■
Competition issues and regulation	-		■						■	■	■

1.5 Research issues

Bundling of logistics services

The research creates a theoretical framework on the issue of bundling with an application to logistics and maritime transport. The idea is to visualise ocean transportation as a segment in the chain and identify which services are or could be bundled together with it. The selection of the components to be bundled responds to different considerations, such as the degree of complementarity among services, transaction cost issues and demand characteristics.

Bundling strategies in the presence of scope, scale and network economies

The testing of the feasibility of bundling within transport and logistics, as well as the proposition of optimal bundling strategies requires an extension of the theoretical approach used in the literature. This involves the necessity of extending the bundling paradigm proposed by Adams and Yellen (1976) to encompass some of the distinctive characteristics of transport and logistics services, the existence of economies of scope, scale and network among others, but primarily the investigation on the nature of the transaction between logistics service providers and shippers.

Bundling and pricing of logistics services and ocean transportation: evidence

The research relies on a market survey of shippers and carriers in order to assess the willingness to pay for a bundled service instead of an unbundled one. The indirect estimation of elasticities of demand and other conceptual issues are also addressed in the thesis and increase the relevance of the research, both from an empirical and a theoretical point of view.

Logistics services definition problems

From the research it should be clear what logistics services are outsourced by whom and how much they differ from each other. The problem of the definition of services leads also to the issue of complementarity and substitutability among logistics services and logistics chains. Complementary logistics services, in fact, are bound to be more easily combined in successful bundles. The attractiveness of a bundled proposition though is not only related to how easily can services be combined together, but also to the existence of substitutes that are provided, for instance, by competitors. Further issues refer to the easiness with which a bundle component can be replaced, e.g. with a component provided by a competitor. When bundles result in a symbiotic relation between the supplier and the customer, in other words when the degree of asset specificity is high, bilateral dependency develops and switching costs are high.

Issues of competition and policy implications

There are several aspects related to competition that are relevant for this research. Firstly, it is worth discussing whether bundling grants shipping lines any type of market dominance on the logistics market, either by rising barriers to entry, or soothing competition. Secondly, it is interesting to analyse to what extent shipping lines compete with logistics operators in the provision of bundles. Thirdly how competition in the shipping and the logistics markets is affected by vertical integration among logistics operators and shipping lines. This aspect has naturally a determinant geographical dimension, as well as a vertical dimension within the logistics chain. Nowadays carriers' sources of competitive advantage are to be found at the network or at the chain level more than at the level of the chain component.

Proposed approach

The research underlying the thesis consisted of the following phases:

- Phase 1 - Literature review. In this phase a comprehensive literature review was performed in the various research sub-areas. The outcome is the overview of the results, hypotheses and problems discussed in the contemporary literature on commodity bundling and in the applied field of logistics integration. The information collected is analysed and synthesised. The output of this phase is a clearly structured framework of the available theory and methods aiming at selecting the conceptual frameworks that better fit the research problem.
- Phase 2 - Empirical survey. This phase of the research consisted of a survey of carriers' business practice with respect to bundling and of shippers' perception. This phase aimed at gaining insight to the feasibility of bundling practices in the liner and logistics industry and at inferring possible future developments.
- Phase 3 - Model. This phase entailed the selection and the elaboration of theoretical models that encompass the relevance of bundling in the logistics and transportation sectors. The outcome of phase 3 consists of: a) a theoretical model of product bundling in an oligopolistic market; b) a optimal bundling strategy definition model.
- Phase 4 - Evaluation of the model(s). Once the models had been selected, their validity is tested against the survey data previously collected. The objective of phase 4 will be to answer the major research question.

1.6 Methodological approaches and data

The thesis makes use of a large set of methodologies. In addition to desk research, the following methodologies are used in the thesis:

- Interviews;
- Survey;
- Game theory;
- Simulation;
- Conjoint analysis.

In addition to applying existing methodologies to a new problem, the thesis also contributes in a new direction by developing a conjoint analysis methodology for application in ocean transportation.

The information used in the research derives from ocean carriers and their customers, as well as logistics operators. Given the strategic importance of the topic, the limited research performed so far and in order to reduce uncertainty on this business practice, the NOL Foundation has entrusted to the Center for Maritime Economics and Logistics (MEL), Erasmus University Rotterdam and to the School of Economics and Social Sciences, Singapore Management University with a long-term research project to investigate the applicability of bundling to the ocean transportation and logistics industries. The NOL Fellowship is an initiative launched in February 2006 by Singapore's former Prime Minister Goh Chok Tong, who is the Patron of the Fellowship. The Fellowship has been seeded by a large contribution from NOL, to bring about multi-disciplinary, applied research among centres of excellence in universities and research institutes internationally, to enhance knowledge and expertise in the field of global cargo transportation and logistics.

Within the Fellowship's general scope, the aim of the research project *Bundling in the Liner and Logistics Industries*—one of the two flagship projects of the Foundation—is to investigate the scientific underpinnings of product bundling in liner and logistics sectors; determine shippers' perceptions of bundled logistics products; and assess whether the provision of bundled services can sustain, if not enhance, carriers' competitive advantage. This thesis has made extensive use of the information made available to the author through this project.

1.7 Overview of the thesis

In addition to this introduction the thesis provides an extensive literature review of the theory of bundling (chapter 2). This chapter is structured around the two major research areas where bundling has emerged as a literature subtheme: industrial organisation and marketing management. The chapter differs from previously appeared reviews, not only as it is the first to give equal importance and to review simultaneously the literature in both research subareas, but also in the fact that each concept reviewed in the literature is shortly discussed with reference to the maritime industry.

A more detailed analysis of the foundations of liner shipping economics is provided in chapter 3. This chapter aims at highlighting the salient traits of the industry with respect to other forms of transportation and other industries by and large. The focus of this chapter is pricing, costs and the determinants of competitive advantage. Research on liner shipping economics has focused on a handful of crucial issues, e.g. competition, pricing, vertical integration, and major economic journal contributions have been scarce, so that it is still perceived as a rather exotic research area within the broader domains of transport economics and applied economics. Chapter 3 is therefore essential in framing the industry in the more general economic context.

The discussion of the first three chapters has been limited to the theoretical aspects of bundling and liner shipping. The subsequent two chapters aim at adding the empirical dimension to the discussion. Chapter 4 focuses on the perceptions of shippers to the provision of bundles and logistics outsourcing by and large. The aim of the chapter is to provide a review of the advantages obtainable through bundling from the perspective of the shippers. This is done by presenting the empirical evidence available in the literature on the use of bundles and the result of two shipper surveys: one done on a general population of shippers, limited geographically to Singapore, and another performed among the customers of a major carrier.

Chapter 5 integrates the discussion with the perspective of the carriers. The chapter presents, in addition to the literature and documentary evidence, the results of five year targeted interviews with carrier representatives and experts. The chapter pulls together the experience of some of the major carriers, such as Maersk Line, CMA-CGM, American President Line/Neptune Orient Line, NYK Logistics and Megacarriers, and others. The chapter aims at identifying best practice in the current business environment and present to the reader how bundles are formed in practice.

On the basis of the results of chapter 5 and building on the approaches developed in the marketing management literature, chapter 6 provides a set of guidelines on how to set up optimal bundling strategies in the case of logistics and ocean transportation. The chapter provides a set of propositions that help defining the desirability of a bundle on the basis of the characteristics of the shipper, the product transported and the logistics services included in the bundle. In addition, the chapter provides a procedure on how to set up a marketing study at company level making use of conjoint analysis methodologies.

The cost profile of each bundle component and integration capabilities of each carrier, are crucial in the definition of optimal bundling strategies. This issue can be referred theoretically to the concept of transaction costs and the approaches developed within the domains of transaction cost economics. This is the subject of chapter 7. Transaction cost reduction is one of the fundamental justifications for successful bundling and provide an interesting perspective to the problem under analysis. The issues related to the make-or-buy decision and vertical integration are addressed also in this chapter.

Reference to transaction costs inevitably points at the issues of measurement and performance metrics. If transaction costs are not measured and do not constitute part of the company performance measurement system, the formulation of bundling propositions can only be done haphazardly. Bundling can only be successful if the liner shipping company is strategically oriented towards building its competitive advantage on the supply chain and when performance metrics are fine tuned with the supply chain dimension so that they become transcorporate performance metrics. Chapter 8 explores these issues and provides extensive discussions on the importance of using the supply chain perspective when setting up performance measurement systems for ocean carriers and container terminals.

Chapter 9 and chapter 10 focus on the strategic potential of bundling. Drawing on the extensive number of examples in the industrial organisation literature of oligopoly models with bundling, chapter 9 presents two game theory models that connect market dominance, bundling and transaction costs. The results of the model are interpreted on the basis of carriers' payoffs and social welfare. The overarching conclusion of the models is that when bundling appears in oligopoly as a result of exploiting transaction costs differentials among carriers, results are ambivalent, although gains for society can be substantial.

Chapter 10 expands on the issues presented in chapter 9 and complements the results with an overview of antitrust legislation in Europe, United States and Asia, and its implications on the liner shipping industry. The chapter argues that so far, antitrust legislation has limited the applicability and scope of bundling in the context of ocean transportation. This is as a result of the fact that antitrust exemptions have been granted to ocean transportation only against the vertical integration tendency of the industry. Thus carriers have tried, although unsuccessfully, to bundle around the only service that enjoys antitrust immunity, i.e. port to port services. The consequences are that, if on the one side, eventual competition distortion have been avoided, on the other side, this has also limited the possibility for carriers and society to benefit from bundling and develop the practice as it has happened in other industries.

Chapter 11 concludes and provides a summary of the research issues that can be further explored.

1.8 Conclusions

This introduction aimed at presenting the research problem, the main and secondary research questions, the research approach adopted in the thesis and its overall structure. It has been argued that although the sale of goods and services in a bundle at a single price is a pervasive business practice, and extensive research has been conducted in the industrial organisation and marketing management literature, limited attention has been given to the bundled sale of (ocean) transportation and other logistics services.

This has lead to the formulation of the main research question; on whether bundling of logistics services together with ocean transportation is a winning strategy for shipping lines, shippers and society at large. The main research question entailed the subdivision of the research problem in six areas of research: the analysis of the bundling practices in the industry; shippers' perception of bundled services; definition of bundling strategies for ocean carriers and logistics service providers; the application of the existing bundling theory to the logistics and ocean transportation industries; competition and the impact of bundling strategies on entry/exit barriers; and the assessment of the strategic value of logistics activities for a shipping line.

These areas of research are represented in six themes deriving from the four major research domains connected to the thesis: Transport Economies, Industrial Organisation, Marketing Management and Supply Chain Management.

The introduction also explains what is the methodological framework that the thesis makes reference to in order to answer the main research question and address the major research issues emerging from the research problem.

2 A Review of Bundling Theory

2.1 Introduction

This chapter presents the detailed review of the theory of strategic bundling drawn from the existing economics and management literature. It also provides the reader with the key concepts and basic terminology that the rest of the study makes reference to. The chapter is based on the discussion of the academic contributions to the issues connected to bundling, and as such, it accomplishes some of the major tasks of a literature review. A literature review is performed in two stages: the first stage aims at defining a research problem and research questions, confirming hypothesis and selecting adequate research methodologies; the second more extensive stage focuses on identifying past theoretical research that is relevant (Hair, *et al*. 2003: pg. 94). This chapter is the result of the second stage of the literature review. The significance of the second stage of the review cannot be underestimated, and it is therefore useful to mention at least the most important tasks it is expected to accomplish.

Firstly, as also mentioned by Creswell (2003), a literature review relates the current work '*to the larger dialogue in the literature about the topic*' (Creswell, 2003, pg. 30). By summarising and presenting the ideas behind the most important literature contributions, the chapter frames the research problem in the bigger theoretical stance. In particular, as clearly discussed by Arksey and Knight (1999: pg. 47-49), for studies where interviews constitute an important methodological component, such as ours, the literature review is an essential step in order to avoid repeating research already performed, missing significant results, conceptual frameworks and information already available to the researcher and that could be useful in the study. Furthermore, ocean transportation and logistics seldom constitute the objective of the investigation in industrial organisation articles, if compared with telecommunications or financial services for example, and as a result are perceived as somewhat ‘exotic’ in the academic community. This review is thus important in order to connect the discussions on bundling of ocean transportation and other logistics services, which constitute the topic of the following chapters, to the ongoing debate on bundling.

Secondly, it is generally recognised (Cooper, 1984; Marshall and Rossman, 1999), that the aim of the literature review should contribute identifying the gaps in the ongoing research and how the current research can be extended. The major objective of this study is naturally to extend the findings of the literature on bundling to the ocean transportation and logistics industries, but in doing so other unresolved more general issues are addressed. For example, the role that bundling may play in enhancing market power in oligopolies or how the presence of economies of scope impacts the success of product bundling strategies are core to our discussions and the debate in the industrial organisation literature is still ongoing. The rest of the chapter therefore will present an account of the issues still open in the literature on bundling, and at the end, it explains how this study contributes in addressing these issues.

A third task of a literature review is to provide a coherent framework for establishing and benchmarking the importance of the study with respect to what has been done so far (Miller, 1991). Although theoretical in its nature, this chapter provides several industry examples, explaining how the theory of bundling has been more or less successfully applied in different industries. For instance, the experiences deriving from the use of bundles in the tourism industry provide a useful benchmark against which bundles of ocean transportation and other logistics services can be tested. Although the analysis of the applicability of bundling in connection to the container industry, because of its centrality to the current discussion, is the topic of the next chapter, which simultaneously equips the reader with the fundamentals of liner shipping economics, this chapter frames the present study in the broader applied economic literature on bundling.

The importance of this chapter lies not only in the accomplishment of the previous tasks, but also in providing the reader with a coherent and consistent terminology. As pointed out by Stremersch and Tellis (2002), the academic publications on bundling in general in the various streams of literature—industrial organization, applied economics, marketing and law—have been inconsistent in the use of terminology and have created ambiguity about the basic principles underlying bundling. The lack of a rigorous terminology and of a consistent definition of the theoretical concepts hinders the comprehension of the benefits and consequences of bundling, therefore undermining its potential as a new business strategy in liner shipping and its attractiveness to industry practitioners and academics. It is therefore critical, before proceeding further to provide a set of rigorous definitions of the various forms of bundling and explain the theoretical underpinnings of strategic bundling in the various market structures.

The rest of the chapter is structured in the following way. The next section deals with definitions and key concepts in the theory of strategic bundling. The overall framework for the literature analysis and a literature map is presented in the following section. Section three discusses the most relevant contributions in the industrial organisation literature. The following paragraph presents the review of the major concepts presented in the marketing management literature. Paragraph five reviews the most important debate in the various industries on the use of bundling. Section six explain the connection of the present study with the current literature debate and explain how this chapter contributes extending the current findings.

2.2 Basic concepts and definitions

The sale of products[3] as a package or as a bundle is a common business practice in multiproduct firms. This practice is generally referred to in the literature as *commodity bundling* or *tie-in sale*, and can be formally defined as: '*the sale of two or more separate products in one package*' (Stremersch and Tellis, 2002: pg. 56). A textbook example of bundling is the well-known case of Microsoft Windows operating system and Internet Explorer web browser that resulted in litigation against Microsoft (Rubinfeld, 2009; Whinston, 2001; Liebowits and Margolis, 1999; Ayres and Nalebuff 2005). Before the trial, a consumer had the option of purchasing a Microsoft Windows operating system only in combination with Internet Explorer web browser. In other words only the bundle Microsoft Windows operating system and Internet Explorer was available to consumers. When the products or services are sold without the requirement that the customer also purchases some other products or services, in other words no bundling of products or services has taken place, we say that the firm pursues an unbundling strategy also sometimes referred to as a pure component strategy (Adams and Yellen, 1976) or no bundling (Dolan and Simon, 1996).

An important distinction is between commodity bundling and tie-in sale, sometimes also referred to as *tying* (Burstein, 1960*a*). While in commodity bundling the bundled package contains a fixed proportion of each of the individual components, in tie-in sales the firm does not control the proportions in which the two or more products are consumed. Nevertheless the purchase of some amount of one of the products is conditional to the purchase of some amount of a second, *tied* product. A typical example of tied-in sales refers to the policy that Kodak adopted in the mid-1980s of selling parts of its photocopier and its micrographics equipment exclusively to controlled maintenance service dealers. This practice allegedly aimed at making it virtually impossible to an independent service organization to provide maintenance contracts for Kodak equipment. In 1987, these organizations

[3] Here and in the rest of the study *product* is defined to include both goods and services.

filed suit against Kodak who lost at trial and on appeal (McKie-Mason and Metzler, 2004).

A classic example of tie-in sales is the IBM tabulating machines (Telser, 1965; Wharhit, 1980; Liebowitz, 1983; Simon, 1989; Simon and Wübker, 1999). At the time IBM was the dominant producer of tabulating machines and a lessee of an IBM-patented tabulating machine was required to purchase punch cards (the tied good) from IBM as a condition of the lease. The tying relations were artificially set, as in principle the tabulating machine could perfectly work also with punch cards produced by other manufacturers[4]. The IBM example is a case of *contractual* tie-in sales. In more modern examples, firms generally make use of *technology*-based tie-in sales, where it is not a contractual agreement that forces the customer to purchase also the tied good, but more the technical specifications of the product. For instance, Sony's PlayStation 2 games function neither on Microsoft's Xbox systems, nor on Nintendo GameCube. Analogously, Hewlett-Packard, Canon and Epson, for example, manufacture printers that can use only their own brand cartridges and not those of their competitors. Other classic cases discussed in the literature are International Salt (Peterman, 1979), Northern Pacific (Cummings and Ruther, 1979) and Xerox (Blackstone, 1975; Nagle & Holden, 2002; Phlips, 1989; Simon, Faßnacht & Wübker,1995).

In the article of Stremersch and Tellis (2002), the authors distinguish between *product bundling* and *price bundling*. With the latter they refer to the sale of two or more products in a package at a discount, without any economies deriving from the joint production of the bundle components. This implies that the reservation price for the bundle is equal to the linear sum of the reservation prices for the separate components. This type of strategy is common in consumer goods, for example when a certain shampoo is sold in a package with a hair conditioner. It should be noted that this type of strategy takes advantage of a certain degree of complementarity between the two products, and leverages on the likelihood that a consumer that requires one product will need also the bundled one.

The concept of product bundling should be used instead when the creation of the bundle provides at least some of the consumers with an increase in value (Stremersch and Tellis, 2002). In other words, the bundle is somewhat perceived by the consumer as a different (new) product and as such consumer reservation prices are different than the linear sum of the prices of the individual bundle components (most likely higher). The sale of holiday travel packages is an example of this type of bundles that may include a return flight to Milan, a four nights' accommodation and two operas at the *Scala* theatre. Another example of product bundling is the integration of logistics services and ocean transportation. The provision of the two services in an integrated form generates added values for the consumers in terms of better coordination, supply chain visibility, etc.

[4] *International Business Machines vs US* (1936) 298, US 131.

Product bundling should not be confused with *premium bundling*. In the case of premium bundling, the bundle is sold at a premium rather than at discount (Cready, 1991). Implementing a premium bundling strategy requires the seller to be able to prevent consumers to purchase more than one of the bundle components individually. This possibility is excluded in most of the studies on bundling (Bitran and Ferrer, 2007). It should be noted that premium bundling differs from product bundling insofar as the former refers to the price that is charged to the consumer, while the latter to the intrinsic characteristics of the bundle.

A further important distinction that is generally made in the literature is between *pure bundling* and *mixed bundling*. These two approaches are defined by the options the firm makes available to its customers in the market place. In the case of pure bundling the products are sold together only as a package and consumers do not have the possibility of purchasing them separately. The classic example of pure bundling is provided by Stigler (1968) on its note on block booking in the movie industry[5]. Cable television providers market access to TV channels only as a bundle, and consumers cannot purchase access to one channel only (Crawford 2008; Crawford and Cullen, 2007; Crampes and Hollander, 2005; Rennhoff and Serfes, 2009). This differs from the case of mixed bundling, where consumers are given the choice of purchasing the products or services separately or together as a package (Guiltinan, 1987). Mixed bundling is in general a more common approach than pure bundling, and most of the firms engage in some form of mixed bundling (Simon and Wübker, 1999).

Typical examples are the hotel and tourism industry (Kim, Bojanic and Warnick, 2009; Rewtrakunphaiboon and Oppewal, 2008; Campo and Yagüe, 2007; 2008), restaurant menus (Adams and Yellen, 1976; Heide, *et al.* 2008), the software industry (Liebowitz and Margolis, 1999; 2009; Sidak, 2001), the high-tech industry (Sarin, Sego and Chanvarasuth 2003), telecommunications (Kridel and Taylor, 1993), academic journals (Edlin and Rubinfeld, 2004; 2005), WiFi connections (Efimov and Whalley, 2004), health products (Simon and Wübker, 1999), pain relief and cold medicines (Evans and Salinger, 2004), mobile navigation services (Bouwman, Haaker & de Vos, 2007), e-banking services (Altinkemer, 2001), and industrial maintenance services (Stremersch, Wuyts and Frambach, 2001).

[5] see Hanssen (2000) for a careful review of the *US vs. Paramount Pictures, Inc.* 334 U.S. 131 of 1948 and *US vs. Loew's, Inc.*, 371 U.S. 38 of 1962 and the arguments that lead the Supreme Court to ban the practice.

Table 3: Bundling strategies alternatives.

	Focus	
Form	Price bundling	Product bundling
Unbundling	X, Y	
Pure bundling	(X,Y)	(X⊕Y)
Mixed bundling	(X,Y), X, Y	(X⊕Y), X, Y

Source: Stremersch and Tellis (2002)

A more general concept but closely connected to strategic bundling is *nonlinear pricing*. Nonlinear pricing occurs when a consumer's total expenditure on an item does not rise linearly (proportionally) with the amount purchased (Wilson, 1993). Methods of nonlinear pricing are used to practice second-degree price discrimination, where arbitrage is difficult and firms do not know the demands of each individual (Carlton and Perloff, 2005). Particular forms of product bundling are volume discounts either in the form of a lower unit price for a pack of a homogeneous product or for a multiple-unit pack of the product that are generally discussed as nonlinear pricing. Examples include energy markets where consumers are often able to buy their gas and electricity from a single supplier or from different suppliers. In both cases consumers face volume discounts and further price reduction if they purchase both services from the same supplier (Armstrong and Vickers, 2010; Armstrong, 2006; Stole, 2007).

Often companies offer customers an annual rebate on total annual sales across the entire company product line. This type of *sales rebates* are aiming at increasing customer loyalty (Dolan and Simon, 1996) and are a mixture of mixed-bundling and nonlinear pricing, in the sense that the discount is independent of whether the sale comes from a single product or the entire company production line. This kind of bundles are similar to discounted annual contracts where the discount is based on the commitment the customer makes to purchase at a certain store, or retailer of supplier and are very close to forms of prepayment discounting.

Another form of bundle is that of providing a certain stand-alone basic product with a set of add-on enhancing features. This form of pricing goes under the name of *add-on bundling* and is not strictly a mixed bundling option because the add-on feature will not be sold unless the basic product is sold (Guiltinan, 1987). In this sense they are more similar to tie-in sales (Simon and Wübker, 1999). A common example of this form of bundling are cars, that can be offered as stand alone products or with a set of additional features such as ABS, airbags, radio, etc. (Liebowits and Margolis, 2009). Another example are Oracle customer licenses to database use, for which Oracle faces competition from other products such as SQL Server, etc. for the initial sale. In order to make access to the databases more effective, Oracle provides a performance tuning product or other add-ons (Wright 2001).

A common form of bundling that is encountered in practice in markets for consumer goods is *cross couponing*. Coupons grant consumers who purchase a certain product discount on the purchase of another product from the firm assortment (Simon and Wübker, 1999). They are generally used to introduce new products or increase the sale of less popular products by linking them to the established products of the firm's line. This represents bundling because the buyer of both products receives a discount compared to someone who buys them separately without the benefits of the coupon.

2.3 An overall framework for a literature analysis

The various definitions of bundling discussed in the previous paragraph may appear very different from each other. Some refer to rigorously defined economic concepts, other are more loose industry practice descriptions. A possible reason is that all formalisations on bundling emerged in different contexts and aimed at explaining the different objectives that firms may try to achieve when setting up a bundling strategy, often to a very different audience and with dissimilar objectives. The resulting ambiguity in formalization and definition already addressed by Stremersch and Tellis (2002) is probably the direct consequence of a concept that developed in parallel in different disciplines. As mentioned by Fuerderer(1999), the literature treats the rationale and results of commodity bundling within the frameworks of industrial organisation; competition legislation; economic analysis; behavioural economics; and decision-making.

The idea of bundling originated in the 1960s in the seminal works of Burstein (1960*a*, 1960*b*) and Stigler (1961) but can be also linked to the work on transaction costs of Coase (1960) and Demsetz (1968). The early examinations in the economic literature aimed at assisting policy makers in assessing the antitrust implications of bundling and tying practices (Stigler, 1968; Burstein, 1960*a*; 1960*b*; Telser, 1965; Blackstone 1975; etc). This expanded in a more general attempt to understand the potential of bundling for companies and consumers in monopoly (Adams and Yellen, 1976; Warhit, 1980; Palfrey, 1983; Schmalensee, 1984; Whinston, 1990) or in more generalised settings such as oligopoly or monopolistic competition (Porter, 1985; Carabjo, de Meza and Seidmann, 1990; Lawless, 1991).

A parallel stream of research aimed at defining optimal bundling strategies from the marketing management point of view. This required on the one side, setting up guidelines for companies on how to successfully implement strategic bundling in general (Porter, 1985; Eppen, Hanson and Martin, 1991; Stremersch and Tellis, 2002; Fuerderer, Herrmann and Wübker, 1999) and in connection to the market conditions (Wilson, Weiss and John, 1990; Guiltinan, 1987; Stremersch and Tellis, 2002), and on the other side, investigate customer's perception of bundled products (Nagle and Holden, 2002; Gaeth, *et al.* 1991; Yadav and Monroe, 1993). This connected with the literature on how to measure utility and structure product lines maximizing market share, buyer's utility and seller's profit. A large set of literature refers, for example, to conjoint analysis (e.g. Zufryden, 1977; Dobson and Kalish, 1993; Bauer, Herrmann and Mengen, 1994; Cattin and Wittink, 1989) while other explored stochastic choice models (e.g. Ogawa 1987) or aggregate utility structure (e.g. Green 1984; McFadden 1974, 1980; Daganzo 1979).

Table 4: Market structure assumptions in the literature.

	Good X		
Good Y	Monopoly	Limited competition	Competition
Monopoly	Cournot (1938)*, Stigler (1961, 1968)*, Adams & Yellen (1976)*, **; Schmalensee (1984)*; Salinger (1995)*, E; McAfee et al. (1989)*; Bakos & Brynjolfsson (1999)*; Chioveanu (2007); Carlton and Waldman (2006); Fang and Norman (2006); Geng et al.(2005); Ibragimov (2005); Burstein (1960a)*; Warhit (1980)*; Seidman (1991)*; Bork (1978); Venkatesh & Kamakura (2003)*,**,PC.	Nalebuff (2004b)*; Whinston (1990)*; Whinston (2001)*; Tirole (2005)*,**; Spector (2007)*.	Schmalensee (1982)** Nalebuff (2004a)** McCormick et al.(2006)
Limited competition		Economides (1993)*,**,Matutes & Rigibeau (1992)**,PC; Carlton & Waldman (2002),*; Stole (1995)*,**; Choi & Stefanadis (2001, 2006)*,PC; Nalebuff (2000)**; Liao & Tauman (2002)*,**,PC; Farrell et al (1998)**, E, PC; Tauman, et al.(1997)**; Carbajo, et al.(1990)*.	Chen (1997)*,X,Y
Competition			Evans & Salinger (2004, 2005)*,E; Liebowits & Margolis(2009)*,**, Craswell (1982)*; Thanassoulis (2007)**.
No assumption	Stremersch & Tellis (2002; Eppen, et al.(1992); Mathewson & Winter (1997).		

*=Pure bundling; **=Mixed bundling; E=Efficiencies in production allowed; PC=Assumption of perfect complements.

Source: Kobayashi (2005*a*), adapted and expanded by the author.

The brief review presented in the previous two paragraphs is by no means exhaustive and it aims at summarising the major research streams in which the concept of bundling has been discussed. A more detailed review of the existing literature on bundling is presented in the following sections. In order to proceed with a systematic presentation of the key findings on bundling a somewhat more systematic approach to literature analysis is required. Generally speaking we can distinguish the literature on bundling on the basis of several characteristics: its reference discipline, the affinity of the authors with a certain scientific domain, the market structures it refers to, the objectives of the paper, the objectives that bundling aims at achieving. For the purpose of this study we decided to subdivide the literature contributions in two major groups: the contributions that refer in a broader sense to the industrial organisation literature (presented in section 2.3 to 2.10) and the contributions that can be tagged under the marketing management label (2.11 to 2.12).

As far as the industrial organisation literature is concerned we has several options at hand in order to categorize the different streams of research. In previous literature reviews (see for example Kobayashi, 2005*a*) the leading subdivision has been the market structure to which the authors referred to (monopoly, oligopoly, competition). This approach is presented in table 5. Others (e.g. Stremersch and Tellis, 2002) categorised the contributions on the basis of the objective of the paper. In the following, the contributions have been grouped around key themes, mirroring the attention that these themes have received in the academia. This review is in a certain way also historical as the themes presented are ordered, to the extent possible, following the logic that older contributions are discussed before newer ones. Our framework for reviewing the literature is presented in the following table. In particular is should be noted that section 2.5, 2.6, 2.8 and 2.9 are closely related, and the setting somehow differs only on the market structures put forward in the models and are not presented sequentially for exposition reasons. Finally, like often in this case, this subdivision is purely conventional and motivated by practical reasons.

Table 5: Literature review organisation.

Discipline	*Theme*	*Section*
Industrial Organisation	Bundling as a vehicle to price discrimination	2.4
	The leverage theory	2.5
	The foreclosure argument	2.6
	Bundling related cost efficiencies	2.7
	Bundling in imperfect competition settings	2.8
	Bundling as a barrier to entry	2.9
	The theory of vertical organisation for complementary products	2.10
Marketing Management	The opportunities offered by bundling, optimal bundle composition and optimal pricing strategies for bundles	2.11
	The assessment of consumers' perception of bundles	2.12

Source: Author.

2.4 Price discrimination

One of the first articles directed specifically to bundling is the already cited paper of Stigler (1968). The focus of the paper on block booking in the film distribution industry is price discrimination through bundling, and it led to a particularly relevant stream of literature. In this influential paper, Stigler argues that in case customer valuations of two movies are negatively correlated, pure bundling helps reduce the valuation heterogeneity across customers and allows the film distributor to effectively price discriminate and extract consumer surplus. The author shows how this strategy delivers better results than the independent setting of the (monopoly) price for each movie. The example thus clearly illustrates the role of product bundling as a pure price discrimination tool for the extraction of consumer surplus[6].

This is also the focus of the important article of Adams and Yellen (1976) that constitutes also the first structured attempt to present the rationale and effects of bundling as a pricing strategy and is the first to introduce a graphical representation of commodity bundling. Adams and Yellen (1976) in particular demonstrate that product bundling achieves the objective of sorting consumers on the basis of their reservation prices thus, allowing price discrimination. The incentive for bundling under short-run profit maximization arises exclusively in order to price discriminate (Kühn, *et al.* 2005). The original article and Simon and Wübker (1999) among others, provide numerical examples of the gains deriving from this form of bundling.

Several contributions have followed the direction set by Stigler (1968) and Adams and Yellen (1976) in discussing and explaining under which conditions bundling acts as an effective consumer segmentation mechanism (Schmalensee, 1982; 1984; Guiltinan, 1987; McAfee, McMillan and Whinston, 1989; Salinger, 1995; Pearce and Winter, 1996; Steremersch and Tellis, 2002). In general all contributions show that with bundling, sellers could extract more revenue from customers. For this to be true in the case of pure bundling additional assumptions on consumers' preferences are required. Pure bundling acts as an effective price discrimination tool for consumers with strong preference for *one* of the goods in the bundle (Adams and Yellen, 1976). In more general terms the effectiveness of pure bundling as a price discrimination tool depends on the distribution of reservation prices (e.g. normal or uniform distribution) and their joint distribution across the bundled products and on the correlation of consumer valuation across the products (Schmalensee, 1984). Stremersch and Tellis (2002) refine this finding clarify-

[6] This was also the position taken by the Supreme Court in the two landmark cases that triggered Stigler's analysis (See previous footnote). Although the arguments of Stigler are logically sound, more recently it has been argued that in reality the rationale for block booking was more related to the practical necessity of providing films in large quantity and at a lower cost (Hanssen, 2000). The antitrust regulation preventing block booking has been argued to have been actually detrimental to the industry (Orbach and Einav, 2007).

ing an implicit assumption of the model of Adams and Yellen (1976) and Guiltinan (1987), i.e. that reservation prices for the bundle are assumed to vary across consumers. If this is not true, pure price bundling yields always at least as good results as mixed price bundling.

Even when the consumer valuations for the products are not negatively correlated, mixed-bundling could be profitable. Schmalensee (1982) shows that mixed bundling can be profitable to the firm even when customer valuations are positively correlated as long as the correlation is not near to or equal one. The profitability of bundling is based on its ability to reduce the dispersion of reservation prices and thereby makes it possible for the monopolist to extract a greater share of consumer surplus (Schmalensee 1982; 1984). The contribution of McAfee, *et al.* (1989) is important in two respects. Firstly they demonstrated that a mixed bundling strategy almost always strictly dominates pure bundling, when cost effects are absent and customer valuations are uniformly or normally distributed. Secondly they demonstrated that a mixed bundling strategy dominates unbundled sales for virtually all distributions of reservation prices as long as component re-sale can be prevented. In these circumstances, the optimal bundling price can exceed the sum of the prices of the individual goods.

In a recent article, Fang and Norman (2006) expand the analysis of Schmalensee (1984) to the case of a limited number of goods with zero marginal cost. Similarly to Bakos and Brynjolfsson (1999) and more recently Geng, Stinchcombe, and Whinston (2005) and Ibragimov (2005), the authors aim at establishing reasonably general conditions under which bundling is a profit-maximising strategy. They argue that pure bundling in the case of monopoly should be preferred to pure components strategy for high marginal costs and low mean valuation. In general in accordance with the results of Schmalensee (1984), they note that the variance in the willingness to pay is reduced when products are bundled, i.e. bundling reduces dispersion. These findings seem also to be supported by recent empirical results (Crawford, 2008).

Salinger (1995) developed the analysis in a different direction. In his article, he proposes a graphical interpretation of bundling that clarifies the profitability and welfare consequences of bundling and extends the considerations of Schmalensee to all distributions defined over a finite range. But probably the most interesting extension in the analysis refers to the explicit consideration of cost savings from bundling and not only demand interactions. In other words, Salinger expands the findings of the literature on *price* bundling to *product* bundling. The finding of Salinger are particularly interesting as he shows that when bundling lowers costs, it tends to be more profitable when demands for the components are highly positive correlated and the components costs are high. This is in net contrast to the pure demand-based theory of price bundling, where this strategy tends to be more profitable when components costs are low and demands are negatively correlated.

2.5 The leverage theory

It is convenient to continue the review of the industrial organisation literature on commodity bundling with the case of a multi-product monopolist. This is not only because originally the idea of bundling has been developed within the settings of this market structure but also because understanding how product bundling may be profitably employed by a multi-product monopolist is useful in realizing why certain problems have been given particular attention in the literature and why the legal framework has developed as it is today.

In general we refer to the conventional two-product framework, although, occasionally, reference will be made to the n-product case. In general most of the results discussed in the literature can be extended, not always without complicating heavily the notation, to the n-product case.

The articles of Burstein (1960*a*, 1960*b*) dealt more in general with tie-in sales and in particular with the possibility offered by this practice to extend monopoly control to the tied product market, thus violating sections 1 and 2 of the Sherman Act and Section 3 of the Clayton Act in the U.S. and Article 82 of the EC treaty in the European Union. The interest in bundling was stirred by a series of legal cases[7] in the United States and more recently in Europe where it was argued that the firms involved engaged in restrictive market practices that violated competition rules. The essence of the legal cases was whether the firms had violated the relevant competition rule (or as in the case of GE/Honeywell, would be in a position to violate EC competition rules) by means of commodity bundling. The discussion was based on the observation that the defendant firms enjoyed some sort of monopoly position in a certain market as a result of a patent protection or of a merger but competed with other companies on a complementary product.

This issue is central in the literature on bundling and is connected to the broader debate on the *leverage theory*. The traditional interpretation of the leverage theory argues that a firm with monopoly power in one market can use the leverage provided by this power to foreclose sales in, and thereby monopolise, a second market (e.g. Kaysen and Turner, 1959). The discussion presented by Burstein on the relevance of the leverage theory for bundling was then further discussed in

[7] Landmark cases of this type include Heaton-Peninsular Button-Fastener Co. vs. Eureka Specialty Co. 77. Fed. 288. (Sixth Cir. 1896); United Shoe Machinery Corp. vs. United States, 258 U.S. 451 (1922); International Business Machines Corp. vs. United States, 298 U.S. 131 (1936); International Salt Co., Inc. vs. United States, 332 U.S. 392 (1947), United States vs. IBM, C.A., 69-200 (1969) and United States vs. Microsoft Corp., C.A., 98-1232 (2000), United States vs Microsoft Corp., 253 F.3d 34 (D.C. Cir., 2001); U.S vs Microsoft Corp., 231 F.Supp. 2d 144 (D.D.C. 2002), the European Commission Decision against the merger of General Electric and Honeywell, (Case COMP/M.2220 General Electric/Honeywell 2001), the European Commission decision on Microsoft and Windows Media Player (Case COMP/C-3/37.792 Microsoft, 2004).

Warhit (1980) and more recently in Whinston (1990) and Seidmann (1991). It should be noted that the major focus of these papers is pure bundling[8].

Although pure price bundling by a firm with market power is forbidden under antitrust law, the leverage theory is generally dismissed by economists on the basis of an argument attributed to Aaron Director (Director and Levi, 1956) according to which if the monopolist could extract full consumer surplus when selling the tying good independently, it would never find it profitable to bundle, as this would require that every increase in the tied good price to be matched by an equivalent decrease in the price of the tying good[9]. This formulation of the Director's argument implies that the logical purpose to bundle is to allow a seller to make use of the patent rights that it holds with regard to a product through for example price discrimination as discussed below.

And *indeed* some of the firms in the legal cases previously mentioned did refer to price discrimination, or more precisely to *metering*, explaining that the purpose of bundling was that of distinguishing between different type of users. For example in the Heaton-Peninsular Button-Fastener Co case, the firm required the customers of its patented stapling machines also to purchase the staples form it, effectively facilitating the extraction of monopoly rents. By forcing its users to purchase staples jointly with the stapling machine, the company had the possibility of charging those customers that made heavier use of the machine a higher price than those who made a more limited use of the machine, as indicted by the staples purchased. The analogy with the IBM tabulating machines described before is obvious.

By this reasoning, the bundling practice in question is effectively an exercise in price discrimination and has nothing to do with leverage. The Chicago School strongly endorsed this view (Director and Levi, 1956; Bowman, 1957; Burstein 1960*a*; Posner, 1976; Bork, 1978 and others), and although this is not conclusive on the legality of the practice, the economics underlying this discussion suggests that indeed no extension of monopoly power from the tying good market to the tied good market has taken place.

---

[8] Although, for example, Warhit (1980) recognises the role that bundling may play in reducing of transaction costs, she dismisses this as a good reason to practice pure bundling, as the same benefits can be achieved by means of mixed bundling. In reality, Warhit dismisses the advantages of bundling, as they referred to *product* bundling, instead of *price* bundling, that is the core of the discussion of Burstein (1990*a*). It should be observed that the practice of pure price bundling by a firm with market power could be unfavourable to consumer as it allows for an effective application of the leverage theory (Warhit, 1980; Whinston, 1990).

[9] The essence of Director's argument is that bundling does not lead to higher profits. In fact if the monopolist could earn a higher profit by selling its product in a bundle for a bundle price b, lower than the sum of the monopoly price m and the price c of the good produced competitively, this would be equivalent to a new implicit monopoly price $m' = b - c < m$. Since the competitively produced good is available at c, anyone who buys the bundle is willing to pay for the product provided under monopoly $m' = b - c$. The monopolist could then directly sell the product at m', eliminate the bundle and its profits would be at least as large.

Nonetheless, this argument only holds when consumers make use of the bundled products in different proportions and it is possible for the firm to observe the extent to which the consumer makes use of the product. When the tying and the tied goods are used in fixed proportion, as in the formal definition of bundling discussed in section 2.2, this justification for tying cease to be relevant. Analogously when the bundle components are unrelated, i.e. there is no possibility for product bundling or there are no economies of scope on the consumption side, there is no real incentive for the firm to consider product bundling when the correlation in the valuations of the products is not known (Schmalensee, 1982; 1984; Stigler, 1968).

This point of view is examined further in detail in Seidmann (1991). In this article the author argues that Director's Argument against the leverage theory is true only in particular circumstances and in general it is possible for a firm to bundle in order to extend monopoly power. This happens as Director's argument holds only if the monopolist obtained on the tied-good market full consumer surplus or monopoly profits and applied linear pricing for the tied good and for the bundle (Seidmann, 1991).

In Nalebuff (2004*a*; 2004*b*; 2005) the potential for a monopolist to extend its influence to adjacent markets by mixed bundling of a product produced under monopoly and another product is further discussed. The interesting point of the article lies in the fact that consumers are not forced to buy the bundle, but accept it voluntarily. The firm achieves this outcome by reducing the price of the bundle and maintaining the price of the tied product sufficiently high. The reduction in price causes no first-order loss to the firm, while providing a first-order incentive for customers to voluntarily accept the deal (Nalebuff, 2004*a*).

This approach is similar to the one discussed by Whinston (1990) although his article 'Tying, foreclosure and exclusion' brings the discussion on a different level. Whinston demonstrates that in theory, leverage through bundling is feasible in a strategic setting. The leverage theory is also reinterpreted in view of the possibilities offered by product bundling. If we allow for economies of scale (and scope), bundling could remain a profitable strategy for the incumbent multi-product monopolist. In this case in fact, bundling will ensure that a higher level of sales in the tied market is achieved, in turn implying lower unit costs of production for the firm compared to that of its rivals. This provides the firm with the opportunity to foreclose its competitors by lowering the price that it charges for tied product. In principle, only the threat to tie could deter rivals from entering the tied product market.

Nevertheless, the argument presented by Whinston (1990), although interesting in theory, is based on the assumption that the bundling firm never prices below marginal cost. As a result, rivals with equal or lower marginal cost are excluded only if fixed costs are high enough (Kühn, *et al.* 2005). In addition the theory gives limited insight into the issue of complementarity, as for highly complementary products Director' argument holds. In addition Carlton and Waldman (2006) did not find practical evidence that could support Whinstons's point. Although virtually all cases of technical bundles would then be eligible for foreclosure, in practice the conditions required for the it to actually happen are too restrictive (Liebowits and Margolis, 2009).

The article of Whinston can be connected to the literature developed by the so-called *New Chicago School*. In the perspective of the New Chicago School, the attractiveness of bundling is not based on the benefits that it delivers to the firm at present, but on the shift of demand from the competitor to the bundling firm *in the future*. This theory is often referred to as the *foreclosure argument* that is discussed in the next paragraph.

2.6 The foreclosure argument

The foreclosure argument presented by Whinston (1990) and more recently by Carlton and Waldman (2002; 2006) and De Graba and Mohammed (1999), postulates that bundling firms could preserve and create market power in evolving industries. Market foreclosure is one of the last standing defences of antitrust provisions against bundling. In its original formulation, the theory is as follows[10]. A first assumption in the model is that a firm enjoys monopoly power for a product whose consumption requires the purchase by consumers of a second product provided in a more competitive downstream market. By tying the two products together, the monopolist has the possibility of crowding out potential rivals in the downstream market. As already mentioned, production of the tied product is subject in the model of Whinston to scale economies, implying that a company providing the tied product can survive only if it reaches a certain minimum efficient scale. If users of the tying product constitute a large enough proportion of the downstream market, the tying strategy would have the potential to foreclose it.

It should be noted that raising prices in the downstream market for the share of customers that purchase the tying product would not increase the profits of the monopolist, as he is already extracting monopoly rents and a price increase on the tied market would most likely result in some customers switching to a competitor, so in other words, rising the price for the product produced in the competitive market will only lower the price the monopolist can charge users of the product produced under monopoly. The advantage of the tying strategy would lie in the ability that the monopolist would acquire to extract monopoly rents from the consumers that purchase exclusively the tied product.

In Whinston's discussion on the foreclosure argument, Liebowitz and Margolis (2009) argue that the set of hypotheses required for this situation to happen are far too restrictive and unrealistic. The users of the product provided under monopoly must constitute a large enough share of the market for the product pro-

[10] A critical discussion on the foreclosure argument is provided by Liebowits and Margolis (2009).

vided in competition in order to reach minimum scale effects, but at the same time not too large, as otherwise there would be not enough consumers in the tied market to make the tie-in worthwhile (given that the monopolist would already control the tied market). In addition the minimum efficient scale for the tied product is not large enough then the monopolist will have difficulty crowding out rivals in this market. Furthermore, the average cost curve must be steep enough so that entry at output levels below the minimum efficient scale is deterred even as prices for the product produced in competition increase.

Also Liebowitz and Margolis (2009) note that if increasing returns to scale are great enough in the market for the product sold in the competitive market, it might have been monopolized already so that the switch in monopoly ownership that could result from the tie-in would in reality not harm the consumers. In addition this formulation of the foreclosure argument lacks empirical evidence (Kühn, *et al.* 2005; Liebowitz and Margolis, 2009). In practice in fact, the direct effect of tie-in contracts were observed, was to allow the seller to charge a price for the tied-good that was above the price *available elsewhere*. Competitors were not foreclosed from the market for the tied product. In some cases, the seller of the tying product could even purchase the tied product form other producers and resell is at a higher price. IBM, for example, did this with Hollerith cards. IBM had no chance to monopolize the paper or cardboard market and made no attempt to do so (Liebowitz and Margolis, 2009).

Carlton and Waldman (2002) present a similar discussion. In their framework a multi-product monopolist could hold at bay a potential entrant into the primary and complementary product markets through bundling. The focus of this paper is the sequential strategy of entry. In their model, an entrant is considering sequential entry into the primary market and subsequently into the complementary one. The model considers the case where the entrant may possess a superior technology. If the entrant only enters the primary market, industry profits would rise, and the monopolist would be better off. Under these circumstances, pure bundling would not be used to deter entry. However, Carlton and Waldman show that pure bundling may be used if the entrant also attempts to enter the complementary product market at a later stage. If this reduction in profits is large enough, the deterrence of entry may be sufficient.

Once again, the Carlton and Waldman result requires that the initial monopolist commits to bundle—he would otherwise choose to cease bundling if entry actually occurred—. In this way, the monopoly status of the incumbent is preserved. Carlton and Waldman (2005*b*) also extend the theory encompassing the prospect that the incumbent multiproduct monopolist may try to acquire a monopoly position in a newly emerging market that makes use of the same complementary product and examine the use of tying in the presence of anticipated product upgrades and consumer switching costs (Carlton and Waldman, 2005*b*).

The results of Carlton and Waldman (2002; 2005*b*; 2006) create dynamic incentives for entry deterrence that are not present in static models. These results seem rather convincing in theory, but nonetheless in another paper (Carlton and Waldman, 2005*a*), the authors suggest that "a very cautions approach" to antitrust liability be taken based on such dynamic models (Kobayashi, 2005*a*). The debate of the foreclosure argument is not exhausted. In particular its relevance in different formulations shaped part of the literature focusing on the importance of bundling in the imperfect competition setting. Before addressing this and other theories, it is expedient to consider first the reasons that might motivate bundling and tying when strategic incentives are not present. This is the topic of the next section.

2.7 Cost efficiencies

In his influential article '*The Nature of the Firm*', Ronald Coase (1937) set the foundations of transaction costs economics[11]. The efficacy of bundling in reducing transaction costs is often cited as one of the major reasons why firms may want to engage in this type of strategy (Adams and Yellen, 1976; Lawless, 1991; Kohli and Park 1994). The literature on bundling indicates that potential efficiency benefits form bundling could arise essentially because of two mechanisms: benefits on the production side and benefits on the consumption side (Kühn, *et al.* 2005). On the consumption side, bundling allows buyers to avoid the transaction costs of contracting with several firms and therefore save time and information costs (Simon and Wübker, 1999; Kobayashi, 2005*a*; 2005*b;* Evans and Salinger, 2005). On the production side bundling reduces costs by allowing the firm to reap economies of scale (Paroush and Peles, 1981; Guiltinan, 1987) and scope (Guiltinan 1987; Venkatesh and Mahajan, 1993; Liebowitz and Margolis, 2009) of joint production, and reduce complexity costs (Eppen, *el al.* 1991; Anderson and Narus, 1995). If these cost reductions are passed on to consumers, bundling further benefits society by and large (Simon and Wübker, 1999).

An example presented by Telser (1979) and more recently refined by Liebowitz and Margolis (2009) may be useful to explain the advantages deriving from bundling that occur independently of the hypotheses made on the structure of the markets for the bundle components. The authors refer to a car as a *bundle* of different components (seats, engine, radio, heating system, brakes, etc.) similarly to personal computers that are a *bundle* of keyboard, monitors, motherboards, software, etc.

The example on the automobile should not be interpreted as if all products are the result on bundling—along this line Stigler (1968) argued that also a pair of shoes could be considered a bundle—. Firstly the standard automobiles come with a set of options that are bundled together with the basic model, such as air-

[11] A further review of the literature on transaction costs is provided in chapter 6.

condition, radio, airbags, etc. As such, this is an example of add-on bundling as defined above. Some of these options were not included in the standard equipment in the past and have become an integral part of the modern automobile. Heaters, rust proofing and sound systems are simple example of what in the past was optional and supported an active aftermarket, and has now become standard equipment. This shows that what might have been perceived as a bundle in the past, may be perceived as a product in its own right now[12] (Liebowits and Margolis, 2009).

Secondly, while there is not aftermarket for left or right shoes alone, there is a considerable aftermarket for some car parts such as radio equipment and tires. These components are products in their own right although most of their uses are tied to the automobile. For some of these options, there are economies of producing and selling these options together with the car, for others, simply shipping and assembling them to the car generates additional costs that can be avoided when the car is purchased as a all inclusive bundle. These savings in production and transaction costs changed as new technologies in car manufacturing were introduced and mass production required integration in order to make automobiles available to the masses.

Thirdly, it is observed that the sum of the prices of all the parts in an automobile, is a large multiple of the price of the entire car. This may be motivated by the market conditions under which some car parts are produced and provided, but it cannot be denied that much of that cost differential has to do with the high costs of maintaining inventories, arranging supply channels, packaging and shipping individual items, and handling the transactions. Bundling provides important reductions in these transaction costs (Liebowits and Margolis, 2009).

In particular in those cases where no market power is involved, the economies deriving from bundling seem to be sufficient to motivate this ubiquitous practice. The industrial organisation literature on bundling in view of its potential in generating cost efficiencies is far more limited that that on the multiproduct monopoly. Two major exceptions are worth mentioning. The first article is Craswell (1982) that discusses whether there is any role for antitrust policy when bundling is applied in competitive markets. The author recognises that in general bundling would benefit both producers and consumers in virtue of the cost efficiencies described above. Craswell attributes the beneficial effects of bundling on consumer to the following four classes of efficiencies:

Efficiencies in production; these efficiencies arise when products are cheaper to be produced or distributed as one instead of separately. The automo-

[12] Consider that in the early days of the automobile, chassis, drivetrains and instrument panel were assembled and sold separately from the coachwork and the car body itself. At the time this constitute two different products with interrelated, but yet independent markets. As Liebowits and Margolis (2009) suggest, a car manufacturer that sold both as a unique product would have practiced a form of bundling.

bile example given above is an obvious case of this type of efficiencies. Craswell (1982) argues also that although customisation in the case of these efficiencies might still be possible, as time passes and the production process develops to embed these production efficiencies, customization may become prohibitively expensive. This is the phase, when, the bundle effectively becomes a separate product (Liebowits and Margolis, 2009).

Efficiencies in product selection; when the information costs make it difficult for the buyer to make the selection of the complementary product or the seller can enjoy economies of scale or greater bargaining power in procurement, we can talk of efficiencies in product selection. This type of efficiencies is common when the seller has a better understanding of the operational or quality requirements of a bundled product as in some cases of franchising relations. Consider for example that a certain appliance functions better with certain products. The seller can tie the use of the appliance to the use of the product so that to ensure best performance of the appliance. This is also the case of logistics integration in the case of customers that possess less understanding of the quality of a certain transport mode choice with respect of a third party logistics service provider (Acciaro and Haralambides, 2007; EUR and SMU, 2006; 2007). Franchisors may tie the franchise together with certain specifications on the location or attributes of the premises where the product has to be sold. This is the result of a better understanding of the franchisor of the quality requirements of the product (Craswell, 1982).

Efficiencies in product evaluation; Craswell argues that when a consumer purchases unbundled products from different producers, there might be circumstances in which he is able to assess the quality of the joint product but not the quality of the individual components. Think for example of software running on computer. As a consumer, it might be difficult to verify, in case the software does not perform as expected, whether the computer or the software is of poor quality. A more concrete example may involve a franchisee that makes use of low quality supplies. The franchisor may require the franchisee to make use of certain supplies in order to safeguard the quality of the franchised product. This is the case, for instance, of McDonalds restaurants that require in the franchise contract a large component of supplies, e.g. frying fat, potatoes, milkshakes, to be purchased directly by McDonalds-approved retailer.

Efficiencies in allocating risk; these efficiencies arise when the seller and the buyer do not have full knowledge of the amount of product that needs to purchased. A buyer might not know in advance how much the tying product will be used and how it will perform (for example, a new printer), but the amount of the tied product that is purchased will depend roughly on the amount of use the tying product receives (for example, ink cartridges). In such a case, both buyer and seller may prefer a sale of the tying product at a price that is below its cost, on condition that the buyer purchases the tied supplies at an above-market price. If the tying product turns out to be useless, not many supplies will be purchased, and the total amount the buyer will have paid will not be very much. Conversely, if the tying product turns out to be successful, then the buyer will purchase more supplies, resulting in a larger total return for the seller. Such an arrangement thus shifts some of the risk as to the product's value from the buyer to the seller.

A further interesting point of the article of Craswell is that certain patterns of imperfect information may allow bundling to harm consumers. This can happen as tying does not represent a cost reduction but is the result of some market failure other than monopoly. In this case three non-exclusive explanations are provided:

a) *Fraud or surprise*: the consumer is not entirely aware or does not completely understand the tying arrangement. This case manifests when the consumer does not have possibilities of estimating how much of the tied product he will need to consume, but he is unable to escape the bundle.

b) *Opportunism*: In this case the consumer is forced to further purchase the tied product even if it was not aware of this requirement at the moment of the purchase of the tying product; this can be the case technology-based bundles. As an example, Sony marketed a music portable player that converted all music formats in a unique format, the *.oma* that could only be read by Sony-technology-based devices. Users might have purchased the player attracted by the versatility and sharing possibilities of the digital music file, such as *.mp3*, but, as Sony had a direct interest in preserving the copyright of the music it sold, earlier versions of its digital music players would not allow file transfer;

c) *Lemons equilibria*: in the previous two cases the buyer receives some element of surprise, but asymmetries in information can imply that buyers can be harmed even if they understand well the implications on the offer they are purchasing. This can happen because they do not posses full information in terms of prices and quality on options made available to them by competitors (Akerlof, 1970).

In a more recent contribution by Evans and Salinger (2005), the authors suggest that in those markets where competition results in setting market prices equal to average costs, bundling can emerge as a result of cost based reasons. Also in this contribution, price discrimination and strategic considerations are explicitly excluded from the analysis. The model allows for mixed bundling, and assumes that all product components are produced at fixed marginal costs, fixed costs do not change among the various product components, and that economies of scale in production characterise all markets as natural monopolies, so that only one firm produces in equilibrium. The model assumes free entry and contestability ensures zero profits. In their analysis they allow two costs saving mechanisms; marginal cost savings and fixed costs savings. Their analysis shows how industries with high fixed costs, or moderate fixed costs and limited demand for one of the components of the bundle, may benefit from bundling.

In their model they assume three type of consumers, that prefer consuming only X, Y or a combination of both X and Y respectively. Demands are assumed inelastic and uniformly distributed among the three classes of consumers. They assume five possible seller strategies:

1. X and Y are sold separately;
2. X and Y are sold as a bundle and individually (mixed bundling);
3. X and Y are sold as a bundle only (pure bundling);
4. X and Y are sold as a bundle and only X is made available separately;
5. X and Y are sold as a bundle and only X is made available separately.

In their discussions, options 2-5 are defined as *bundling*, while 3-5 as *tying*. The article offers the following conclusions. Marginal costs savings are neither necessary nor sufficient for tying to occur in competitive markets. Fixed costs saving are a necessary but not sufficient condition for tying to rise in competitive markets. Pure bundling will occur either when fixed costs are high, or, if fixed costs are moderate, when consumers demand all components in the bundle and at least one of those products is demanded in small quantity. Mixed bundling will emerge when fixed costs are absent. Finally, firms will sell products in addition to the bundle when demand for one component is high but it is low for the other (Evans and Salinger, 2005).

In essence bundling will occur only if it generates fixed costs or variable costs savings. In particular if fixed costs are high enough[13], then pure bundling is sustainable. Mixed bundling is induced by a combination of fixed costs and variable costs savings. The major finding of the model is that firms may decide to eliminate certain configurations for two main reasons: i) They eliminate a choice because it saves costs and in turn lowers the price of the other offers; ii) they eliminate the choice because it is not profitable to offer that choice to the group of consumers that demand it (Evans and Salinger, 2005). The article concludes with examples of the empirical applicability of the findings in the following industries: over the counter cold remedies and pain relievers; foreign electrical adapters; optional equipment on automobiles.

The article of Stremersch and Tellis (2002) points out that little research has been done to understand the role of costs in the optimality of bundling. They mention that the relevance of costs for product and price bundling is related essentially to the relative contribution margin, given by the difference between price and variable costs divided by price, the existence of economies of scale and scope and the additivity of costs in the bundling process. They argue that price bundling is likely to be more profitable than unbundling when the relative contribution margin is higher and when economies of scale and scope are stronger. In addition they mention that if costs deriving form a product bundle are subadditive, this strategy is always superior to unbundling strategy irrespective of consumer reservation prices or the nature of competition.

[13] In the example provided in the article, higher than three times the total variable costs of producing the stand-alone product.

McCormick, Shughart and Tollison (2006) provided an interesting application of transfer pricing theory to bundling that suggests that bundling is equivalent to vertical integration in final consumption goods. The authors argue that if one of the products is provided at prices above marginal cost in the market, as a result of for example market power, consumers will be prompted to buy them in less than optimal quantities by substituting them with other products. This is the result of what is generally referred to as the *Transfer Pricing Theorem* (Hirshleifer, 1956). Let us assume for example that a certain transport corridor is entirely controlled by a provider, so that tariffs to exploit this route are maintained above marginal costs. Transport operators will avoid using this route and will develop alternatives that may be less efficient, so that the allocation of traffic flows through the fully monopolised route and the alternatives will be suboptimal.

McCormick *et al.* (2006) suggest that assembling products in a bundle would overcome this type of distortions in the relative prices of the alternative routes, although it would maintain the deadweight loss. The transport operator could provide an integrated route as a bundle and reallocate traffic on the fully monopolised route. They observe in essence that bundling has the potential of correcting distortions in the combinations of final goods employed in household production, contributing an additional efficiency rationale to the literature.

2.8 Bundling in imperfect competition

Once the importance of costs issues has been assessed, it might be worth discussing the role of bundling as a leveraging device in markets characterized by imperfect competition in one or both products. The difference with the traditional formulation of the leverage theory is that in the case of a multiproduct monopolist, the leverage issue becomes relevant only in a dynamic setting (foreclosure).

The literature on strategic bundling in imperfect competition is more limited and seems to point to two major directions. On the one side there are those, such as Carbajo, *et al.* (1990) and Chen (1997) that emphasize the reduction of aggressiveness in duopolistic competition, i.e. higher prices, and in general find that bundling tends to decrease competition. This argument derives from the ability that bundling grants the firm to differentiate its product from rivals. In contrast with the article of Whinston (1990) previously discussed firm entry and exit decisions are unaffected by bundling.

More specifically, in Carbajo *et al.* the monopolist in the primary good (X) market engages in Bertrand price competition with its rival that distributes an identical product in the complementary good (Y) market. Under the hypothesis of Bertrand competition in the duopoly market, bundling is always profitable. In fact, if the monopolist does not bundle, the products in the Y market are perfect substitutes and then prices are driven down to unit cost. Through bundling, the monopolist is able to differentiate Y from the rival, so that both firms are no longer such close competitors and so both are able to raise price above cost. In equilibrium consumers with high (low) reservation prices for both goods purchase the bundle (the individual item). The authors also argue that this is not the case if the duopoly market for the complementary product is characterised by Cournot competition.

The model presented by Chen (1997) is different than those discussed so far as it considers a situation of duopoly characterised by Bertrand competition in the primary market, where both firms produce an undifferentiated good *X*, and a situation of competition in the secondary market, where more firms are active in the production of good *Y*. The two goods are complements, but consumers are indifferent between the various firms. The basic argument of the paper though is very similar to the one developed by Carbajo *et al.* (1990), in the sense that bundling allows the firm that practices it to differentiate product *X* from its rival and as a result also induces a less aggressive pricing policy. The equilibrium solution of the game where one firm sells pure bundles and the other firm does not, results is increased profitability for both firms. This is because consumers that highly value *X* (duopoly), will purchase it from the firm that does not engage in bundling; those that have a relatively high value for both *X* and *Y*, will purchase the bundle. Finally, those consumers that have high reservation prices for *Y* only will purchase it directly from the competitive market.

The equilibrium prices in this model are higher than the prices when bundling is not allowed, i.e. the price for *Y* is higher than *Y*'s marginal cost and the price for the bundle is higher than the linear sum of the marginal costs of producing *Y* and *X*. It is worth noting that the profits of the company that provides *Y* as a stand-alone product are higher than the profits of the firm that provides the bundle. In general the game formulation proposed by Chen allows for multiple equilibria, where one of the two firms provides the bundle and the other does not and an equilibrium in mixed strategy. The mixed strategy outcome is less favourable to both firms, while in general the firms would always prefer to be the producer of the stand-alone product[14]. How the firms solve the coordination problem is not addressed in the paper (Kobayashi, 2005*a*). According to Chen (1997), the policies adopted by some credit card institutions to bundle their cards with other goods as rewards is an example of this type of tying.

The analysis of Matutes and Rigibeau (1992) arrives at different conclusions. In their formulation, that represents an extension of a previous article (Matutes and Rigibeau, 1988), the authors consider two firms that produce two products each (*X* and *Y*). The firms have to decide whether to make their products compatible with those of the competitor and whether to engage in bundling. The paper shows that when bundling is allowed, the competing duopolists have a strong in-

[14] The firm that bundles is said to follow the "puppy dog" strategy of Fudenberg and Tirole (1984). But as is well known in the literature, it is the firm who did not bundle that will profit more from it.

centive to produce compatible products. The game though generates a prisoner dilemma situation, since by bundling and producing compatible goods, the firms earn lower profits than in the case in which both firms sold their products individually. From this point of view both firms would be better off if they could agree not to bundle. Bundling tends to increase consumer welfare, decrease profits, and decrease overall welfare. For this reason the duopolists will opt for a strategy that does not allow integration of their product, *de facto*, although not explicitly, avoiding mixed bundling.

The findings of Matutes and Rigibeau (1992) are close to those of Economides (1993). This problem is structured as a two-stage game in a duopoly market for two complementary products X and Y, where in the first stage firm 1 and firm 2 decide whether to bundle or not and in the second stage, set prices. Consumers can choose whether to buy both products as a bundle by the same firm, or opt for the unbundled components. It is assumed that all consumers purchase a unit of product X and a unit of product Y respectively and that they are characterized by different preference for the four resulting market options. The author shows that mixed bundling is a dominant strategy over no bundling and pure bundling. However, when the composite goods are not close substitutes, in equilibrium firm profits are lower than in the no bundling case.

The setting of Economides is similar to the one used by Tauman, Urbano and Watanabe (1997), Liao and Urbano (2002) and Liao and Tauman (2002), which provides also a literature review on the role of bundling in price competition. In these contributions, the strategic interactions between the two duopolists are described by a two-stage game, where in the first stage the firms decide on their bundling strategy and prices and then, in the second stage, consumers make their consumption selection. The authors show that in these circumstances bundling strategies play a central role, since if the use of bundling is not allowed, equilibrium may not exist. Bundling strategies are therefore important as a market stabilization mechanism (Liao and Tauman, 2002). Another important point of the above-mentioned contributions (but also of Chioveanu, 2007), is that, contrarily to the findings of Chen (1997), Matutes and Rigibeau (1992), and to a certain extent Carbajo *et al.* (1990), for example, bundling in oligopoly results in welfare maximisation. The article though shares with these contributions and others (e.g. Liao and Urbano, 2002) that firms may be better off when bundling is not permitted. In other words bundling stimulates inter-firm competition.

The model structure and findings are closely related to those of Anderson and Leruth (1993). In this article bundling never results in equilibrium, since in duopoly firms fear the increase in competition that results from bundling. This is in clear contrast to the results of Carbajo *et al.* (1990) and Economides (1993), where the equilibrium is characterised by pure bundling, and to the results of the literature on multiproduct monopoly (e.g. Whinston, 1990), where mixed bundling emerges as dominant strategy. Firms wish to avoid mixed bundling in this model because it means increasing competition, and they wish to avoid pure bundling because all discriminatory power would be lost. The pure components pricing equilibrium arises as the intermediate case. For this to hold, though, firms must be able to commit to this strategy (Anderson and Leruth, 1993). It should be noted that the article of Anderson and Leruth explicitly excludes the existence of economies of scale and scope or any other cost efficiencies, limiting the applicability of these findings to price bundling only.

In general it seems that the emergence of bundling as equilibrium in oligopoly and the resulting welfare effects are controversial, independently of the level of market power enjoyed by the bundling firm. In some cases the results on firm profits are ambiguous (Krämer, 2007*a*; 2007*b*). In some models firms are worse off as a result of the practice of mixed bundling, as some of the games clearly present prisoner dilemma situations (Economides, 1993; Chioveanu, 2007). In other cases, the benefits deriving for firms from bundling are unequivocal (Chen, 1997; Farrell, Monroe and Saloner, 1998; Nalebuff, 2000; Choi and Stefanadis, 2001; 2006).

In some of these contributions the results of the models are highly dependent on the hypothesis on consumer reservation price distributions. In general we can observe that for low values of consumer reservation prices, if products are compatible, firms tends to prefer mixed bundling. This causes profits to fall. If the firms have the capacity to foresee this outcome, they may try to prevent the possibility of mixed bundling by producing incompatible products, and therefore engaging in pure bundling. For moderate values, mixed bundling by one firm and no bundling by the other is an equilibrium for a wide range of moderate reservation prices. For high, or low values of consumer reservation prices, both firms will sell pure components (Kobayashi, 2005*b*). Stremersch and Tellis (2002) show through simulation that in competitive markets a mixed price bundling strategy dominates a pure price bundling strategy. A mixed product bundling strategy should be preferred to a pure product bundling strategy. The authors though argue that further statements on the impact of competition on the optimality of other bundling strategies cannot yet be made.

An interesting perspective on the discussion is provided by Krämer (2007*a*), who expands the role of (pure) bundling as a quality leverage device in oligopoly for non-complementary products. The model is based on a reciprocal duopoly setting that results in the convergence of the communication and entertainment media service industries as a result of the development of digital cable transmission technologies. These services are offered by former telecommunication and cable monopolists, which sell them in a bundle—the so-called Triple Play package. The author considers a three-stage game in order to investigate whether bundling is indeed a profitable pricing strategy, if it can facilitate market power leverage and if it emerges as an equilibrium strategy. The game is structured as follows: in the first stage the firm decides whether to engage in bundling at all, in the second stage it decides on the quality of the services provided and in the last stage on the price. In this setting bundling functions as a leverage device, through quality sorting effects where firms need to protect themselves from price competition in the bundled market. The result of the game is that one firm emerges as a high profit and high quality provider in both markets, while the other firm needs to settle for low qualities and low profits.

In Krämer, the welfare effects of bundling are unambiguously positive, as prices fall and quality rises. This conclusion is in contrast with other findings, e.g. Carbajo *et al.* (1990), Chen (1997), Choi and Stefanadis (2001, 2006) and Choi (2008), where the welfare effects of bundling are negative. Nonetheless, Krämer indicates that the welfare results in the case of bundling need to be judged on a *case-by-case* basis especially accounting for the different market structures and dynamics. The is also the recommendation emerging from the reviews of Kobayashi (2005*a*), Kühn *et al.* (2005), Hahn (2006), Evans and Salinger (2005) and in more general terms on the impact of price discrimination of Armstrong (2008).

2.9 Bundling as entry deterrent

In section 2.5 the historical foundations of the leverage theory have been presented. In that framework a monopolist in one product could expand its profits by means of bundling. We discussed how this argument has been criticised in the literature and how, subsequently it has been revisited through the foreclosure argument in Whinston (1990), and Carlton and Waldman (2002) among others. The arguments of Carlton and Waldman provide an alternative, and to a certain extent complementary, formulation of the foreclosure argument. The role of bundling as a vehicle to deter entry in imperfectly competitive markets is important and deserves some further discussion. The intuitive idea is that an incumbent firm makes entrance for a rival more difficult in a market if it engages in a set of interlocked activities. This argument is presented informally also in the management literature by Porter, when he notes "*positions built on systems of activities are far more sustainable than those built on individual activities*" (Porter 1996, pg. 73).

This idea is central in the articles of Choi and Stefanadis (2001) and Nalebuff (2004*a*). An incumbent seller of two products X and Y, faces the threat of entry by single-product rivals producing a perfect substitute to either product. An appropriate bundling strategy can be an effective vehicle to deter entry into either market by raising the level of investment costs necessary to enter the market. A good example is provided by carriers that invest in logistics and hinterland terminals. In this way they are able to secure a solid position in the hinterland since a potential competitor would have to invest not only in assets but also in know-how. If a competitor would be interested in entering the market an acquisition or a joint-venture would be a more effective way, e.g. NOL merger with APL.

This holds also in case of the risks associated with R&D costs. Choi and Stefanadis (2001) present as an example the case of bundling of Microsoft's Windows operating system with Internet Explorer previously discussed. In this example Microsoft faces competition by Sun Microsystems in the operating system and Netscape and other web browsers in the Internet browser market.

A similar example is the case of the merger between General Electric and Honeywell previously mentioned that was blocked by the European Commission in July 2001. The commission feared that the merged company could bundle its products in the aircrafts and avionics sector together preventing competitors, such as Pratt & Whitney and Rolls-Royce, in engines, or Rockwell Collins, in avionics, from introducing product improvements into their markets. In a more recent article, Choi (2008) examines mergers in the context of a duopoly model. The effects of a merger are to allow (or lower the cost of) bundling. The welfare consequences of allowing the merger are the same to the welfare consequences of allowing bundling.

Also Nalebuff (2004*a*) shows that bundling is a particularly effective entry-deterrent strategy. Bundling allows an incumbent to credibly defend its array of interlocked products without having to price low in any of them. Even if a one-product rival enters the market, bundling mitigates the market impact of entry. Making use of simulation, Nalebuff (2004*a*) showed that the rival takes fewer customers away, and prices do not fall significantly. As an example, Nalebuff points to the case of Microsoft's Office applications Word and Excel and their counterparts in Corel's Word Perfect and IBM's Lotus 123, respectively. By bundling Word and Excel as part of MS Office, Microsoft is able to use the near-monopoly status of one product to protect the near-monopoly status of other and vice versa and a potential entrant in only one component will find it hard to enter the market against an incumbent that sells the bundle at a discount.

The models of Choi and Stefanadis (2001), Whinston (1990) and Carlton and Waldman (2002) assume that one of the firms enjoys a monopoly position in one of the markets and that the second market is characterised by competition. These assumptions are relaxed in a more recent article (Choi and Stefanadis, 2006) where, similarly to the setting proposed by Nalebuff (2004*a*), both markets are assumed to be oligopolies. This is similar for example to the case of container terminals and ocean carriers. The results of the literature discussed above would provide a strategic motivation to the phenomenon generally referred to as *dedicated terminals* (Haralambides, Cariou and Benacchio, 2002). A carrier that invests in a dedicated terminal facility, that for example enjoys a certain degree of geographical market power, would be able to extend it to the complementary market for ocean transportation.

The model of Choi and Stefanadis is interesting also because they distinguish between two different types of potential entrants. On the one hand there are those rivals that face low marginal costs for both products produced by the incumbent company, on the other hand there are those competitors that face low marginal costs only on one of the products. The former are called *generalists*, while the latter *specialists*. The specialists may enter the market only if the complementary product to the one they produce is available as a separate component. Through bundling, the incumbent can keep specialist innovators out of the market, effectively deterring the introduction of innovations. Clearly the impact on consumer and total welfare is ominous.

In large part of the literature (e.g. Porter, 1985; Lawless, 1991; Choi and Stefanadis, 2001; 2006; Choi, 1996; 2003; 2004; Nalebuff 2004*a*), the effectiveness of bundling as an entry barrier is rooted in the degree of complementarity among the bundle components. This corresponds to improving the strategic positioning of a firm on the basis of enhanced buyer-seller relationship (Penttinen and Palmer, 2007) and is why logistics and supply chain management has become so attractive and seemingly indispensable. In most of these papers bundling the product in a market with an upstream or downstream product acts as an effective entry deterrence as long as the products are complementary in consumption (Lewbel, 1985). Product complementarity was also at the core of the discussion on technology-based or contract-based tying, and has come back as a critical issue in some of the recent antitrust legal case involving for example software manufacturers. It is therefore expedient now to address the issue more in detail.

2.10 Theory of vertical organisation for complementary products

Producing a good or getting it to a final consumer often entails more than one stage or component of production. These stages and components of production are often combined and coordinated to create bundles of complementary activities that result in what is often referred to in the literature as systems (Farrell, *et al.* 1998). Efficiency, consumption and profit considerations influence the way the industry organises in order to manage these complementarities. On the one side, firms can compete on the final product (system) or alternative they can compete on the intermediate stages (components), or on both, systems and components.

In the case of a multiproduct monopolist, this corresponds to the case presented by Stigler (1968), whose ideas can be traced back to Cournot's discussion on the problem of double mark-up (Cournot, 1838) and have been generalised by Telser (1979). In the situation in which a monopolist produces two (or more) complementary products and faces a set of customers that require the different components in different but fixed proportions, the monopolist will find more profitable to sell some of the products as bundles. These bundles can be customised to the requirements of the consumers and will result in higher level of profitability than that achievable under no bundling. The resulting mixed bundling strategy may entail that some of the products need be sold below marginal cost, but by doing so, it would allow higher sales of the bundle or system with a net positive effect on the overall company profits.

Farrell *et al.* (1998) extends this line of reasoning to a more competitive environment. In their model the authors assume that a firm can pursue two different strategies without vertically integrating. It could either develop the administrative ability of providing an entire system, or can limit itself in providing the separate components. Competition on systems requires *active managerial effort* to coordinate the various complementary activities. Each firm has to closely co-operate with the others and in the end compete on the final system. In Farrell *et al.* this way of providing complementary products define a *closed* organisation, since only a selected group of firms can contribute an intermediate input. This is opposed to an *open* organisation, where firms produce system components in the hope that they can be combined ex post with those produced by other firms. Notice that in the former type of organisation closed operation does not imply vertical integration strictly speaking, as each firm maintains its legal or financial independence.

These two models of organisation are at the base of a large set of examples. The most obvious refers to the computer industry, where until the 1980s the various components of a computer system where produced by large integrated firms such as IBM. Since then the industry has evolved towards a more open organisation, where users and manufacturers are able to assemble a system with off-the-shelve components, although variations from this tendency still exists. Another example, probably more pertinent to this thesis, is of course that of logistics service providers. While in the eighties many providers had the tendency of offering only those logistics services they could provide in house, we observe the tendency of expanding the range of capabilities, aiming at extensive network coverage or tailored logistics solutions, often relying on local or smaller suppliers. This possibility is granted by the standardisation of logistics interfaces, among which IT is the most relevant, allowing therefore *closed* organisations to become *open*.

The article of Farrell *et al.* is particularly interesting, as it offers a broader view on the impact that the vertical organisation of an industry has on competition, far beyond the role of bundling. The authors show that competition can be less intense when firms are organised in a closed way, i.e. each firm has hand-in-glove partners in a closed value chain and competes on systems more than individual components. For a large enough number of firms in the industry, closed Bertrand competition is less fierce than open Bertrand competition. Their model shows that although open organisations are in general socially more desirable, firms in most cases would prefer closed vertical organisation. This result differs from the foreclosure argument, since in profitability does not emerge as a consequence of an increase in market power, but is the result of an increase in cost heterogeneity among firms.

Notwithstanding the far-reaching implications of the paper of Farrell *et al.* yet limited literature has stemmed from its principal idea. The contribution of Arora and Bokhari (2007) is worth mentioning. In this article the authors develop a model of industry evolution where firms decide on whether to adopt a certain common standard or develop their own proprietary standard. The trade off is clearly identified by the authors between the advantages provided by a 'mixing and matching' (Farrell and Saloner, 1985; 1986; Matutes and Rigibeau, 1988; Economides, 1989) *versus* the reduction in transaction costs within the organisation. In the article they model the advantages of open systems as deriving not from the heterogeneity in consumer preference, but by allowing firms to draw different costs of producing the various components. Since being a low cost producer of multiple components is more difficult, open systems have the advantage that firms can specialize in the production of single components.

2.11 Optimal bundle-pricing decisions

The discussion so far has focused on the implications of bundling as a vehicle to increase profit or sales, for consumers, for society by and large and in terms of market structures. We have shown that bundling is a pervasive business practice in a large number of industries and that its consequences and impacts are far from clear-cut. What has not been the objective of the analysis so far is how firms set up adequate bundling strategies and how consumers perceive bundles. There is a large amount of literature that aims at answering these questions. This is the literature that refers to marketing management and that will be reviewed in this and the following section.

The marketing management literature has aimed at analysing two distinct, but inevitably overlapping streams of research. On the one side a large set of contributions (Hanson and Martin, 1990; Eppen, *et al.* 1991; Guiltinan, 1987; Bakos and Brynjolfsson, 1999; 2000; Venkatesh and Mahajan, 1993; Ben-Akiva and Gershenfeld, 1998; Wübker and Mahajan, 1999; Stremersch and Tellis, 2002) focused on the analytical determination of optimal bundles. On the other side others (e.g. Yadav, 1994; Yadav and Monroe, 1993; Soman and Gourville, 2001; Johnson, Herrmann and Bauer, 1999) concentrated on consumer perceptions of bundles.

Eppen, *et al.* (1991) present seven strategic guidelines for the successful implementation of bundling to a large extent based on the Hanson and Martin model discussed above. One general point the authors make refers to the fact that bundles act in markets as new products, but they are in general cheaper and less risky to create. They proceed with a set of guidelines for the use of bundles depending on whether the firm's basic strategic position is low costs or differentiation.

They identify the following rationales for bundling:

- ***Cost efficiencies***: a) production efficiency bundling aims at promoting components that have high setup costs; b) margin spread bundling aims at pricing together products that deliver similar margins;

- ***Market expansion strategies***: c) aggregation bundling aims at combining together different market segments, reducing product complexity and expanding sales; d) trade up bundling entails creating a product line that consists of a number of bundles that gradually include more items, so that this can lead consumers to increase the number of products bought in the bundle over time; e) in loyalty bundling, the seller tries to reduce consumers incentives to sample in order to reduce the likelihood of a consumer switching to a competitor;
- ***Bundling as a vehicle to improve product performance***: f) Joint performance bundling aims at increasing consumer satisfaction by bundling together products that tend to perform better if they are jointly used. This is often the result of asymmetries between producers and consumers on the functionality of the product; g) product definition bundling aims at simplifying consumer selection especially for new products.

At the end of the article, Eppen *et al.* also provide some guidelines on how to implement bundling in practice. The major obstacles in designing and pricing bundles, lies in the limitation in management's ability to analyse the large number of possible bundles and to track consumer choice and response to them. In order to solve this problem they propose the use of conjoint analysis. A similar contribution is Green, Krieger and Agarwal (1991), who analysed how to design and bundle services in order to gain market share in certain aggregate markets or market segments.

The first contribution to provide a practical method for a single firm to design and price optimal bundles is Hanson and Martin (1990). The mode of Hanson and Martin is a liner programming formulation of the optimal bundling formation and pricing problem, where the objective function is the firm's profit and the behaviour of the consumers as maximisers of their surplus is treated in the model as a constraint on the firm's objective function. Fuerderer (1999), points out at some of the issues that are not considered in the model of Hanson and Martin. Firstly in the formulation, segmenting consumers on he basis of their reservation prices results in too many market segments. This can be simplified by clustering similar segments together and assigning a stochastic reservation price variable to each segment. Secondly, the model does not account for complementarity and substitutability effects among bundles and components. Thirdly, the model has been developed for a multiproduct monopolist, but clearly in many applications, competition and strategic behaviour may play a crucial role in the determination of the optimality of the strategy. Finally the model does not account for the fixed costs that the firm will have to incur as a consequence of the introduction of the bundle.

Venkatesh and Mahajan (1993), propose a probabilistic approach that would enable sellers to determine optimal prices in pure components, mixed bundling and pure bundling strategies. They use as an example a season ticket for various events and music performances. Consumer decisions were modelled as a function of two variables: the time available to attend the performance and the reservation price for the performance. The distribution of reservation prices is assumed to follow a specific probability distribution directly related to demand. On the basis of this they calculated price strategies that resulted from profit optimisation under each strategy. In this approach, respondents were requested to indicate their reservation prices directly. This is clearly one of the disadvantages of the model.

In a more recent article, Wübker and Mahajan (1999), propose the use of conjoint analysis to measure reservation prices in order to price bundles. Conjoint analysis is a marketing technique that allows educing consumer preferences for alternative sets of product attributes (Urban and Hauser, 1993). They compare the results of conjoint analysis based approaches with the results obtained by directly eliciting the reservation price in an application to the fast-food industry. In the model the bundle composition and its price are attributes in conjoint models. They observe that in general, consumers underestimate their reservation price for the bundle when asked directly. In addition the conjoint analysis leads to more realistic results because the price is not evaluated in isolation. This is argued to be the result of the ability of conjoint analysis to address trade-off issues more effectively. Nonetheless, the model does not account for competition, and the application it does not allow for variations in the prices for all bundles and components at the same time.

Since the formulation of Zufryden (1977) of a market share maximizing product line as an integer programme, the problem of optimal product line design, i.e. the determination of what products to bring to the market, in the context of conjoint analysis has generated an extensive literature. In general we can distinguish between approaches that assume deterministic preferences and those that assume stochastic preferences. Deterministic approaches are in general flexible enough to adapt to the variety of bundling problems. Unfortunately though, these approaches are often computationally intractable and objective functions are not concave (Fuerderer, 1999). In the article of Zufryden, the author suggests the selection of the product line directly from the idiosyncratic part-worth utility data obtained by conjoint analysis. Similar approaches have been followed by Dobson and Kalish (1993), and Bauer, *et al.* (1994). Kohli and Sukumar (1990) present a 0-1 integer formulation on how to structure product lines maximising share, buyer's utility and seller's profit. Classic non-linear programming problems for product line selection and pricing are NP-hard (Dobson and Kalish, 1988), therefore they proposed a dynamic programming heuristic that extends the results of Kohli and Krishnamurti (1987) for choosing a share maximizing single item. Other contributions (McBride and Zufryden, 1988; Green and Krieger, 1992) consider a finite reference set of candidate items from which they select the product line. Dobson and Kalish (1988) measure consumer's utility in reservation prices and consumer choice behaviour by the obtained surplus. They consider fixed and variable production costs and propose heuristic to solve the resulting non-linear problem to maximise profit.

The second class of approaches makes use of stochastic choice models to represent consumer utility and segment consumers accordingly. Many contributions aimed at exploring the aggregate utility function. They assumed different functional specifications: linear (Green, 1984), quadratic (Louviere and Woodworth, 1983), logit (McFadden, 1974), probit (Daganzo 1979), maximum score (Manski 1975) or Generalized Extreme Value (McFadden, 1980). In particular the multinomial logit model (McFadden, 1986) has been particularly successful. Several authors (e.g. Kamakura and Russell, 1989; Allenby and Rossi, 1991) applied this model to product line design and pricing. Hanson and Martin (1994) present an interesting approach on how to maximise a non-concave profit function using a multinomial logit model.

Lele (1992) points out that if customers do not have information about the components, bundling then can be priced as a new single product. For customers that do have some or full knowledge of the components, the bundle needs to be priced below the sum of the prices of the single components. Therefore bundling is profitable for the introduction of new products. Carlton and Perloff (2005) show that bundling is profitable in the case of consumer with heterogeneous demand[15].

Another contribution (Fuerderer, Huchzermeier and Schrage, 1999) presents an optimisation model for a single firm under uncertainty in reservation prices and consumer choice behaviour considering both volume dependent and variant-dependent costs. The model allows also for assessing the optimality of pure bundling versus mixed bundling. The authors also provide an application to the automobile industry. This is the first article that allows for uncertainty in reservation prices. The model though does not allow for a choice of several products or product bundles within the same product line. Scale economies are also ignored. The solution is achieved by decomposing the stochastic bundling problem in an integer master problem and a non-linear sub-problem.

A similar problem is discussed in Tönshoff, Fine and Huchzermeier (1999), with reference to the customisation of modular machine tools. In the early nineties countries such as Germany have been struck by economic downturn in the manufacturing industries for industrial machinery. This has forced firms to seek efficiency and specialisation. A result of this strategy has been the development of modular manufacturing that has been widely adopted (Campagnolo and Camuffo, 2009). The problem is connected with the literature on variety management (cfr. Tönshoff *et al.* 1999, for a selected literature review on the problem). The authors argue that bundling can potentially overcome some of the traditional setbacks of a mere modularization strategy as it can achieve cost reduction through standardisation of modules and consideration for demand risks, shorter delivery time as a consequence of reduced complexity and customer differentiation through the use of add-on bundles. The models presented in the literature so far (e.g. Hanson and

[15] See Stremersch and Tellis (2002) for more detail.

Martin, 1990; and its generalisation Fuerderer, *et al.* 1999) aggregate customers in broad market segments. This approach is inappropriate for the machine tool industry as customers demand very specialised products, and sales, compared for example with the automobile industry, are relatively small. In addition machine tool manufacturers face very volatile demands, as they are positioned at the end of the supply chain (Tönshoff, *et al.* 1999). Customers are therefore treated in the article as individuals facing uncertain demand for their own product. Tönshoff, *et al.* use a stochastic optimisation model that is fed by information on the conjoint analysis provided exogenously (for a review of the literature on conjoint analysis see Green and Srinivasan, 1990). The model is structured in four sub-models each dealing with module design, module selection, bundle pricing and demand interactions.

An important question in the selection of bundling and customisation is at what point to stop (Ringbeck, Neumann and Comet, 1999). Competitive pressure forces manufacturers to maintain prices low and sustain quality, and as a consequence new products are launched at shorter and shorter intervals. In the automobile industry product cycles have shrunk from eight to four years between 1980 and 1995. This has gone hand in hand with increased customisation, facilitated by product modularity in production, bundling in marketing and IT. This resulted in companies targeting increasingly micro-markets. McKinsey has developed a concept for successful micromarketing in which bundling plays a crucial role. In their example based on Lufthansa the authors explain how simulating customer response can help a company penetrate micro-markets better. In the study, each flight is a product, where some flights can function as a transfer connection in a package of flights. The authors argue that in these applications, the costs of product differentiation are to be made transparent through IT. This can be achieved through product configurations. The article of Volker Lingnau (1999) discusses the important issue of costs associated with variants. The article concludes that where a large number of variants are produced leads to costs increase in practically all areas of a company.

A complete review of the conditions under which bundling is advisable is presented by Stremersch and Tellis (2002). In their article, the authors list and test through simulation twelve propositions on the optimality of bundling in different situations. These propositions result in the optimality of choices between pure and mixed bundling and pure components, product and price bundling on the basis of asymmetry and variation of the distribution of reservation prices. They argue that price bundling should be preferred over pure components when reservation prices are asymmetric. Product bundling always yields higher revenues than no bundling. Mixed product or price bundling should be preferred to pure price bundling when reservation prices vary across consumers. Combining product and price bundling is a better proposition than only product bundling for consumers whose reservation prices are asymmetric for the separate components and for the product and price bundles. They summarise their conclusions on the ability of a firm to achieve its objectives through bundling, stating that market penetration objectives can be achieved equally well with pure price or product bundling than any other strategy.

2.12 Behavioural aspects

The previous section discussed the approaches used to establish optimal combinations of bundles in order to define a product line and a related marketing strategy for a firm. It has been shown that most of these techniques would require observation or assumptions on reservation prices of consumers. But constructing attractive bundle offers depends on more than an understanding of the distribution of consumer reservation prices. Equally important is the process by which consumers evaluate bundles, or how bundling has been defined in the literature (e.g. Janiszewski and Cunha, 2004), '*framing of price information in a bundle offer*' (pg. 534). In parallel to the developments discussed in the previous paragraph, since the early 1990's researchers have attempted at explaining consumers perception of bundling on the basis of several behavioural theories. Some researchers (Mazumdar and Jun, 1993; Kaicker, Bearden and Manning, 1995; Heath, Chatterjee and France, 1995; Johnson, *et al.* 1999; Janiszewski and Cuhna, 2004) have looked at consumers selection of bundles using prospect theory, proposed by Kahneman and Tversky (1979), or the mental accounting theory developed by Thaler (1980). Prospect theory provides an alternative approach to consumer behaviour, other than expected utility, based on the evaluation of losses and gains (McDermott, Fawler and Smirnov 2008; Post *et al.* 2008). Similarly, according to the mental accounting theory (Thaler, 1980), the utility an individual receives or expects from a transaction (e.g. a purchase) is determined by the way the transaction is framed in the individual's mind.

The application to bundling can be traced back to the work of Thaler (1985; 1999) that proposed that the overall utility of a transaction could be decomposed into acquisition utility or value and transaction utility (value). The acquisition value corresponds to the money the individual is willing to part with for physically acquiring a product or '*the value of the good received compared to the outlay*' (Thaler, 1985, pg. 205). The transaction value is the value that the consumer attaches to purchasing the good at a price below its outlay, or in other word the satisfaction deriving from having made a bargain. The formulation proposed by Thaler referred to a single item transaction, but Yadav and Monroe (1993) extended this concept to transactions involving multiple items such as in the case of bundling. The work of Yadav seems to indicate that the acquisition utility depends on two evaluations: the processing of non-price information about the bundle items in order to calculate the value of what is received, and the processing of price information to calculate the sacrifice it represents. Some contributions (Yadav, 1994; Yadav and Monroe, 1993; Suri and Monroe, 2003) analysed how consumers perceived transaction value of the bundle is influenced by the magnitude of the savings offered directly or on individual items. Their findings imply that a discount offered on a bundle is perceived by buyers as having a greater impact than a discount offered on the bundle's individual components (Wübker and Mahajan, 1999).

These contributions as clearly summarised by Stremersch and Tellis (2002) in proposition 12 of their article already cited several times (pg. 69):

> *For price information is optimal for companies to (a) integrate all prices information in a single bundle price rather than present it in a list of separate product prices and (b) spread the bundle discount in multiple savings rather than present it as a single saving.*

The rationale for this proposition is that a single bundle price lowers price sensitivity, since consumers tend to perceive aggregated losses less than multiple losses. As a consequence they tend to value a single bundle price more than one that sums the prices of the separate components.

In general there is evidence that bundle prices and discounts are sensitive to the framing of the prices and discounts in the presentation of the offer. This leads to the discussion on the correct presentation of the bundle discount for example in contracts. In the case of shipping service contracts are the standard instrument that regulates carrier-shipper relations (Marlow and Nair, 2008). Although large parts of these contracts are standardised, they allow for flexibility in the pricing scheme to be applied, since they are confidential and do not need to follow published tariff rules. There is no study, to our knowledge, aiming at assessing the impact of offer presentation in service contracts.

There is evidence that equivalent price savings on the overall bundle, or on one of the bundle components, or distributed among the individual components in the bundle can alter the perceived attractiveness of the offer (Heath, *et al.* 1995; Johnson, *et al.* 1999; Kaicker, *et al.* 1995; Mazumdar and Jun, 1993; Yadav, 1995; Yadav and Monroe, 1993). The contributions of Mazumdar and Jun (1993) and Kaiker *at al.* (1995), for example, seem to indicate that buyers prefer the bundle when the price(s) were higher than expected, while the individually priced alternative was preferred over the bundle when selling prices were lower than expected. Similarly, it has been shown that combining the price of the components in a single bundle price can influence the attractiveness of the bundle offer (Chakravarti, *et al.* 2002; Drumwright, 1992; Johnson, *et al.* 1999; Yadav and Monroe, 1993).

Yadav (1994; 1995) noted that the information that a buyer has to analyse even for simple bundles, might be significant and that it is likely that individuals will try to simplify the assessment process, by, for example, following a set of sequential evaluation steps. This step-by-step evaluation procedure has been analysed by Lopes (1982) and can be traced back already in the anchoring and adjustment heuristic discussed in Tversky and Kahneman (1982). It is suggested that in the evaluation of the bundle an arbitrary chosen reference point may substantially affect the perception of the savings for the bundle. Lopes argues that it is during the selection process of this reference point (i.e. the anchor) that the evaluation process starts. Yadav and Monroe (1993) indicate that consumers are likely to start their assessment from the savings attainable in the bundle, and then move to the savings attainable in the separate components.

In the process of adjusting their assessment from the anchor, some information will be lost or considered irrelevant or less important in order to minimise the cognitive effort, suggesting that buyers will anchor to the most relevant piece of information and marginally adjust on the basis of aggregate evaluation of the remaining information (Lopes, 1982; Payne, Bettman and Johnson, 1988). The anchoring and adjustment approach has been further elaborated in Yadav (1994) in the context of bundling. The result of the two studies undertaken by the researcher show that consumers examine information in decreasing order of importance and, when if the anchor is properly selected, they would readily adjust the value of the bundle downwards. In case though the anchor was poor, the readiness to adjust upwards was considerably lower. Bundle complexity, expressed either by the number of bundle components or by the number of possible bundles, substantially lowered the level of adjustment.

A similar effect is reported by Gaeth *et al.* (1991). In their article, the authors use the information integration theory to assess how consumers evaluate bundles. The Information integration theory proposed by Anderson (1981), postulates that consumers integrate several information sources to make a judgement through three functions: the valuation function, the integration function, and the response function. In this respect negative information tend to impact judgment more than positive information. Therefore, in the bundle evaluation it is easier to lower the value of the anchor, than to increase it (Gaeth, *et al.* 1991). This justified Yadav (1994) to conclude that consistent quality levels in a bundle proposition are important.

The analysis is expanded in a recent article by Janiszewski and Cunha (2004). The authors show through six experiments that consumers subjectively value the components of the bundle and then sum these values to arrive at an overall evaluation of the bundle. When price discounts are assigned to a bundle component, the value of these discounts are referent dependent, or in other words are based on a reference point rather than a general state of wealth. Price referents act as anchors on the value function for the value of a bundled product, and price reductions are viewed as movements along the value function. Note that the value function has diminishing marginal returns for gains (i.e., concavity) relative to a referent and increasing marginal costs for losses (i.e., convexity) relative to a referent (i.e., diminishing sensitivity), and is steeper for losses than it is for gains (i.e., loss aversion). Therefore a lower price with respect to a referent will have smaller impact than a higher price.

The behavioural evidence on the response of consumers to bundle discounts is not yet conclusive, nonetheless these contributions offer insight on the importance of bundled offer presentations. Herrmann, Huber and Coulter (1997) provide an interesting expansion of the analysis. In their article the authors aim at assessing the impact of four key determinants of a bundling strategy: whether the bundle is pure or mixed, the number of components included in the bundle, the functional relation among the bundle components and the price discounts on the bundle in respect to the sum of the components in mixed bundling. They conducted two studies, one in the context of goods choice (a car purchase) and the other in the context of service choices (the purchase of automotive maintenance service package). The findings of the studies point at price discount and complementarity as key drivers of purchase intention. In general, a 20% price reduction results in the greatest purchase intention. The results indicate though that on average the interactions between the discounts influence the likelihood of consumers to purchase.

2.13 Conclusions

The previous review provided a comprehensive summary of the extensive literature available in the context of bundling and tying. The contributions have been grouped around key themes, mirroring the attention that these themes have received in the academia. It should be clear that, notwithstanding how pervasive the practice of bundling may be, a rigorous, coherent and far-reaching theory of bundling encompassing all its implications for business and consumers is still missing.

In particular, as far as the industrial organisation literature is concerned, authors primarily focused on the purpose that bundling might serve to multiproduct firms enjoying market power. Although this theory in the case of multiproduct monopoly is rather extensive—but, it should be noted, not yet conclusive—, only a handful of contributions have aimed at explaining the role that bundling might play in more complex market environments. Recent reformulations of the leverage theory in imperfect competition have seldom tried to assess the joint effects of bundling as a vehicle to increase market power, to differentiate consumers and provide costs efficiencies. With reference to the latter, with the exception of a few papers, no investigation has been directed on the influence that cost efficiencies, in the form of economies of scale and scope, and transaction costs reduction, accruing from bundling practices play in a strategic environment. Furthermore, the types of bundles used in the models are always rather fundamental, while in practice we observe a variety of bundle structures.

Even in the case of firms with considerable market power, the understanding of the mechanisms through which bundling may harm consumers is limited, and evidence of the likelihood of bundling to hinder competition is far from conclusive. This is epitomised in the words of the United States brief as *Amicus Curiae* to the

Supreme Court in the case of *M3 vs LePage's* in 2004 (Rubinfeld 2005, footnote 5, pg. 244):

> *[A]lthough the business community and consumers would benefit from clear, objective guidance on the application of Section 2 to bundled rebates, … the United States submits that, at this juncture, it would be preferable to allow the case law and economic analysis to develop further and to await a case with a record better adapted to development of an appropriate standard.*

This point of view is supported by the literature reviews more eminently directed to the assessment of bundling as an anticompetitive practice[16]. We can only associate with those authors in recognising the lack of conclusive evidence on the applicability of antitrust regulation to bundling. In particular, as noted by Kobayashi (2005*a*), the majority of the advances on the competition front have been primarily theoretical, with little or no empirical support other than Court rulings. Besides, limited attention has been paid to identifying testable hypotheses and carrying out empirical tests of the theories and their underlying assumptions.

Considering the pervasiveness of bundling business practices, it is rather surprising that no further attention has been paid to bundling in the case of monopolistic competition. The literature in this area is scant and results hardly comparable. The results on overall welfare effects are controversial, although there seems to be accordance that mixed bundling increases consumer welfare. In particular the impact of bundling strategies on profit is not yet fully understood. Another point that requires further investigation is the impact of bundling commitment on welfare. The results so far seem to indicate that the ability of a firm to credibly commit to the provision of a bundle may critically influence the effectiveness of bundling in achieving its objectives.

A further point of attention is that in most of the publications, bundling of goods or services has been treated identically. Commodities and services though may have very different characteristics, so that further characterisation of he product typology can be relevant. So far, only the issues of complementarity and substitutability have received some attention. We can also mention the growing amount of contributions focusing on fixed and marginal costs characteristic of the production/provision of the product. The literature on marketing management can be very illustrative in this respect.

Issues related to the reduction of transaction costs are also relevant in the development and organisation of an industry. In particular the article presented by Farrell, Monroe and Saloner (1998) and their discussion on open and closed organisation could be a prolific area of investigation. This is somewhat related to the

[16] See for example the already cited reviews of Kobayashi (2005) and Kühn, *et al.* (2005). A discussion on the competition issues and bundling is presented in ch. 10.

article of McCormick *et al.* (2006), that indicates a new possible area of investigation in bundling. In particular, the considerations of McCormick *et al.* in reference to household production could be extended to include other production processes. This leads to a more general observation, that bundling has been analysed to a large extent as explaining a (final) consumer-firm transaction. Nevertheless, in many real instances—an example of which is *full-line forcing*, when a manufacturer forces a retailer to carry an entire line of products—it should be noted that bundling takes place at an earlier stage of the production process, i.e. firm-firm transactions or channel transactions. Consumers purchase choices and firm procurement decisions are characterised in practice by very different motivations, processes and rationales. It is therefore imperative to adapt this framework to the firm-firm context, as bundling may have implications beyond the boundaries of a sector.

Moreover, the quality sorting effect discussed by Krämer (2007*a*) could be a prolific direction for further research, in particular if investigated in its strategic implications. In this respect the only article so far make reference to pure bundling, while mixed bundling effects have been ignored. This analysis could be associated with the investigation of the role of bundling-related cost efficiencies in granting firms strategic advantages in bundling, previously mentioned. A further observation is also relevant for the industrial organisation literature. While the marketing management literature has widely referred to the corpus of investigations provided in the industrial organisation literature, rarely, the industrial organisation literature has referred to the results and recommendations provided in the marketing management publications. Further interaction between the two disciplines should be fruitful.

As far as the marketing management literature is concerned, two major research directions emerge clearly as urgent. Firstly, no clear, coherent framework on the determination of optimal bundles is available in the literature. Although the article of Stremersch and Tellis (2002) is an important contribution in this direction, they provide neither formal mathematical proof nor empirical validation of the propositions they present, nor an indication of the relative importance of conditions for optimality. Limited literature has aimed at using the concepts of price and product bundling as defined by Stremersch and Tellis (2002). In particular product bundling has hardly been discussed. In our view this distinction is fundamental in correctly and clearly modelling bundling strategic effects. In their article they indicate several possible directions for research. No research has addressed the optimality either of product bundles, or of the combination of price and product bundling. Furthermore, the literature has not addressed any goals of the firm other than profit or revenue maximisation.

Secondly the literature on the perception of bundles by consumers is far than conclusive, although large amount of contributions have appeared in recent years. One of the areas still open for research deals understanding the reasons of the different and sometimes contradicting results on why and how consumers' perception of bundles differs in the various studies. Another direction where research could reveal to be prolific refers to the assessment and explanation of the cognitive effort involved in evaluating bundles or the relevance of discounts in bundles and bundle components.

The ultimate aim of this literature review is to provide the theoretical underpinnings of the chapters that follow and a bridge between the broader research on bundling and the investigations, of a more applied nature, of the following chapters. Accordingly, before concluding it is useful to briefly discuss the areas of research in the industrial organisation and marketing management literature that could benefit from the scrutiny of the container transportation and logistics industries and that will be addressed partially in the rest of the study.

It should be clear that the container transportation and the logistics sectors deal primarily with the provision of services provided as components of a supply chain and therefore to a large extent characterised by a high degree of complementarity. Although the issue of competition in the provision of these services is said to vary from market to market, empirical evidence is limited. In addition, the highly dynamic nature of the market for transportation and logistics services, and the high geographical difference, limit the validity of any study to a determined physical and temporal context, therefore it is simplistic to state that a specific segment of the chain is competitive as this highly depends on the location where the service is demanded and the time of reference. The temporal dimension in particular is relevant as the transportation, and even more the maritime transportation industries are characterised by pronounced cyclical fluctuations in price (freight rates) and demand. Phenomena of overcapacity or, on the other side congestion may influence substantially the competition nature of the supply chain components under analysis and, consequently, of the strategic desirability of bundling practices.

A further interesting challenge in the application of the bundling concepts developed in theory refers to the specificity of consumer demand. If on the one side a large number of supply chain components is homogeneous in their nature—warehousing and transportation in container being typical examples—the integrated final collection of services demanded by every consumer as a supply chain, or part thereof, can be highly differentiated. In other words each consumer will demand different bundles. This is true not only in terms of actual differences among the services provided but also in terms of volume and quality. The issue of volume in particular is relevant as many of the services provided are characterised by indivisibilities in production, scale efficiencies and network effects, that may grant producers substantial volume-related savings.

SMU and EUR (2008*a*; 2008*b*) note that an innovative integrator could quickly intervene in the chain in order to provide integrated services enjoying somehow the advantages of a multi-product monopolist as mentioned in theory in Telser (1979). In their argument they state that the integrator could reap economies of scale and scope, especially when the individual component providers engage in fierce competition, somehow creating a situation equivalent to having access to constant returns to scale technologies for every component. This point, although interesting, seems difficult to accept in reality, since the market for the innovative integrator operates virtually at no fixed costs, and therefore contestability is high. This is surely the case for logistics, as proven by the large number of 3PLs, forwarders, consolidators, etc. If cash on the table was available, it is difficult to justify why a producer of one or more of the individual components could not step up to the level of integrator.

This leads to the interesting point on whether such a asset-based integrator would have advantages in providing the integrated service with respect to a asset-light integrator. This problem can be reframed in the following terms if we consider that the integrator, in essence, is the provider of another service, i.e. combining the supply chain components in a value delivery proposition for its customers. This issue can then associated with the more general problem of competition between vertically integrated firms with divergent fixed cost profiles. An interesting issue for further research is on whether one of the two would be in a better position to make use of bundling strategies and with what results and what consequences for consumers and society by and large.

The issue is closely connected with the ability of an integrator to control transaction costs, not in absolute terms but in relation to the same ability of competitors. The competitive advantage of the integrator, in the end, lies in its aptitude to control and reduce transaction costs deriving from the integration of the supply chain components at the benefit of its customers. In terms of management and optimality of the bundle, an additional point of discussion refers to the strategy that the integrator would have to pursue in terms of providing services independently or outsourcing them from third parties, in order to minimise transaction costs. This issue is related to the question that also Stremersch and Tellis (2002, pg. 71) formulate at the end of their article as '*especially pressing*: *[…] How can suppliers optimally organise themselves to offer product bundles when they do not have competence in all products in the bundle?*'

With reference to the marketing management literature, the analysis of the container transportation and logistics industries, may contribute on a variety of issues. First and foremost, the identification of optimal bundling strategies in the case of logistics is a new issue and it has hardly been discussed. Most of the literature (not part of this review) makes reference to supply chain management, where bundling as such has been the subject of limited investigation. Secondly, the study of the perception of bundles from the side of customers is virtually limited to internal company marketing investigations. Better understating of consumers perception of bundled offers could be crucial in determining the effectiveness of a bundle proposition.

3 Liner Shipping Costs, Pricing and Competitive Advantage

3.1 Introduction

The importance of the global liner shipping industry cannot be overstressed. It is a well-known fact that without the development of containerisation and the liner shipping industry, globalisation could not have taken place the way we know it nowadays. Transport in fact is one of the four cornerstones of globalisation, together with telecommunications, trade liberalisation and international standardisation (Kumar and Hoffmann, 2002). The role of (global) transport networks in determining the competitiveness of a country or an industry has been widely recognised in the literature (see for example the often cited article of Krugman and Venables, 1995) and so has the influence that institutional agreements (or lack thereof) can have on the achievement of benefits of trade (Londoño, 2006).

The economic characteristics of the liner shipping industry are bound to have an impact on the competitiveness of countries and on global production systems by and large (Haralambides, 2007). The crucial role of the liner shipping industry in the world economy has been the ground for the antitrust regulation exemption from which this sector has benefited in a large number of countries, and has allowed for the existence of industry cartels—the so-called *conferences*—for decades (Jansson and Shneerson, 1987: pg 36). Although the conference system has been the subject of a harsh debate (see Haralambides, *et al.* 2003 and Sjostrom, 2004 for a review), which partially influenced the repeal of the conference exemption for trades from and to Europe in October 2008[17], it is widely recognised that the liner

[17] Council Regulation (EC) No 1419/2006 of 25 September 2006 repealing Regulation (EEC) No 4056/86 laying down detailed rules for the application of Articles 85 and 86 of the Treaty to maritime transport, and amending Regulation (EC) No 1/2003 as regards the extension of its scope to include cabotage and international tramp services.

shipping industry possesses some distinctive characteristics, which seem to require some form of self-regulation[18] (Jansson and Shneerson, 1987; Haralambides, 2007).

It has been noted that as the value of the goods transported rises, the relative importance of transport costs with respect to the good delivery price decreases, while the value of transit time increases (Brooks, 2002*a*). In particular any change in liner shipping business practices that affects the quality of the service provided is likely to have also an impact on global supply chains and world production systems (Heaver, 2002*a*; 2002*b*). This is also the result of modern logistics systems where outsourcing and supply chain management concepts determine high degrees of interdependencies among the various stages of the chain (see for example Dubois, Hulthén and Pedersen, 2004). The development of bundling practices in liner shipping is therefore representative of the changes that are taking place and may contribute to reshape the industry (Haralambides and Acciaro, 2010).

Although carriers have been providing intermodal services since the 1980s, it is only since the mid-1990s that the major shipping lines have set up logistics branches and given logistics activities a more central role in their group strategies (Midoro and Parola, 2006; Olivier, *et al.* 2007; Acciaro and Haralambides, 2007; Haralambides and Acciaro, 2010). As pointed out in these studies and already theoretically anticipated by Casson (1986), Henriksson, Chow and Heaver (1994), Frankel (1999*b*) and others, the interrelation between the maritime sector and logistics has become a necessity and it makes limited sense to discuss maritime container transportation without considering a supply chain approach.

The logistics industry though presents very different characteristics from the liner industry. It is in general characterised by a larger number of products and suppliers. If liner companies dominate the market on the sea leg of the supply chain, on the landside the scene is set by third-party logistics operators (3PL) who provide, coordinate and oversee land transportation, often extending their role to the ocean leg as well. The general tendency observed in the liner sector of an increased participation in the provision of land based logistics services is counteracted by the practice of 3PLs of offering services as Non Vessel Operating Common Carriers (NVOCC). The borderline and the definition of the markets thus becomes somewhat blurred.

The integration of maritime container transportation services and logistics is a fact and is likely to develop further. Logistics operators and shipping lines are already *de facto* providing product bundles or better service bundles, when they take

[18] See for example point (4) of Council Regulation (EC) No 246/2009 of 26 February 2009 on the application of Article 81(3) of the Treaty to certain categories of agreements, decisions and concerted practices between liner shipping companies (consortia), or the Ocean Shipping Reform Act (OSRA) of 1998 or Federal Maritime Commission (1989).

care of terminal handling, hinterland transportation, container services, etc. So that product bundling is not a new concept in container transportation.

The industry general perception on integration is rather positive (EUR and SMU, 2006). This of course represents the first step towards the possibility of providing integrated supply chain solutions under a single price, or in other words price bundles.

This chapter aims at presenting the salient characteristics of the liner shipping industry relevant for the purposes of the thesis. In doing so we will focus on pricing, cost determinants and sources of competitive advantage. Although liner shipping regulation will be the subject of a more extensive discussion in Chapter 10, some critical issues will be introduced in the this chapter. In general in this chapter the perspective that will be adopted is that of strategic management, hoping in this way to point at the benefits that can accrue to ocean carriers from bundling. Although pricing and cost determinants will be discussed in detail, the real focus is more eminently on how shipping lines achieve (and maintain) competitive advantage.

The chapter is structured in the following way. The next section presents an introduction on the basic concepts of liner shipping economics, namely: demand, supply and market structure. Section 3.3 zooms in the determinants of demand, while section 3.4 and 3.5 address costs and scale and scope economies. Section 3.6 briefly introduces the port and terminal industries. This is followed by pricing and market structures in the liner and logistics industries. The following section discusses different forms of horizontal integration in the industry, such as alliances, consortia, mergers and acquisitions. Discussion on vertical integration along the supply chain follows in the section 3.10. The issues presented so far are reviewed and expanded in section 3.11 from the perspective on how ocean carriers achieve and maintain their competitive advantage. Section 3.12 summarises and concludes.

3.2 Basic concepts

A definition of liner shipping is given by Fayle in 1933:

> *'The liner service is a fleet of ships, with common ownership or management, which provide a fixed service, at regular intervals, between named ports, and offer transport to any good in the catchment area served by those ports and ready for transit by their sailing dates. A fixed itinerary, inclusion in a regular service, or obligation to accept cargo from all comers and to sail, whether filled or not, on the date fixed by a published schedule are what distinguish the liner from the tramp'* (Fayle, 1933, p. 253).

The two major differences observed with respect to tramp shipping lie in the fact that a large number of customers and parcel sizes requires a larger and more complex administrative overhead, mostly due to regularity and service network, and, secondly, the obligation to sail to a fixed schedule makes capacity even more inflexible and costs fixed. These differences may seem trivial but in reality have shaped liner shipping as a complex industry. Whereas tramp operators have the possibility of mitigating the imbalances between supply and demand by for example laying up their most inefficient ships, liner operator are forced to respect their schedules (Stopford, 2002). In general capacity management is of paramount importance for liner shipping (Brooks, Blundel and Bidgood, 1993).

Container traffic has been growing close to 11 percent yearly in the period 2004-2008, which represents one of the periods of highest growth in the sector ever observed[19]. This growth has come to a dramatic slow down in late 2008. A growth rate between 8 and 9 percent is considered[20] to be a reasonable average demand growth in the long term. It is difficult nonetheless to estimate the consequences of the world economic crisis on long-term forecasts, although there is good evidence that container demand tends to grow in general twice as fast as GDP (Drewry, 2009; Ocean Shipping Consultants, 2009). Container traffic presents large seasonal and cyclical patterns, with 10 to 20 percent shifts between the winter months and the summer months (Drewry, 2009) and cycles of 3 to 6 years on average although with large variations (Stopford, 2009).

The peculiarity of the industry profile is attributable to the economic features of liner shipping, which, albeit not exclusive to this industry, imply that the sector is not characterised by perfectly competitive stable equilibria. In particular, the following traits are generally referred to as typical of liner shipping:

- it is capital-intensive, not only as a result of the use of ships but also as the requirement of schedule regularity (Davies, *et al.* 1995);
- supply is lagged by the long ship construction time and supply adjustments are difficult (OECD, 2002);
- load factors are variable, with directional imbalances and cyclical and seasonal variations (Brooks, 2004);
- this variability requires excess capacity that is another distinctive trait of the industry (Fusillo, 2003);
- strategic excess capacity aiming at deter competitors' entrance in certain markets exists in the industry (Fusillo, 2003);
- inventories are not feasible (Sjostrom, 2004);
- the resultant reserve capacity tempts firms to engage in discounted pricing when demand is not at the peak (Brooks, 2004);

[19] The data in this paragraph is loosely based on Drewry (2008).
[20] Ocean Shipping Consultants and Drewry Shipping Consultants among others. 9% growth rate is referred to as 'Hercules law', see for example Haralambides, *et al.* (2003).

- demand is relatively inelastic to price changes, therefore lower rates do not result in more demand, similarly to the airline industry (Davies, *et al.* 1995);
- economies of both scale and density, high fixed avoidable costs (Davies, *et al.* 1995) and network effects (Bergantino and Veenstra, 2002);
- price discrimination can be an effective way to allocate these costs without depressing trade (Jansson and Shneerson, 1985; 1987; Sjostrom, 1992).
- supply is indivisible, cannot be incremented to the margin, and changes in capacity can only take place in lumps (Davies *et al.* 1995).

3.3 Demand

Demand for ocean transportation is a derived demand, its major determinant being seaborne trade (Stopford, 2002) and as such it is relatively inelastic to price changes (OECD, 2002). This, in conjunction to inelastic supply motivated by the lag between ordering and taking delivery of a new ship has been traditionally considered the cause of cycles in liner shipping (Stopford, 2009) and high variability in freight rates. It can be argued that the development of supply chain management concepts such as *just-in-time* (JIT) or *materials requirements planning* (MRP) may have increased the dependency of modern supply chain on timely and reliable transport, for which shippers might be prepared to pay a premium (Morash and Clinton, 1997).

Since transportation costs are estimated to count 2 to 4 percent of the final delivery price of the goods transported, while other logistics costs may reach up to one third (Brooks, 1995), it is obvious that the attention in the case of general cargo has shifted from price to quality (Liberatore and Miller, 1995; Murphy and Hall, 1995). This is particularly true for containerised cargo and it is one of the major considerations that determine carrier strategic decisions, such as network planning (Notteboom, 2006).

Ocean transportation is a constituent of the supply chain and customers perceive the costs and benefits of transportation in the context of the business as a whole (Brooks and Fraser, 2001). The character of manufactured good transportation has changed dramatically in the last decades as a consequence of the globalisation of production and consumption, and products may be moved several times before reaching the retail shelf or the assembly plant. This is definitely the result of lower real transportation costs, but also of the lower information and communication technologies (ICT) costs and the decreasing weight to volume ratio (Meersman and Van de Voorde, 2001).

Increasingly qualitative factors are perceived as more important than price by shippers (Carbone and Gouvernal, 2007). A survey by Durvasula, Lysonski and Mehta (2000) of a sample of 221 Singapore-based companies, which make use of ocean transportation, indicates that shippers tend to highly value the ability of carriers to deal with claims and complaints quickly and effectively. The problem solving ability of ocean carrier is a determinant factor in the shippers' choice of the transport provider. Since time reliability, network coverage and service frequency are necessary requirement for all carriers, customer-service-related attributes become decisive aspects in determining the competitiveness of a carrier.

This trend is in general well accepted in theory. Stopford (1997, pg. 362) for example summarizes the major determinants of liner shipping demand in:

- freight costs;
- frequency of sailing;
- transit time door-to-door;
- reliability of timekeeping;
- reliability of administration;
- space availability.

In general ocean transportation is considered a complement of other modes of transport since transportation chains rarely end in the port (Brooks and Fraser, 2001; Panayides, 2007*a*; Haralambides, 2000). Ocean transportation alone faces no competition from other modes of transport for long distances, e.g transcontinental routes, as the low values of the elasticities of substitution seem to suggest (Oum, Waters and Yong, 1992). This is not necessarily the case for shorter distances, with short-sea shipping (SSS), barge, train or road being adequate substitutes. When ocean transportation is considered as one of the many components of a supply chain, substitutability with other supply chains may become relevant (Notteboom and Merckx, 2006; Notteboom and Rodrigue, 2008). In this sense, a certain route, i.e. Singapore-Rotterdam, can be a (almost perfect) substitute in the supply chain with another route, i.e. Singapore-Hamburg, depending on the final destination of cargo. The issue has been analysed extensively in the perspective of port competition (see for example Robinson, 2002; Notteboom and Winkelmans, 2001*b* and Heaver, *et al.* 2000 and the next paragraph). In order to serve as many supply chains as possible, ocean carriers will ideally call at several ports in the same region (Frémont, 2007; 2009), although the number of direct ports of call is expected to be reduced due to the growth in the vessel size (Cullinane and Khanna, 1999; Gilman, 1999).

3.4 Liner shipping costs

The liner shipping industry has developed very rapidly since the introduction of the container in 1956. At the basis of the container revolution there is the container box, which allows for faster and cheaper handling, reduces damage and improves the overall transport service (Notteboom and Rodrigue, 2008). The container itself had appeared already in different shapes and sizes in the XIX century (Levinson, 2006). The importance of the box is due to the economic conditions of the Fifties and Sixties, namely the growth of post-fordist production processes and international trade growth, that allowed for the exceptional growth in containerisation of the past fifty yeas (Jessop, 1994). As pointed out by Brynjolfsson and Hitt (2000) in the context of IT, economics benefits arise not from the innovation itself, but from the organisational changes through which businesses reshape themselves to take advantage of the new technology.

One of the most important developments necessary for the growth of containerised ocean traffic is the evolution of the cellular ship (Hayuth, 1987; Slack and Frémont, 2008). Cellular ships have substantially improved in terms of fuel consumption efficiency, speed and navigation safety, but most notably have constantly grown in size and capacity from a couple of hundred TEUs of the first vessels to over 13'000 TEUs of the last generation post-panamax container carriers[21]. This growth has important implications on ports, terminals and their hinterland but is bound to have even more determinative effects on the liner industry itself (Klein and Kyle, 1997; Fusillo, 2003) and is motivated by the economies of scale obtainable through large vessels (Cullinane and Khanna, 1999; 2000).

Similarly to other shipping sectors, costs in liner shipping can be subdivided in capital costs, operating costs, voyage costs and cargo handling costs (Drewry 2008; 2009). This is similar to the categorisation proposed in the literature (Gilman, 1985; Goss, 1985; Jansson and Shneerson, 1987: pg. 118 *et passim*; Stopford, 2009: pg. 221), in capital costs, operating costs, voyage costs and cargo handling costs that this paragraph will follow[22].

Capital costs obviously depend on the newbuilding or chartered price of the ship, increase with interest rates and decrease with the economic life of the vessel (Benford, 1985). These costs highly depend on the structure that is used to finance the ship but in general consist of depreciation, interest payment and return on owner's equity (Douglas, 1985). It should be noted that in many cases capacity has increasingly become available through institutional investors, thereby lowering the capital commitment necessary to enter the shipping business. Ocean carriers are in a position to charter capacity when needed from, for instance, KG funds.

Operating costs consist mainly of labour costs, maintenance and repairs, stores and lubricants, insurance and other general costs (Heaver, 1985; Stopford, 2009; Leader, 1985; Proctor, 1985; Köhn, 2008). Labour costs represent the highest cost item among the operating costs and are related to administrative personnel and personnel at sea (Moreby, 1985). The crew costs as a percentage of operating costs have been decreasing steadily in the last forty years, as a consequence of productivity increases, the shift in the nationality of seafarers towards low wages countries, the development of labour-saving technologies and the development of

[21] See for example Wijnolst and Wergeland (2009) ch. 7, for a technical account of the growth in container vessel size.

[22] A detailed account and categorisation of container shipping costs is provided by Krüger-Kopiske (2008).

the flag of convenience (FOC) system that allows ship owners to avoid the sophistication of the labour regulatory regimes of many maritime nations (ILO, 2004). The number of seafarers onboard a ship is decreasing, in spite of the increase in vessel size, with post-panamax container vessels requiring as little as between 15 to 18 crew members (Wijnolst and Wergeland, 2009). Nonetheless, the availability of seafarers is likely to become a bottleneck in the future with the majority of seafarers coming from developing countries and with increasing wage differentials.

Voyage costs comprise essentially of fuel and diesel costs, port costs and canal dues (Stopford, 2009). Fuel costs are the most important single item of shipping costs, are highly volatile and dependent essentially on oil prices (Buxton, 1985). Fuel consumption has been reduced as a consequence of better vessel and engine design, consumption of lower grade fuels and sailing speed (Notteboom and Vernimmen, 2009). Variability in fuel costs is passed on to the shippers through a Bunker Adjustment Factor (BAF) on the freight rate (Cariou and Wolff, 2008) that will be discussed in the section on pricing.

The remaining important items included in the voyage costs are canal dues, charged when a vessel transit a canal—most notably the Suez or Panama Canal—or a waterway, and port costs. Port costs are a set of charges and levies on the vessel or the cargo, that are due when a vessel makes use of a port or of the services it provides. These include pilotage, towage, mooring, docking and wharfage or simply the provision of basic port infrastructure, and vary substantially from port to port (Reid, Dally and Welard, 1978). Port charges depend on the charging policy of the port authority, vessel size, vessel type, time spent at port and the type of cargo loaded or unloaded (Button, 1979; Walters, 1975; Goss and Stevens, 2001). In liner shipping port dues and charges related to the vessel are paid by the shipowner, while the cargo owner pays all charges on the cargo (Branch, 1998: pg. 203). In the specific case of cargo-handling charges, the stevedore pays a lease to the port authority out of the income deriving from the cargo handling activities. This income derives from the fees charged to the shipping lines, that will then transfer the cargo handling costs incurred to the cargo owner through a set of ancillary charges, referred to as Terminal Handling Charges (THC) (Fung *et al.* 2003).

The characteristics of the liner shipping industry require further clarification on costs. It is often argued that overheads and non-shipping related costs are substantial in liner shipping (Stopford, 2009: pg 231) especially if agency and other shore-based managerial and administrative activities are taken into account. Following the analysis of MergeGlobal Value Creation Initiative (2008*b*), they account for half of the total industry cost structure, or even more depending on the level of fuel costs. In particular liner shipping specific (operating) costs include: container management costs, shipment origination and routing costs (agency costs), as well costs related to inland delivery. Container management costs are the costs necessary to acquire, maintain and operate a fleet of containers. Containers are part of the equipment owned or leased by the carrier that need to be available in the right size and type where and when the shipper requires them. This comes along with the repositioning and empty management costs that, in an industry where margins can be extremely thin, may make a difference between successful and unsuccessful carriers.

Considering modern industry practices, it is not possible to operate liner trades without the support of corporate department such as marketing and sales, human resources or strategic planning. In this sense liner shipping companies differ substantially from many bulk and tanker companies.

A further important issue relates also to the more theoretical definition of output in liner shipping. If in general it can be argued that the output of shipping service provision as a production process is the amount of cargo a ship can transport, a closer analysis reveals that this is not so simple. First of all the process of transporting cargo requires at least a complementary service, port handling, that is in general not directly performed by the ocean carrier. The effectiveness of delivering a certain service is therefore constrained by the terminal and port where the ship berths, more or less similarly to the way the effectiveness of road transport is affected by the quality and congestion of roads.

Secondly, in the moment in which the service that is purchased is not pure port-to-port transportation, but, in view of the demands of shippers and the changes in business practice, becomes door-to-door transportation, the nature of the liner company is fundamentally changed, since then issues of hinterland congestion and hinterland costs become crucial. This becomes even more apparent when time considerations become relevant, since the service purchased by a shipper is not merely a port-to-port delivery, or a door-to-door delivery, but a door-to-door delivery within a specific time framework.

This framework in theory can be generalised to the observation that what a container carrier is delivering to its customers is essentially value, by allowing them to change the spatial attributes of a product in the first place, but eventually also in other ways. In this *value delivery framework*, liner shipping becomes intrinsically different from bulk or general cargo shipping, and closer to airline transportation or freight forwarding. This is partially also the view of Robinson (2005), whose arguments will be discussed further down in this chapter.

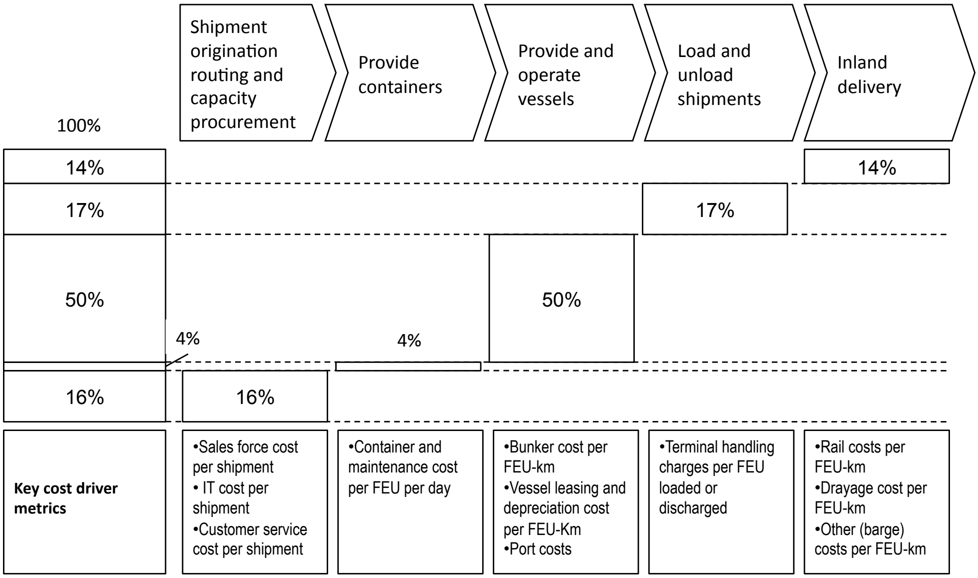


Figure 1: Container shipping industry cost structure.

Source: MergeGlobal Value Creation Initiative 2008*b*.

3.5 Scale, scope, density and network economies

Similar to other shipping sectors, the liner shipping industry enjoys economies of scale (EoS) deriving from the vessel size, the length of the haul and the size of the fleet (Jansson and Shneerson, 1978; 1985; Cullinane and Khanna, 1999; 2000). Particular attention has been paid to economies of scale and scope. These economies may be the result of various characteristics of the production process (Besanko, Shanley and Dranove, 2007: pg. 78) such as fixed costs indivisibilities; productivity increases due to specialisation; joint costs; construction economies; joint purchases and inventories, marketing, and R&D costs (Van de Voorde and Vaneslander, 2009).

The major determinants of the vessel size economies of scale are the technical costs of building and operating a ship that grow less than proportionally than its carrying capacity (Jansson and Shneerson, 1987). The largest containerships carry 13,000 TEU with similar and larger ships to be delivered in the coming years. For over a decade now the maximum size of vessels is considered to be 18,000 TEU, since larger ships would require two engines and would be constrained by the size of the Malacca Strait (Wijnolst, Scholtens and Waals, 1999). It is likely though that limitations on the ship sizes will come from the port sector, seeing that productivity increase constraints in ship handling are likely to offset the benefits obtainable from the growth in the ship size (Jansson and Shneerson, 1987).

In addition is should be noted that EoS exist only when a certain level of utilisation is achieved (Cullinane and Khanna, 1999). Given the non-storable nature of transportation services, all transport industries operate with a certain degree of excess capacity in order to meet fluctuations in demand that in manufacturing can be accommodated by means of inventories (Button, 1993). Excess capacity is a defining trait also of ocean shipping and has been analysed extensively in the literature (e.g. Zerby and Conlon, 1978; Davies, 1983; Fusillo, 2003; 2004). The use of excess capacity as an entry deterrence or as a form of limit pricing has been the subject of a harsh debate (see for a review Fusillo, 2003) to which we will refer to in paragraph 3.7 and chapter 10.

Although empirical work in this area is scarce (Button, 1993: pg. 74), economies deriving from larger fleet size over a certain level seem to be less relevant in the industry (Jansson and Shneerson, 1985). Although a study of Tolofari, Button and Pitfield (1986) found evidence of limited economies of fleet size (EoF) in the bulk sector, flagging out and the diversity of market conditions tend to make the assessment of EoF rather complex (Button, 1993). In addition, EoF are difficult to disentangle from economies of density (EoD) if they exist at all.

At the basis of the Economies of Scope (EoSc) is the multi output nature of transportation services and tend to develop when there are costs savings in a supplier producing a range of services rather than having a range of suppliers each specialising (Hensher and Brewer, 2001). EoSc are also present in liner shipping. They derive from the possibility of setting up networks and provide additional strings from a specific hub. The ability of shipping lines to provide integrated services increases the potential for scope economies (Heaver, 2002*b*). Often in transportation scope economies are not always present at all levels of output. EoD emerge when larger markets allow for higher load factors to be enjoyed, and therefore lower per unit costs. This is clearly the case for container transportation (Notteboom, 2004*a*). The combination of EoD and EoSc has been characterised by the development of the *hub-and-spoke* (H&S) operations (Brown, 1991).

Network economies are present in liner shipping, since a carrier with better network coverage represents a better alternative for a shipper (Frémont, 2007). Although nowadays, with the development of global alliances, all major shipping lines virtually compete on all destinations, network coverage still represents one of the strategic decisions for the carrier (Bergantino and Veenstra, 2002; Ferrari, Parola and Benacchio, 2008). Network and service schedules remain one of the sources of competitive advantage for global carriers (Brooks and Fraser, 2001; Robinson, 2005). The existence of EoN is generally used as one of the major justifications of alliances (see paragraph 3.8)

A possible further source of costs savings is related to the existence of economies of experience, or learning-by-doing cost advantages in the liner shipping industry. Learning-by-doing implies that firm specialisation increase over time as a consequence of the knowledge and experience it acquires by performing a certain production activity (Arrow, 1967). Although to date no empirical survey exists in this sector, and limited analysis has been presented in transportation by and large (Button, 1993), it is to be expected that economies of experience might play an important role in ocean transportation. This role may even be greater when integrated transportation is provided.

3.6 Ports and terminals

A crucial development that allowed the phenomenal growth of containerised ocean traffic in the last fifty years involved the port and terminal industry, that is the complementary necessary counterpart of the liner-shipping sector. A large amount of literature has focused on the port sector (see for example Pallis, Vitsounis and De Langen, 2010 for a review of the emerging distinct domain of *Port Economics*). The port represents the point of contact of the ship with its demand basin, and the demand of a certain area (hinterland) can only be channelled through the port (Rodrigue, Comtois and Slack, 2009; Notteboom, 2004*a*). Consumers are located at various distances away from the port and may have the possibility of choosing among different ports if they are located in what is called *contestable hinterland*. Consumers who are obliged to make use of a port because distances between the demand location and the port are to great or transportation is too expensive are said to be located in the *captive hinterland* of the port (De Langen, 2007). The extension of the captive hinterland has decreased especially in those areas of the world that show a high degree of supply chain integration (Haralambides, 2002).

The relation between ports and shipping lines, albeit symbiotic, has generally been characterised by arm's length negotiation, where competition among ports for throughput has tended to favour shipping lines against port authorities (Slack, 1993; 2001). Ports have been investing heavily in new infrastructure in the attempt to capture a bigger share of (transhipment) container traffic (Acciaro, 2003; 2006*c*) and as a consequence of the increasing size of vessels (Cullinane and Khanna, 1999; Peters, 2001). In the last decades, as pointed out, for example, by Haralambides (2004), port authorities and governments have attempted to boost terminal productivity, since they realise that for carriers to benefit from economies of scale, it is necessary that ports meet the efficiency requirements of larger vessels.

The effects on ports of the changes in the structure of the liner industry deriving from larger vessels, concentration and trade rationalisation are deep and multifaceted, and it seems clear that competition for acquiring and maintaining hub status will increase (Rimmer, 1998; Acciaro, 2006*b*; 2006*c*). Intense port competition, the fear of congestion and the complexity of port planning process, have also resulted in an extensive expansion investment programme in all major ports in the world. It is often perceived in fact that only those ports that are in a position to offer capacity and accommodate larger vessels will surge to the role of global hubs (Gilman and Williams, 1976; Baird, 2002).

Although the development of strategic alliances among competing ports envisaged for example by Frankel (1996) seems unlikely at least among port in different countries, ports are actively pursuing collaboration along the supply chain. Cooperation agreements with transport service providers in forms of joint ventures or public private partnerships (PPP) are common and are aiming at increasing accessibility and maintaining centrality in transport and distribution networks (Heaver, *et al.* 2000; Van der Horst and De Langen, 2008). This centrality is also essential for ports to realise their development potential (Acciaro, 2005; 2008*a*), and policy makers should aim at port hinterland accessibility if their objective is to foster regional development (Acciaro, 2006*a*).

Consolidation and internationalisation trends are visible in the terminal industry, where large global operators as part of industrial conglomerates, such a Hutchinson Port Holdings (HPH) or container transportation groups (APM Terminals) have taken the stage next to internationalised port authorities, such as PSA and DP World (Acciaro, 2004; 2008*b*; Midoro, Musso and Parola, 2005; Olivier, *et al.* 2007).

3.7 Pricing and industry structure

Probably one of the most debated issues in liner shipping, the antitrust exemptions granted to it has become a less relevant issue since the repeal of Council Regulation 4056/86 in Europe in 2008 and the Ocean Shipping Reform Act (OSRA) of 1998 (Benacchio, Ferrari and Musso, 2007; Brooks, 2000; Marlow and Nair, 2008). Although collective pricing is still allowed in some region of the world, the prohibition for trades to and from Europe and the *de facto* irrelevance of the conference rate in trades to and from the USA has substantially reduced the importance of such agreements. Ocean transportation pricing is the result of negotiations between carriers and shippers on terms that are essentially confidential and reflect market conditions (Marlow and Nair, 2008).

Given the importance of the topic, it is expedient nonetheless to briefly outline the pricing mechanisms that determined ocean container transport tariffs for over forty years and that was inherited from the general cargo liner tariff setting structures that dominated trades before the advent of containerisation: the conference system (see Jennings 1980 for an historical review). Conferences are price-setting cooperative schemes among carriers aimed at the limitation of price competition and at the setting of rates at 'minimum common denominator'. The most often cited formal definition[23] is provided in the first chapter of the UNCTAD *Code of Conduct for Liner Conferences* (UNCTAD, 1974; Malinowski, 1974):

> [*A conference is*] *a group of tow or more vessel-operating carriers which provides international liner services for carriage f cargo on a particular route or routes within specified geographical limits and which has an agreement or arrangement, whatever its nature, within this framework of which they operate under uniform or common freight rates and any other agreed conditions with respect to the provision of liner services.*

The major rationale for the existence of conferences was allowing an inter-organisation structure able to control destructive competition, reduce price variability, and allow sustainable services in the long run to the benefit of shippers (Haralambides, 2007). Since the 1980s though the market share of conferences has declined and conference membership in many jurisdictions eroded (Brooks, 2000). The reasons for this change are manifold, and will be dealt with more in detail in chapter 10, nonetheless they refer to: change in industry structure, the increasing use of confidential contracts outside of the conference regulation (independent action), the increase in the importance of alliances and consortia (Haralambides, 2004; 2007).

A relatively large portion of liner shipping economics literature has focused on the industry structure, although empirical studies are scant. In a recent article Christa Sys (2009) calculates and compares the market shares of major container carriers and alliances of carriers as shares of total capacity available on major shipping routes. Her conclusions show that, if we consider capacity as a proxy of output, the liner shipping industry is organised as an oligopoly. The degree of oligopoly is dependent on the trade route, but in general it has increased, although at decreasing rates. However, it would be interesting to evaluate how much of the available capacity is actually employed at various points in time. With large amounts of newly built capacity coming into the market and decreasing vessel utilisation rates, a high capacity share would not necessarily imply a higher market share in terms of TEUs carried. This is the major conclusion of Lam, Yap and Cullinane (2000) who observe that notwithstanding the increase in concentration, the industry is still contestable.

The theory of contestable markets has been applied in liner shipping in the attempt of assessing liner conferences' market power (Davies, 1986*a*; 1986*b*). Since liner shipping markets typically involve a relatively limited number of firms provid-

[23] Another often cited definition is due to Daniel Marx Jr: '[*Conferences are*]…*agreements organised by shipping lines to restrict or eliminate competition, to regulate and rationalise sailing schedules and ports of call, and occasionally to arrange for the pooling of cargo, freight monies or net earnings. They generally control prices, i.e. freight rates and passenger fares. The nature of their organisation varies considerably, depending on the market structure of the trade route. Some have been conferences quite literally -informal oral conferences- but many have employed written agreements establishing a permanent body with a chairman or secretary, and containing carefully described rights and obligations of the conference membership...*' (Marx, 1953).

ing a fairly homogenous product fear of abuse of market power has characterised early discussions[24] (among others Deakin and Seward, 1973; Bryan, 1974; Heaver, 1972; 1973*a*; 1973*b*; Shneerson, 1976; Jansson and Shneerson, 1987). As clearly outlined by Haralambides (2000) two factors were discussed as crucial in the explanation of conference freight rates: unit values and stowage factors. The significance of the former versus the latter would imply existence of market power versus cost-based competition, therefore demonstrating the allegation that conference would abuse market power.

Particularly crucial in these discussions was the existence of barriers to entry in the industry (Franck and Bunel, 1991). Drawing on the extensive literature on the theory of contestable markets proposed by Baumol (1982), barriers to entry were perceived to be relatively high due to the high fixed costs of ships. Davies and others (Davies, 1984; 1986*a*; 1986*b*; 1988; Jankowski and Davies, 1989; Zerby, 1988) argued that contestability in the industry was ensured by access to the same technology be potential entrants and low sunk costs, since ships could be easily diverted and reemployed on other routes among other arguments. In addition it can be argued that the increase tonnage made available by institutional investors has somewhat lowered the barrier to entry in the market (Haralambides, 2007).

Franck and Bunel (1991) observed that although some of these considerations are undeniable, contractual obligations and the necessity of liner companies to maintain network coverage might reduce contestability. In any case, the authors conclude that even when contestability is not ensured, conferences were unable to limit competition from, for example, large independent carriers.

More recent studies (Reitzes and Sheran, 2002; Brooks and Button, 2006; Lam, *et al.* 2007; Fusillo, 2006; 2009; Ferrari, *et al.* 2008) moved away from the theory of contestable markets and aimed at assessing the degree of competition in the industry in the absence of effectively functioning conferences. Although conclusive evidence is lacking, these studies seem to indicate the overall tendency of the industry towards concentration, mostly as a consequence of economies of scope, density and network. The increase of cartel enforcement costs that followed OSRA, although benefiting shippers through efficiency gains, might favour larger carriers, better apt to exploit economies of network and scale (Reitzes and Sheran, 2002; Fusillo, 2006). In particular when demand conditions become unfavourable, there seem to be evidence of increasing M&A activity, therefore raising the fear of increase industry concentration (Fusillo, 2009; Benacchio, *et al.* 2007). Lam *et al.* 2007 nonetheless argue using data up to 2003, that consolidation does not seem necessarily to grant carriers the possibility of exploiting market power, and highlights, similarly to Haralambides, *et al.* (2003), the necessity of a mechanisms able to ensure price stability.

[24] See Haralambides (2007) and Sjostrom (2004) for a review.

Similar conclusions arise from the theory of the core proposed in general by Telser (1978; 1987; 1994; 1996) and applied to liner shipping in search for a formally-rigorous theoretical support to the argument of destructive competition by Sjostrom (1989; 1993), Pirrong (1992), Davies, *et al.* (1995) and Jenkins (1996). The theory of the core is based on cooperative game theory and derives from a simple basic consideration: an increase in capacity by entry of a firm cannot take place below a certain level (integer problem) since avoidable fixed costs would make entry below a certain capacity level unprofitable (Sjostrom, 1993). This can happen if there are EOS and capacity constraints, since transporting an additional unit of cargo reduces average costs up to the level of full capacity. This implies that a supplier has incentives to attract demand in order to reduce average costs. The impossibility of demand to perfectly match supply implies high instability of prices (or core emptiness).

The implication of the existence of an empty core are that shippers would gain from cooperation among carriers, who would have no or limited incentive to undercut the agreement. Contrarily to a cartel model where both shippers and carriers would have advantages deriving from deviation from the agreement (read conference). Three major empirical contributions aimed at testing the theory of the core: Sjostrom (1989), Pirrong (1992) and, albeit indirectly, Haralambides, *et al.* (2003) in what is generally know as *Erasmus Report* (Marlow and Nair, 2006). Sjostrom (1989) shows that output increases when conferences' market share is higher and that conferences are more dominant when demand variability is higher. Pirrong (1992) proves declining average costs over a substantial range of outputs that can be considered as proof of the relevance in liner shipping of the integer problem.

Although not specifically aiming at testing the theory of the core, the *Erasmus Report* shows that rather than adhering to conference rate structures, individual carriers tend to cut prices and cause instability in pricing (Haralambides, *et al.* 2003). Their results suggest also that the larger the imbalance between supply and demand the higher the freight rate, which subsequently may be regarded as evidence of collusive price setting behaviour. The authors observe though that market concentration is not positively related to freight rates, while excess capacity is. This leads to the conclusion, in line with Clyde and Reitzes (1995), that conference market share is unimportant in the level of freight rates (or even dampen it), while industry concentration could exert a positive influence via tacit collusion. This is in line with the overall thesis conclusion that the relevance on the debate on conferences had been fading away in view of the fact that nowadays 80-90% of general cargo traffic is carried under service contracts (Haralambides, *et al.* 2003).

Further insight on the market structure and consequent pricing strategies for ocean carriers can be obtained from the extensive debate on price discrimination in liner shipping (Heaver, 1973*a*; 1973*b*; Bryan, 1974; Jansson and Shneerson, 1987; Sjostrom, 1992). Originally aimed at substantiating claims of abuse of market power by liner conferences, acting as price fixing cartels and therefore able to effectively discriminate prices (Heaver, 1972; 1973*a*; 1973*b*; Bryan, 1974), this research may be read as an indication of the potential offered by price discrimination in the liner shipping industry. Ocean carriers price discriminate because the large element of fixed common costs requires carriers to price discriminate in order to survive (Jansson and Shneerson, 1987: pg. 79; Sjostrom, 1992). Price discrimination is therefore a mechanism that allows sustainability in liner shipping, similarly to what happen in the airline industry and consistently with price discrimination models in monopolistic competition (see for example Borenstein and Rose, 1994; Stavins, 2001; Giaume and Guillou, 2004).

Although containers come in different sizes and types and may have different transportation requirements—refrigerated containers need electricity, containers carrying hazardous materials need special handling, etc.—containerisation has transformed ocean shipping in a relatively standardised process. Further possibilities to differentiate service provision exist as a result of route densities, cargo, customers, shipment time sensitivity, dangerous cargo, risk and security issues. It is to be expected that shippers with larger volumes will be treated differently than shippers with only a few containers, and some shippers may have logistics requirements or may be shipping time sensitive cargo, thus implicitly differentiating among the various containers. Furthermore the development of supply chain competition has allowed carriers to further differentiate an otherwise relatively homogeneous product.

The claim that carriers and conferences were able to discriminate among shippers or 'charge what the market can bear' as a result of market power, may have had some substantiation before containerisation, when competition on certain routes was thin and cargo types required different handling (Hummels, Lugovsky and Skiba, 2009), but most of the empirical test in the literature on the topic is unconvincing (Sjostrom, 1992). Containerisation in addition is likely to reduce the traditional practice of price discrimination on the basis of the treatment of different goods according to their particular characteristics (Haralambides, 2000). When price discrimination can be observed among routes (Hummels, *et al.* 2009), it is likely to be the result of Ramsey pricing in the attempt to cover fixed costs for routes where traffics are too thin (OECD/ITF, 2009). In these circumstances contestability seems to ensure that market power is not abused (OECD/ITF, 2009).

In the past, a certain degree of geographical segmentation could also be observed in the liner shipping markets, with Japanese carriers such as MOL and NYK serving Japan and the Far East, American carriers such as APL taking care of traffics to and from the USA and European carriers, such as Maersk or Nedlloyd entrusted with trades to and from Europe. The increasing focus on global network coverage and the development of strategic alliances have expanded the geographical focus of carriers, even if some still retain better control of certain regions for historical reasons (Parola and Veenstra, 2008). In a globalised industry such as liner shipping discrimination on the basis of geography seem therefore less and less viable.

The ability of carriers to differentiate their services on the basis of quality, although not explicitly addressed, has been investigated in the context of conferences by (Devanney, Livanos and Stewart, 1975; Fox, 1992; 1994; Haralambides, 2007). Both Devanney, *et al.* (1975) and Fox (1994) propose an oligopoly model where increase cartel (read conference) membership would lead to increase in price but also in quality of services. Given the higher importance of quality aspects relatively to price in liner shipping, the authors suggests that conferences have been instrumental in increasing industry quality levels. Although these contributions explicitly focused on conference, their discussion on competition among carriers on the quality of service highlights the relevance of quality issues in container transportation. The authors indicate that the main variable in this respect is speed: some conference members are simply able to offer quicker services or, in case of difficult circumstances such as congestion in ports and bad weather, are better able to maintain sailing schedules. Haralmbides (2007) expands the analysis and suggest the following quality variables: the provision of information and EDI systems; logistical services; better coordination and integration with inland transport companies; ownership of terminals and equipment; frequency of service; geographical coverage and efficient response to the particular requirements of customers. Although price differentials seem to be positive correlated with quality variables such as schedule integrity and carrier reliability, limited empirical testing of the ability of carriers to price discriminate on quality variables has been provided so far (Notteboom, 2006; Saldanha, Russell and Tyworth, 2006; Chen, Chang and Lai, 2009).

Although container transportation between two locations within a specific time frame can be considered a homogenous service, this is not necessarily the case when the supply chain to which the container belongs to is taken into account (Lyridis, *et al.* 2005; Wong, Yan and Bamford, 2008). This is because each shipment then becomes virtually a different product, and as such costs and shipper's willingness to pay may differ. No systematic attempts have been made to test this hypothesis so far although reference to this issues are implicitly present in the literature, e.g. in Brooks (1985); Wong, *et al.* (2008); Notteboom and Rodrigue, (2008).

3.8 Pricing in the logistics service industry

Pricing in the logistics industry has been characterised by a relatively high level of freedom in the price stipulation (Jané and de Ochoa, 2007). However, the overall complexity of logistic contracts and the specificity of many service provision agreements, that sometime prevent the determination of initial prices have created a set of price mechanisms that although not limited to logistics pricing are particularly common in this industry. These pricing mechanisms can be grouped into two families: fixed remuneration systems and variable remuneration systems (Jané and de Ochoa, 2007).

Fixed remuneration systems are the most widely used. In fixed remuneration systems the customer firm agrees to pay the logistics service provider (LSP) a fixed amount for providing logistics services based on the pricing model agreed in the contract. This pricing model is in general either transactional pricing or activity-based costing. In transactional pricing, also referred to as unit pricing, the customer pays a fixed flat fee per unit of work. The unit of work is contractually defined and can be the number of pallets or boxes loaded, or more in general the number of units of cargo moved, the weight of the cargo transported, the amount of space used in the warehouse, measured for example in shelve space, or square or cubic meters, or the number of order prepared. This depends clearly on the typology of services provided by the LSP in the specific contract.

A second pricing model is called activity-based costing and is structured as a two-part tariff. The customer company agrees to pay a flat fee aiming at covering the LSP fixed costs such as leases, equipment or management, on top of which a variable component is added, ideally aiming at covering the variable cost component of the service provided, e.g. labour costs, fuel and maintenance. This system tends to adhere better to the costs structure of the LSP and allows more competitive pricing. In general contracts based on fixed remuneration systems will include a revision clause that leads to standard yearly tariff renegotiations.

Variable remuneration systems do not involved the payment of a fixed amount and are generally referred to as cost-plus pricing mechanisms or open book. The tariff consists of the costs incurred by the LSP on top of which the customer firms pays a mark-up or profit margin agreed upon in the contract. The customer firm is allowed to audit the invoices for the services offered by the LSP, and therefore has to be granted access to the LSP account, that for this purpose will keep separate registration of the expenses incurred for each and every customer. The profit margin is generally set as a percentage of the costs incurred in the operation. Variable remuneration pricing is generally used when the contractual assignment is bound to change in nature, such us when a new service is launched or a company is starting new operations.

The main advantage of cost-plus pricing is that the LSP is guaranteed a fixed level of pricing and the customer firm can enact some control on costs and reduce the fees that would arise with transactional pricing. In addition to the technical difficulties related to how to apportion joint costs and other issues of an accounting nature, cost-plus pricing does not encourage cost reduction, since the profits are calculated as a fixed percentage of costs incurred. This type of pricing scheme is as a consequence not viable in long-term transactions unless a gain-sharing clause is added in the outsourcing contract.

Gain sharing clauses are in principle independent from the type of pricing scheme that is agreed upon, and allow for both parties to benefit from the optimisation of the logistics chain or system and works as an incentive for both the customer firm and the LSP to keep costs down, improve processes, IT and technology and in general increase supply chain performance.

Recent literature has investigated the possibilities offered by more complex forms of pricing in freight transportation and logistics outsourcing. Talluri and Van Ryzin (2004) for example refer to freight transportation as a natural candidate for revenue management methods, and indeed just in time manufacturing processes and other supply chain concepts facilitate freight product differentiation. In particular they list some characteristics of freight transportation as relevant in the process of differentiation of freight products such as service level requirements (different sensitivity to delivery time and service reliability), customer relations and customer types. It seems that all large freight companies have implemented some forms of revenue management systems. However revenue management is not yet widely practiced in freight although its potential is significant. Often low-value demand fills up the weight limits of a ship or a truck before the volume limit is reached. This results in high value demand being rejected since low-value customers tend to appear before high-value ones, similarly to what happens in the airline industry (Talluri and Van Ryzin, 2004).

3.9 Horizontal integration

Given the economic characteristics of liner shipping presented by, for example, Davies, *et al.* (1995) and described above, it is not surprising that the industry has shown a tendency towards consolidation (Fusillo, 2009). This has taken the form of:

- M&A;
- Horizontal forms of cooperation such as *alliances* and *consortia*;
- Vertical forms of cooperation.

Since the beginning of the 20th century, M&A have been a recurring trend in liner shipping, with a marked increase since the late 80's (Fusillo, 2009). Although not always successful, the announcements of mergers or acquisitions have always attracted a great deal of attention of authorities, general public and the industry. The acquisition of Sealand by the AP Møller-Mærsk Group was the subject of large media debate in 1999, and so was a few years later the acquisition by the same group of P&O Nedlloyd. The take over by the Singapore-based group NOL of American President Line in 1997 also raised a large public debate on the legitimacy of this large-scale integration and fear of abuse of market power.

Since the important article of Williamson (1968), it has been shown that small cost savings can be sufficient to offset a price increase due to the merger, in what generally is referred to as the *Williamson Trade-off*. This cost reduction can be justified by efficiency increase, scale economies, synergy creation and scope economies (Farrell and Shapiro, 1990; Andrade and Stafford, 2001; Golbe and White, 1988). Increase of market power has been also listed among the reasons of merges, although there is little empirical evidence that market power actually increases as a consequence of mergers (White, 2002).

Although generally welcomed by the stock market also in liner shipping (Panayides and Gong, 2002), the results of mergers are diverse, and not necessarily beneficial for the merging firms (Carlton and Perloff, 2005, pg. 22). Van de Voorde and Vaneslander (2009) report that the attractiveness of an M&A in liner shipping depends on the benefits of scale and scope obtainable from integration. In the case of the merges of Nedloyd and P&O in 1996 and P&O Nedlloyd and Maersk Sealand in 2005, scope benefit exploitation and cost reduction were a stated objective of the merger (Van de Voorde and Vaneslander, 2009). It can be argued though that these objectives were not met in the first case and partially met in the second (Van de Voorde and Vaneslander, 2009). Substantial market share increase also does not seem to be observable in the case of liner shipping (Van de Voorde and Vaneslander (2009) somewhat in contradistinction with the results of Sys (2009).

Sjostrom (2004) observes that the erosion of conference membership has been accompanied by an increase in M&A. Referring to anecdotic evidence advanced by Trace (2002) the author, albeit not explicitly, suggests a negative correlation between the decline of conference and M&A. This claim emerges implicitly also from the study of Sys (2009) and is systematically tested in a recent study by Fusillo (2009) based on US data, that indicates that the probability of mergers and acquisitions tend to increase when regulatory regimes that favour industry cooperation are altered. Fusillo shows that OSRA has been inadvertently instrumental in the growth of M&A activity in the US market, although the effects of regulatory shocks cannot be disentangled from the effects of the new regulation. The author also argues that when demand conditions are unfavourable, indicated by decrease of freight rate levels and increase in idle capacity, mergers are more likely to occur (Fusillo, 2009). Particularly interesting is the observation that increases in excess capacity tend to destabilise the competitive environment and increase the attractiveness of M&A.

The issue of excess capacity has been tackled by carriers also through cooperation agreements that go under the name of *consortia* and *alliances*[25]. Liner consortia have been used next to conferences with the objective of rationalising capacity utilisation since the 70's (Farthing, 1993: p.109-110; Clarke, 1997; OECD,

[25] Alliances and consortia are operational agreements among carriers aiming at allowing the provision of a better service by increasing service frequencies and the number of vessels used in the trade string. Consortia are agreements among conference members while alliances do not require membership to a conference (Sjostrom, 2004). The two terms are often used interchangeably.

2001, p.18). Strategic alliances have grown in significance since the 1990s (OECD, 2001) and aim at route rationalisation with the objective of reducing risk, investment and costs, exploiting EOS, and increase service frequencies (Midoro and Pitto, 2000; Evangelista and Morvillo, 1999; 2000). Bergantino and Veenstra (2002) highlight the importance of EOD and EON, while Evangelista and Morvillo (1999) advance the hypothesis that alliances are a response of carriers to the demand for better supply chain coordination. Unlike conferences, neither consortia nor alliances engage in joint tariff setting and alliances tend to have a broader geographical scope (Sjostrom, 2004). Some authors (Midoro and Pitto, 2000; Sheppard and Seidman, 2001; Haralambides, 2007) suggest that alliances are one of the responses of the decreasing role of conferences in the industry.

Sheppard and Seidman (2001) explain that the increasing importance of alliances is motivated by the demand of shippers for global coverage, limit the costs of trade imbalances and rationalise schedules. They list the following benefits to alliance members:

- The ability to provide a seamless service equivalent to the service of a single carrier;
- The ability to expand service coverage cheaply;
- Increase revenues and reduce costs through productivity improvements;
- Offset losses on a market with rate increases on other markets;
- Gain market share by diverting cargo from other carriers;
- Improve service quality.

The first alliance was created in 1994 by APL, OOCL, MOL and Nedloyd and was named Global Alliance. The second alliance was the Grand Alliance and it was formed by Hapag-Lloyd, NOL, NYK and P&OCL, the third was the formation of alliance (consortia) between Maersk and Sea-Land and the forth alliance was formed from DSR-Senator and Cho-Yang. The number of alliances has reduced and their membership changed as a consequence of M&A activity in the industry. Of the seven alliances existing in 2004 only three large alliances remain today: the Grand Alliance, the CHKY Alliance and the new World Alliance. After the withdrawal of P&O Nedlloyd in February 2006, the 'new' Grand Alliance was formed by Hapag-Lloyd (that acquired CP Ships), MISC (only for the Europe–Asia route), NYK and OOCL. The CHKY alliance includes COSCO, Hanjin that has merged in the meanwhile with Senator, K-Line and Yang Ming. The New World Alliance comprises of APL/NOL, Hyundai and MOL.

Only in the last decade the liner shipping economics literature has started to investigate the phenomenon of alliances (Ryoo and Thanopoulou, 1999; Thanopoulou, Ryoo and Lee, 1999; Evangelista and Morvillo, 1999; Song and Panayides, 2002; Midoro and Pitto, 2000; Sheppard and Seidman, 2001). The emphasis of alliances with respect to consortia, lies in the fact that the original aim of consortia was to supplement the price fixing function of a conference (Breitzmann, 1991) while alliances seems to have a broader scope of cooperation (Evangelista and

Morvillo, 1999). Although from the study of Evangelista and Morvillo[26] (1999) it emerges that the function of alliances is mostly limited to ocean slot sharing agreements, the authors point out the existence of alliance agreements that go beyond the sea leg of transportation to include rail and other transportation services.

One of the interesting aspects of alliances is that they seem to be rather unstable agreements (Midoro and Pitto, 2000), where the composition of alliance changes on the background of M&A activities and competition among alliances, alliance members and independent carriers, often referred to as *soloists*. The application of the theory of the core to the strategic nature of alliance composition theoretically confirms this claim (Song and Panayides, 2002). From their analysis it emerges that alliances are the only way carriers can effectively compete with larger operators.

In addition to providing an extensive overview of the legal background of alliances, Sheppard and Seidman (2001) also list some possible factors determining the future of alliances: consolidation; vessel efficiency and transhipment; US regulatory priorities; and online exchanges. Consolidation seems to be the natural step when an alliance is successful—see for example the case of Maersk and Sealand—although the authors so not conclude that the existence of alliances have an impact on increase M&A. The increase in vessel size seems also to strengthen the role of alliances, even if, we could argue, the benefits of alliances can be obtained through M&A. The US regulatory framework is unlikely to be affected in the short term and the more extensive scrutiny from FMC anticipated in the article does not seem to have materialised. Nonetheless, the repeal of conference antitrust exemption and the review of the consortia regulation in Europe are definitely likely to increase regulatory examination on these types of agreements. Finally the impact of online exchange does not seem to be of substance in the industry so far, notwithstanding the proliferation of on-line container booking and monitoring initiatives, but it is bound to influence the business in the years to come (Stopford, 2002).

3.10 Vertical integration

The liner shipping industry presents various forms of vertical integration. We observe upstream vertical integration in the production activities linked to the provision of ocean transportation, such as containers production and shipbuilding, and downstream integration along the supply chain, with activities such as terminal handling, hinterland transportation, freight forwarding, distribution and other logistics activities. We range from companies like Maersk Line[27], that produces its

[26] Please note that the term *alliance* is used by the author to include broader forms of cooperation, such as joint venturers, slot sharing agreements, etc.

[27] Note that the AP Møller Mærsk, Maersk Line's parent company, is a large diversified industrial conglomerate active in energy production, shipbuilding, shipping, transportation, logistics and distribution, and controls various retail chains and supermarkets in Scandinavia.

own vessels and containers and runs its own terminals and trains, to companies like MSC, whose involvement in logistics is limited to some joint ventures with terminal operators (Frémont, 2009).

Table 6: Main logistics branches of ocean carriers' groups.

Carrier	Intermodal Entry	Logistics Branch		The role of the logistics branch within the group
Sealand	Early '70s	Sealand Logistics[1]	mid-'90s	Taken over by Maersk in 1999
Maersk Line	Early '80s	DAMCO[2]	2000	Under AP Møller Mærsk control (container business unit)
NOL/APL	1979(1997)	APL Logistics[3]	1997	Under NOL control
NYK	1985	NYK Logistics	2000	Under NYK Line control
MOL	1985	MOL Logistics[4]	2001	Under MOL control
K-Line	1986	K-Line Logistics Holding	2000	Holding under K-Line control (K-Line Total Logistics brand)
Hyundai	1990	Hyundai Logistics[5]	1999	Under control of Hyundai M.M.
Hanjin	1989	Hanjin Logistics	2001	overseas operations[6] controlled by Hanjin Shipping
COSCO	mid-'90s	COSCO Logistics	2002	Jointly controlled by Cosco Group and Cosco Pacific
OOCL	'90s	OOCL Logistics[7]	1999	Under OOCL control

Notes:

[1] formerly Buyers Consolidators (taken over by Sealand's parent company in 1993)

[2] formerly Mercantile (established in 1977), and until 2010 Maersk Logistics.

[3] AP Intermodal was established in 1985; the NOL group entered in intermodal and logistics activities only after the takeover on APL in 1997

[4] Formerly M.O. Air System Inc. (established in 1989)

[5] Formerly Asia Merchant Shipping Corporation (1988) and Hyundai logistics Corporation (1993)

[6] Domestic logistics operations are managed by Hanjin Corporation (independent from Hanjin Shipping)

[7] Formerly Cargo System, the group's international freight consolidation unit. OOCL China Domestic Ltd. (since 1998) is the logistics company for China (under OOCL control).

Source: Adapted from Midoro and Parola (2006)

Although carriers have been providing intermodal services since the 1980s, it is only since the mid-1990s that the major shipping lines have set up logistics branches and given logistics activities a more central role in their group strategies, as recently surveyed by Midoro and Parola (2006) and Frémont (2009). Containerization (Hayuth, 1987; 1992), the advances of ICT (Evangelista, 2005) and the centrality of ocean transportation in global supply chains (Rao and Young, 1994), have offered shipping lines the possibility to engage in the provision of additional logistics services in addition to ocean transportation. The opportunities offered by this new form of business have been rapidly embraced by all major carriers (Midoro and Parola, 2006), that recognise the importance of providing integrated services (Heaver, 2005), and *door-to-door* rates, as opposed to *port-to-port* rates, have become common in the industry (Acciaro and Haralambides, 2007).

The reasons behind the decision of carriers to step into the logistics sector may be connected to the increasing shippers' demand of integrated supply chain services, the desire to product differentiate in the attempt to stabilise revenues or better control the market (Heaver, 2002*b*).

The increasing demand of cargo owners for integrated logistics solutions lies in the renewed importance of JIT deliveries, control over inventory costs and the reduction of uncertainty in the supply chain that are a precondition for a successful global distribution and production strategy (Brooks, 2000; Cullinane, 2004; Evangelista and Morvillo, 1999). Cargo owners that have strong relations with a carrier may naturally prefer the shipping line to walk the extra mile instead of having to involve other parties.

Logistics may have also offered the opportunity to carriers to product differentiate and price discriminate (see paragraph 3.7). In addition logistics may represent an alternative source of revenues when the freight rates are at their low, allowing a sort of revenue portfolio management within the group (Heaver, 2002*b*; Haralambides and Acciaro, 2010). Many companies have invested in parallel activities, in other shipping sectors or other businesses. This is believed to allow a better control of demand and reduce revenue volatility in the liner branch of the company or group.

Finally, a further reason is the attempt to better control the market by tying ocean transportation customers also in the upstream and downstream logistics services. This may increase the switching costs for shippers and work as a deterrent for competitors, rising entry barriers (Haralambides and Acciaro, 2010).

The integration efforts however have been met with varying degrees of success (Frémont 2009). The various challenges imposed on carriers by the combination of ocean transportation with the services of a logistics provider can be summarised, not exhaustively, as (Haralambides and Acciaro, 2010):

- the strategic and operational difficulties deriving from the joint provision of two intrinsically different services: ocean transportation, characterised by large assets, tight cost control and in general a business focus on asset use maximisation, and logistics, typically asset-light, highly competitive and with a distinctive focus on customer demands;
- the sceptical and suspicious shippers requiring cost break downs and more transparency;
- the complications generated by the unusual situation of integrated carriers competing with global freight forwarders, de facto some of their major customers.

Notwithstanding some uncertainties and the aforementioned difficulties in providing ocean transportation within the logistics chain as an integrated service, the general perception of the industry seems positive, also encouraged by the successful examples of some leading carriers, such as Maersk and NOL/APL.

With the exception of some recent contributions (e.g. Frémont, 2009), literature on vertical integration in shipping has been scant and descriptive, rarely including in the analysis of carriers' strategic decisions, the role of freight forwarders, the economic drivers of vertical integration and the possible outcomes for shippers and society by and large. This lack of scientific output on the topic could be justified by the limited availability of data and by a certain resistance, on behalf of the carriers, to disclose information perceived as commercially sensitive.

Even if first seminal contributions may be traced back to the 70's, the first structured approach to frame ocean transportation in a more complex (vertical) transportation chain appeared in Casson (1986). The author concluded that vertical integration is clearly a trend in the shipping industry since carriers could enjoy substantial costs advantages when investing in terminals and hinterland transportation. Casson also argues that some of these advantages can be obtainable by means of contractual arrangements (i.e. outsourcing) and do not necessary call for vertical integration. As clearly discussed by Heaver (2002*b*), even if shipping lines are increasingly becoming vertically integrated, the management of logistics services remains distinct from the management of shipping. This has also been observed in a survey conducted by Frémont (2009): even if a large number of shipping lines provide logistics services, they are in most cases neither priced nor offered in conjunction with ocean transportation.

It seems that the forecast of Frankel (1999*a*) that integration in the supply chain would become in the long term the only viable strategy for ocean carriers, has not yet been realised. More recent contributions (Heaver 2002*a*; 2002*b*; 2005; Evangelista, 2005; Frémont, 2009), although recognising the crucial impact of integration strategies on ocean carriers and shippers, are more cautious and stress the fact that integration along the supply chain raises a set of controversial issues. First and foremost the perception of liner shipping customers that may prefer to deal with independent logistic service providers (Heaver, 2002*a*). Secondly are issues related to the different managerial focus of ocean transportation and logistics service provision: costs control for the former and customer service for the latter (Frémont, 2009). To those we could add that empirically the claims for the cost advantages deriving from vertical integration have not yet been tested.

An important example of vertical integration is represented by the joint provision of ocean transportation and terminal operations in the phenomenon described as dedicated terminals (Haralambides, *et al.* 2002; Acciaro, 2009*b*). The provision of transport together with terminal operations is the first and easiest form of vertical integration in the shipping industry (Parola and Musso, 2007). Soppé, Parola and Frémont (2009) present a detailed analysis of the costs and benefits of dedicated terminals for ocean carriers and the implications for port authorities. Haralambides *et al.* (2002) identify as a major driver behind the development of dedicated container terminals the greater flexibility, reliability, short turnaround times and enhanced efficiency in the management of the global chain. These advantages though did not seem to be enough to prevent the recent cases of container terminal participation sales that took place in the past year. Whether these are the results of conscious strategic decisions or of the need for immediate cash relief is difficult to assess at this stage (Hailey, 2009).

Downturn or not, some fundamental reasons to vertically integrate are bound to remain important. In the end, one of the fundamental theoretical arguments presented in support of vertical integration refers to the technical economies, of which vertical economies and economies of diversification are typical examples (Shepherd, 1997: p. 152). Most of the literature on integration along the supply chain in general refers to some forms of cost advantages attainable through vertical integration, since cost reduction is one of the preeminent goals for companies (Treacy and Wieresma, 1993). At the basis of the discussion for vertical integration, is the possibility of attaining some sort of economic advantages by changing the nature of the transaction. Typical examples are better control of the supply base (Choi and Krause, 2006) and procurement (Bharadwaj and Matsuno, 2006). The competitive advantage of a logistics service provider lies in its ability to harness the costs deriving from combining logistics services together (Deepen, *et al.* 2008). In doing so he is in a better position to control and reduce costs, and identify value creation opportunities for its customers.

We can rephrase the previous line of reasoning stating that vertical integration in liner shipping is motivated by the advantages that accrue to ocean carriers and their customers from a different way of transacting. Vertical integration in liner shipping implies a change in chain control from the shipper (or logistics service provider) to the ocean carrier. This is consistent with the approach taken by Robinson (2005). In his insightful paper, the author goes even a step further, stating that a shipping line is *de facto* a LSP.

> *'Shipping lines will only derive competitive advantage by delivering the value that the customer will accept – not by operating on extensive networks, or by operating with larger and faster ships or by operating clever e-business systems through these may be fundamental to the value proposition offered by the line and accepted by the customer'* (Robinson, 2005: p. 252).

Competitive advantage and the chain system perspective that Robinson proposes provide an alternative interpretation of vertical integration.

3.11 Carriers' sources of competitive advantage

One of the important insights in the work of Robinson (2005) consists of looking at ocean carriers' strategies beyond the operational point of view of vessel sizes, network coverage or scheduling. Operational aspects, even if crucial, are not sufficient to explain the consequences of supply chain thinking on carriers' success and performance. This distinction has marginally been addressed in the literature, although references can be found for example in Notteboom (2002) when he explains why ocean carriers have shown an interest on the landside part of container transportation. The author points out that the synchronization of liner schedules and hinterland networks not only increases efficiency (operational perspective), but also guarantees competitiveness and survival in the long-run (strategic perspective). In other contributions (e.g. Frémont, 2009) the analysis is purposely restricted to the operational dimension of vertical integration, while in other (e.g. Heaver, 2002*a*) the strategic dimension of vertical integration is only hinted at.

It is our conviction that in order to fully comprehend the nature of vertical integration in the industry, considerations of an operational nature only provide a partial, albeit important, perspective. Only reference to strategic management can fully encompass the momentous and far-reaching implications of vertical integration for the liner shipping industry. This is the perspective presented by Robinson (2005) and to an extent with reference to short sea shipping by Paixão Casaca and Marlow (2005).

	Shipment origination routing and capacity procurement	Provide containers	Provide and operate vessels	Load and unload shipments	Inland delivery
Key activities	•Customer sales •Shipment routing •Capacity procurement	•Ownership of containers •Storage and maintenance •Repositioning	•Ownership of vessels •Operation of vessels	•Terminal control (ownership or lease) •Terminal operation •Container handling	•Control of trucks •Ownership of railroads •Container handling
Competitor types	• Container carriers • Forwarders / NVOCCs	•Container carriers •Container leasing companies	•Container carriers •Outsorced/third party •Dry lease •Wet lease	•Container carrier •Captive terminal operators •Third-party terminal operators	•Railroads •TL truckers •Drayage truckers •Container carriers (limited)
Total revenue	$32 billion	$ 8 billion	$ 102 billion	$ 35 billion	$ 28 billion
Historical growth	10%	11%	7%	11%	7%
Estimated ROCE	50%	9%	3%	25%	34%

Figure 2: Container shipping value chain.

Source: MergeGlobal Value Creation Initiative 2008*b*.

In particular Robinson (2005) extends the *Chain System Framework* (CSF) developed for ports elsewhere (Robinson 2002; 2003) to the liner shipping industry. This framework is structured around the following concepts and assumptions:

- *ocean carriers are logistics service providers*: since liner companies are in the business of moving freight they intervene in the transaction between buyers and sellers. Freight moves only as long as by so doing it creates value and competitive advantage to the buyer, the seller and to the service provider. Carriers will only derive competitive advantage by delivering the value that the customer will accept, as such they are not only the business of moving freight but also in that of providing logistics services.
- *ocean carriers' activities are framed within networks that are artefacts of corporate strategy*: carriers need to deliver the value demanded by their customers, but the characteristics of the networks they operate impose significant restriction on the value that they are able to capture.
- *ocean carriers do not only compete in markets but also in chains*: the strategy a carrier decides to follow is impacted upon not only by their relative position in the market where they operate and by the degree of competition that exists within it, but also by the value they create and are able to capture in the chains they belong to.
- *power and dominance relationships are the determinants of chain structures and operations*: power and market dominance refers to the ability of a carrier to control critical assets in markets and chains that allow leveraging on its customers, suppliers and rivals and in this way capture value for itself (Cox, *et al.* 2002).
- *ocean carriers achieve business success when they are able to achieve and exploit supply chain and market power*: this view implies that carriers will use their market power to close on weaker and less efficient competitors and their supply chain power to gain cost and quality advantages from their suppliers and increase or maintain their share of total revenues from customers.

These arguments are discussed extensively in Robinson (2005), and are based on the alternative view on competitive advantage proposed by Porter (1979), Penrose (1959), Cox (1997) and Cox, *et al.* (2002). On the basis of these five assumptions Robinson argues that chain perspective is appropriate, even mandatory. Shipping lines carry out their business not simply within marketplaces but also within corporately structured chains and supply chains reflecting particular logistic functions and spatial pathways (Robinson, 2003). Carriers will only derive competitive advantage by delivering the value that their customers will accept. Since ocean carriers are third party service providers, their customers are the end-users of the service process, i.e. shippers or consignees (Robinson, 2005). Chains exist only on the basis that they not only deliver value for the customer but they also capture values for the chain parties involved (Robinson, 2003).

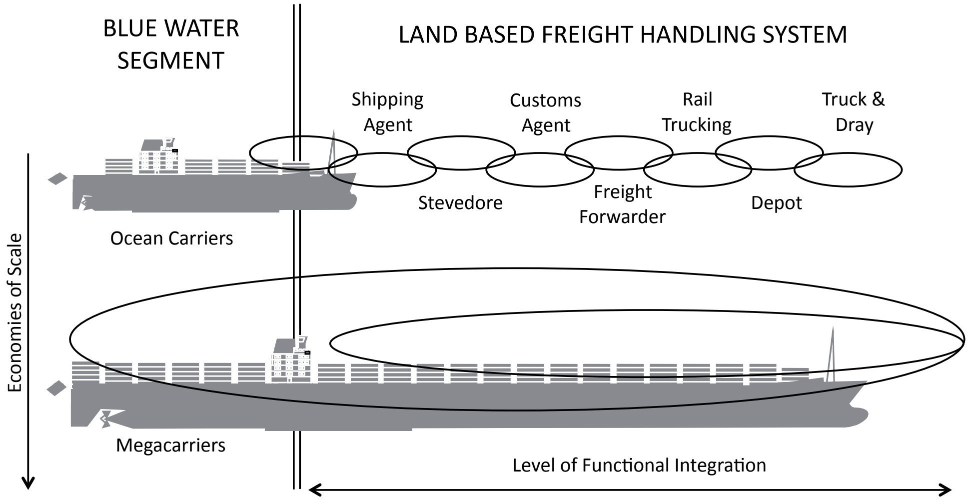


Figure 3: Port-oriented value-driven chain systems.

Source: Adapted from Robinson (2002)

The emergence of megacarriers implies that a better control of the chain is necessary in order to better manage the larger container flows channelled through the port (figure 3), or in other words to better capture value. Since ocean transportation is one of the defining components in global supply chains, carriers are in the best position to do so by offering integrated solutions to their customers in direct competition with third party logistics service providers (Acciaro and Haralambides, 2007). Vertical integration provides an opportunity for megacarriers to reduce or even eliminate the transaction costs among different components in the supply chain.

By reducing transaction costs carriers are able to acquire and exploit power along the supply chain and in turn ensure strategy sustainability. In addition they would gain the capability to use their supply chain power over dependent suppliers to extract cost and quality improvements or impose standards and business practices. Liner companies could gain further resources from the integration of components in chains, and it could even be argued that the advantages of larger vessels are simply the result of increased supply chain power. The conceptualisation of liner strategies in terms of CSF is far from definitive and offers opportunities for further investigation. One of the possible expansions may embed carriers' strategic decisions in frameworks developed in the context of the Resource Based View (RBV) (Mandebvu, 2009).

The RBV argues that the competitive advantage of a firm can be developed on the basis of access and exploitation of resources that are unique to a firm. In other words, competitive advantage can be attained when a firm's strategy is value creating and is not imitated by a competitor (Barney, 1991). A firm's competitive advantage is *sustainable* when it is based on resources that cannot be acquired or exploited by a competitor. The analysis of RBV should not be restricted to single organizations, but it could also be expanded to partnerships or alliances of firms or even a whole industry. Since resources are scarce, it may be convenient that some firms attempt at gaining critical resources through vertical or horizontal integration. In this sense the expansion of an organisation along the value chain ensures resources sustainability. As instance, the advantages of EOS or EOSC can be attained through the combination of resources upstream and downstream along the supply chain.

It is important to note, nonetheless, that some carriers prefer to pool limited resource onto their core business and outsource their supporting business. This does not necessarily imply that carriers may not acquire supply chain power without integrating vertically. Resources in fact can be traded. Some carriers may be even reluctant to get involved with logistic integration in general as a result shortage of resources. It should be noted in this respect that the provision of integrated services does not necessarily imply integration since some carriers have preferred to buy services on an *ad-hoc* basis. We can identify three different basic strategic models with respect to integration along the supply chain:

A) Pure transport service provides (single service);

B) Non asset based logistics service provider;

C) Asset based logistics service provider.

In view of the discussions presented above we believe that the paradigm of reference for liner companies is that of logistics service providers that have strategically selected those assets (strategic resources) that give them the strongest and sustainable competitive advantage.

3.12 Conclusions

This chapter presented a review of liner shipping economics highlighting the crucial characteristics of the industry that are relevant for understanding the potential of bundling. The liner shipping industry is characterised by the following economic features, which, although not exclusive to this industry, imply that the sector is not characterised by perfectly competitive stable equilibria. In particular, these traits are generally referred to as typical of liner shipping:

- it is capital-intensive, not only as a result of the use of ships but also as the requirement of schedule regularity (Davies, *et al.* 1995);
- supply is lagged by the long ship construction time and supply adjustments are difficult (OECD, 2002);
- load factors are variable, with directional imbalances and cyclical and seasonal variations (Brooks, 2004);

- this variability requires excess capacity that is another distinctive trait of the industry (Fusillo, 2003);
- inventories are not feasible (Sjostrom, 1992);
- the resultant reserve capacity tempts firms to engage in discounted pricing when demand is not at the peak (Brooks, 2004);
- demand is relatively inelastic to price changes, therefore lower rates do not result in more demand, similarly to the airline industry (Davies 1990);
- Economies of both scale and density, high fixed avoidable costs (Davies, *et al.* 1995) and network effects (Bergantino and Veenstra, 2002);
- Price discrimination can be an effective way to allocate these costs without depressing trade (Jansson and Shneerson, 1987; 1979; Sjostrom, 1992; 2002);
- Supply cannot be incremented to the margin, and changes in capacity can only take place in lumps (Davies, *et al.* 1995; Davies, 1990).

These characteristics have been at the basis of the antitrust exemption (conferences) that the industry has enjoyed for centuries, and that, although heavily questioned in the USA and Europe in the last decades, is still a crucial step in understanding the industry pricing practices. In particular it can be argued that the existence of conference has affected the ability of carriers to develop integrated door-to-door solution under a single price. This difficulty has been overcome with the development of service contracts and the tendency, after the repeal of the antitrust immunity in October 2008 in Europe, has been towards the development of more innovative pricing strategies.

From an operational point of view, the industry characteristics have lead to the development of large container carriers (megacarriers) in the attempt of achieving EOS. Since EOS appear only when vessels sail with high utilisation rates, the effective exploitation of megacarriers requires liners to increase their control on the chains that move containers to and form the port. This has lead, among other factors, to an increase in vertical integration from the side of carriers. In other words carriers have realised that as LSPs their success does not lie exclusively in optimising their operations but in controlling the chains where they operate. The chain control consists in the ability of an LSP to create value for their customers and to capture value from their suppliers. This value is approximated by the price at which the (integrated) service is provided. An effective strategy to create and capture value is integration along the supply chain.

Vertical integration, although not necessary for bundling in general, is a necessary condition for *product bundling*. Since product bundling provides at least some consumers with added value and product bundles can be thought as an *integral architecture* (Ulrich and Eppinger, 2004), in the case of logistics, it requires the redefinition of services, optimisation of the interfaces among services and redesign of service delivery processes (Stremersch and Tellis, 2002). The questions that the rest of the thesis will aim at investigating refer to what is the best model in terms of value creation and capture and what role product and price bundling may play in this process.

4 A SHIPPER'S PERSPECTIVE*

4.1 Introduction

A crucial condition for the success of bundling as a business practice is that the bundle needs to be attractive for the shipper. Although some advantages for the shippers—such as easiness to compare logistics costs among various providers—are intrinsic to the practice of bundling, the attractiveness of a bundle is inextricably linked to the attractiveness of its components. These components are what is collectively referred to as *logistics outsourcing*, and consist of:

> *'[…] activities carried out by a logistics service provider on behalf of a shipper and consisting of at least management and execution of transportation and warehousing. In addition, other activities can be included, for example inventory management, information related activities, such as tracking and tracing, value added activities, such as secondary assembly and installation of products, or even supply chain management. Also, the contract is required to contain some management, analytical or design activities, and the length of the co-operation between shipper and provider to be at least one year, to distinguish third-party logistics from traditional "arm's length" sourcing of transportation and/or warehousing'* (Berglund, *et al.* 1999: pg. 59)

There is an extensive literature on the attractiveness of logistics outsourcing and a large number of field studies are conducted every year with the objective of monitoring the development of the industry. Although *bundling* and *outsourcing* are two separate concepts, outsourcing is a necessary condition to bundling. It has been observed that shippers outsource services in bundles (e.g. warehousing and

* A preliminary version of this chapter appeared as Acciaro (2008*b*) and Acciaro (2009*a*).

inventory control) and in general logistics service providers (LSPs) tend to combine activities that share common transactional elements and information flows (Maltz and Ellram, 2000; Maltz, Riley and Boberg, 1993; Rabinovich, *et al.* 1999).

Of the many studies that focused on logistics outsourcing, none has focused on shippers' interest in bundles of logistics services. The aim of this chapter is to present the result of two surveys aiming at obtaining a better insight in the attractiveness for shippers of bundling in the logistics sector and the types of services that are more likely to be outsourced jointly. Before presenting the results of the surveys it is expedient to explain the motivation from the side of shippers of outsourcing by and large and review the benefits (and risks) traditionally associated with logistics outsourcing.

The chapter is thus structured as follows. After this introduction the next two paragraphs present a short review of the theory of logistics outsourcing and of the benefits (and risks) associated with this practice. The following sections present the results of a survey conducted as part of the MEL-SMU research on bundling on the advantages that logistics outsourcing delivers to shippers and the type of services that are most likely to be outsourced. This is followed by the analysis of the results of a global survey on shippers' preferences on bundling carried out by a major integrated transport provider on its customers in 2007. The results of this second survey were made available in confidence to MEL researchers in the context of the joint project mentioned above. The last section will present a set of recommendations, topics for further research, and conclusions.

4.2 Logistics outsourcing

Before proceeding with the analysis of the shipper perspective on bundling, it is expedient to discuss the extent to which logistics outsourcing has become a pervasive business practice, what motivates a shipper to outsource and what services are most likely to be outsourced. The literature on logistics outsourcing is rather extensive and the aim of this paragraph is to focus only on the issues important for the discussions that will follow. More extensive reviews are available for example in Marasco (2007), Razzaque and Sheng (2001) and Selviaridis and Spring (2007). Deepen (2007) also provides a comprehensive discussion on all aspects of logistics outsourcing.

The first issue that we aim at discussing is the shipper decision on whether to outsource logistics services to third parties. The so-called *make-or-buy decision* is related to a large variety of considerations, among which the cost of providing the service in-house against the price to be paid to logistics service providers is probably the most obvious (Van Damme and Ploos van Amstel, 1996). Outsourcing is an efficient way of providing a service without the necessity in investing in new assets and developing new capabilities (Persson and Virum, 2001; Stank and Matz, 1996; Bolumole, 2001; 2003). The level of asset specificity associated with the provision of a certain service has also been used to explain outsourcing. High asset specificity in association with uncertainty should lead to in-house provision (Aertsen, 1993; Maltz, 1994*a*; Skjoett-Larsen, 2000).

Cost and asset specificity are clearly not the only dimensions of the make-or-buy decision, and should always be weighted against service level considerations (Matlz, 1994*b*; La Londe and Maltz, 1992; McGinnis, Kochunny and Ackerman, 1995; Sarel and Zinn, 1992). Van Damme and Ploos van Amstel (1996) summarise the determinants of firms' decision to outsource in four groups. They are the economic viability of the service provision, demand variability and customer service, availability of personnel and equipment and the level of dependency on the supplier. The outsourcing decision may also be related to the shipper characteristics, such as firm's size (Hong, Chin and Lin, 2004*b*), or the shipper's organisational structure (Daugherty and Droge, 1997).

Since the aggregating and risk reducing nature of shipper requirements is what makes consolidation, and thus outsourcing, attractive (Van Asperen, 2009), a large number of studies focused on the demand side, surveying shippers and logistics service providers in the attempt to determine which services are most likely to be outsourced. Shippers seem to demand outsourcing mostly of transportation, distribution and warehousing, while advanced logistics solutions such as information management systems or services aiming at supporting production activities are less popular (van Hoek, 2000*b*; 2000*c*; van Hoek and Dierdonck, 2000; Selviaridis *et al.* 2008). On the side of supply these surveys highlight an increase in the offer and complexity of supply chain solutions (Lieb and Randall, 1999; Lieb and Bentz, 2005*a*; 2005*b*), and in general reveal a mismatch between supply and demand (Murphy and Poist, 1998).

Shipper demand for logistics services may also be very diverse depending on the geography of the market where the shipper is operating or the industry sector (Rushton and Walker, 2007). A large number of studies survey the extent of logistics outsourcing in Europe (Virum, 1993; Lieb, Millen and Van Wassenhove, 1993; Gooley, 1997; Van Laarhoven, Berglund and Peters, 2000; Van Hoek, 2001; Hertz and Alfredsson, 2003; Wilding and Juriado, 2004; Selviaridis *et al.* 2008). One of the common observations of these studies is that Europe represents one of the most mature markets in the world, with most European shippers looking at outsourcing as part of their business model, although the historical local focus for each country makes this region a particularly challenging marketplace. Wilding and Juriado (2004) observe that European firms tend to use a mix of in-house and contract logistics, especially in the consumer good industry. The most commonly outsourced services seem to be transportation and overflow storage.

North America represents also a mature market for logistics outsourcing. This has triggered a large amount of surveys (Bardi and Tracey, 1991; Lieb and Randall, 1996; Bradley, *et al.* 1999; Daugherty, Stank and Rogers, 1996; Rabinovich, *et al.* 1999; Maltz, *et al.* 1993; Boyson, *et al.* 1999; Murphy and Poist, 2000;

Knemeyer, Corsi and Murphy, 2003; Lieb and Benz, 2004; 2005*a*; Arroyo, Gaytan and De Boer, 2006). Larger companies seem to be more likely to outsource logistics and supply chain services (Lieb and Benz, 2005*a*). Furthermore logistics outsourcing plays a crucial role for the automotive, the high-tech and the large retail industries (Lieb and Kendrick, 2003; Lieb and Miller, 2003).

A more limited number of studies focused on the Far East (Yeung, *et al.* 2006; Sum and Teo, 1999; Wang, *et al.* 2006; Sohail, Bhatnagar and Sohal, 2006; Sohail and Sohal, 2003; Bhatnagar, Sohal and Millen, 1999; Hong, Chin and Lin, 2004*a*; 2004*b*; Yang, 2009), the Indian Sub-continent (Sahay and Mohan 2006; Vinay *et al.* 2009), the Middle East (Sohail and Al-Abdali 2005), Australia (Dapiran *et al.* 1996; Sankaran, Mun and Charman, 2002; Sohal, Millen and Moss, 2002) and Latin America (Bowersox and Closs, 1997; McCormack, Bronzo Ladeira and Valadares de Oliveira, 2008; Zinn, 1996). The level of logistics outsourcing in these countries is very diverse, ranging from countries with relatively mature markets such as Japan, South Korea, Singapore and Australia, to new rapidly growing economies such as China, India and Asia Pacific Countries. In the case of China, for example, the development of logistics outsourcing has been identified as one of the most urgent requirements for the development of Chinese logistics chains (Yang, 2009). Although the logistics infrastructure of these countries is improving very rapidly, as the entry of foreign retailers such as Wal-Mart, Tesco, Metro and Carrefour (Rushton and Walker, 2007) seems to suggest, local logistics providers seem to be able with difficulty to cope with the requirements of modern supply chains, therefore requiring some form of coordination or support at a national level (Yang, 2009).

All studies though confirm the continuing growth of logistics outsourcing (Ashenbaum, Maltz and Rabinovich, 2005; Lieb and Bentz, 2005*b*; Murphy and Poist, 1998; 2000). This growth is facilitated on the demand side by the reduction in asset intensity and increase in labour costs and the restructuring of distribution, while on the supply side by the reduction in profit margins for basic services, in conjunction with deregulation (Berglund, *et al.* 1999) and ICT developments (Lewis and Talalayersky, 2000; Sauvage, 2003). In particular transport service providers have expanded the scope of their activities in the attempt to differentiate their service offerings from those of their competitors (Sheffi, 1990; Virum, 1993). This expansion, however, has not always been matched by the development of their actual capabilities (Bask, 2001), so that a certain degree of fuzziness remains on the distinction between pure transport providers and logistics service providers (Razzaque and Sheng, 1998).

4.3 Outsourcing advantages and risks for shippers

As mentioned before one of the reasons companies engage in logistics outsourcing is that it allows reduction in logistics costs (Cavinato, 1989; Bardi and Tracey, 1991; La Londe and Maltz, 1992; Lieb, 1992; Browne and Allen, 2001). This logistics cost reduction may take different forms, such as reducing capital investment or maintenance costs (Bardi and Tracey, 1991). The reduction in capital investment may refer to physical facilities such as warehouses or transport vehicles (Foster and Muller, 1990; Richardson 1995) but also IT and other soft infrastructure (Sheffi, 1995; Lacity, Wilcoks and Feeny, 1995; Richardson, 1995). This is also related to the fact that the firm can outsource a certain service only when this is required, avoiding investment in assets that are seldom used, and turning therefore fixed costs in variable costs (Deepen, 2007; Bardi and Tracey, 1991).

In addition, it is to be expected that since logistics is the core activity for LSP, specialization and focus on core competencies should allow them to achieve higher level of efficiency and lower production costs (Lieb, 1992; Bradley, 1994), or simply identify inefficiencies that were not visible when the activity was performed by the firm in-house (Cahill, 2007). Cost reduction can be the result of economies of scale and scope (Van Damme and Ploos van Amstel, 1996; Lutz & Ritter, 2009) deriving from larger volumes (Wallenburg, 2009), higher asset utilization (Weidenbaum, 2005), reduced demand variability (Deepen, *et al.* 2008).

An additional source of cost savings may be related to the reduction in labour costs (Bardi and Tracey, 1991). This can be the result of differentials between wages in the logistics sector and in the manufacturing sectors (Lynch, 2000*a*; Deepen, 2007), or of the reduction in workforce and related expenditures (Richardson, 1995), or of the elimination of labour legal constraints in highly unionised countries (Lynch, 2000*b*).

Cost reductions are naturally not the only reason for outsourcing. An additional advantage of outsourcing is that is allows firms to focus on their core business, while activities that are strategically less important can be entrusted to others (Sink and Langley, 1997). This focus allows the firm to simplify its business processes and concentrate resources on those areas that have the potential to deliver higher market competitive advantage (Cahill, 2007).

A further important advantage of logistics outsourcing is that the logistics performance of the firm can be improved, since the LSPs are likely to possess better technology, infrastructure and logistics expertise than the outsourcing firm (Browne and Allen, 2001). This performance improvement can materialise in better logistics service quality, optimised asset use (Wallenburg, 2009), greater flexibility (La Londe and Maltz, 1992; Deepen, 2007), faster transit times, less damage, and improved on-time delivery (Richardson, 1995), reduction in inventory costs (Daugherty, *et al.* 1996), order cycle times, lead times (Bhatnagar and Viswanathan, 2000) and improvement in customer service (Wong, *et al.* 2000).

Table 7: Benefits and risks of logistics outsourcing.

	Benefits	Risks/Problems
Strategic	- Focus on core competence - Gaining access to external logistics expertise - Gaining access to new markets - Access to international logistics networks - Improve customer satisfaction - Flexibility in relation to market changes	- Loss of control over the logistics function - Loss of customer contact - Loss of in-house logistics capability - Leakage of sensitive information - Lack of responsiveness to customer needs - Employee resistance to change
Financial	- Economies of scale - Reduction in capital investment - Reduction in equipment maintenance costs - Reduction of financial risk - Turning fixed costs to variable - Reducing labour costs - Sharing development costs - Providing external benchmark for logistics costs/logistics cost awareness	- Unrealistic fee structure and financial loss - Cost reduction offset by provider margin - Dependence on service provider/opportunism - Cost saving assessment difficulties
Operational	- Better capacity utilisation - Volume flexibility - Inventory reduction - Order cycle reduction - Lead-time reduction - Access to logistics information systems	- Poor IT capabilities - Poor personnel quality - Poor customer service - Time and effort put on logistics is the same - Inadequate expertise - Inability to handle special product needs - Disruption to operations - Loss of customer feedback

Source: Selviaridis, *et al.* (2008)

Selviaridis, *et al.* (2008) surveyed the literature on outsourcing and classified these and other benefits associated with outsourcing in three categories: those related to the firm strategy; those connected to the financial flows of the firm; and those related to operations. Their categorisation is reported in the table above, that also lists the risks and problem associated with logistics outsourcing.

Since the early 90's it has become clear that disadvantages are also associated with outsourcing (Lynch, Imada and Bookbinder, 1994; McIvor, 2000; Wentworth, 2003). Some of the most often cited issue refer to the loss of control of the logistics function (Bardi and Tracey, 1991), loss of customer contact (Ellram and Cooper, 1990) and the loss of the ability to provide the service in-house that increases the dependence of the firm on the LSP (Wentworth, 2003). It has been observed that firms will attempt to reduce these risks by retaining some logistics activities (Wilding and Juriado, 2004). This strategy nonetheless contributes to increasing the complexity of the relations with the LSP, another disadvantage of outsourcing (Wallenburg, 2009).

The issue of asset dependency in outsourcing relations and the costs associated with the complexity of outsourcing contracts has been studied extensively, and although some contractual characteristics may contribute to mitigate these disadvantages, the relationship between LSPs and shippers can be critical (Barthélemy and Quélin, 2006). The cost savings described above in this paragraph, even if realised, may not offset these complexity costs. Outsourcing may also increase costs as a consequence of excessive fees and overheads (Ackerman, 1996; Wilding and Juriado, 2004), and its financial benefits are in many cases difficult to measure, since firms may not be aware of their actual logistics costs (Selviaridis and Spring, 2007).

Other important disadvantages of outsourcing could be decrease in responsiveness to customer's needs (Van Damme and Ploos van Amstel, 1996); decrease in service quality (Ellram and Cooper, 1990) especially in case special products are requested or in emergency circumstances; lack of workforce expertise and capabilities (Sink and Langley, 1997; Gibson and Cook, 2001; Svensson, 2001); low quality IT capabilities (Van Laarhoven, *et al.* 2000).

4.4 Survey data

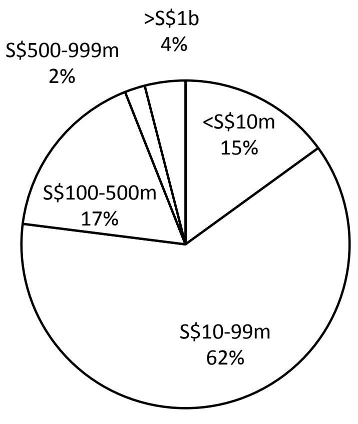
The rest of the chapter presents the results of two surveys. One of the surveys refers to a study by SMU and EUR (2008*b*), performed in the context of the NOL Foundation project previously mentioned. The authors surveyed 53 Singapore based companies in the attempt to understand the role outsourcing plays in different industries and what are the logistics outsourcing preferences. The second survey summarises some of the results of a survey performed by a container carrier, which was made available in confidence to MEL researchers in the context of the MEL-SMU research project at the condition that the identity of the carrier was not to be disclosed. The carrier is a global logistics service provider with an excellent reputation in the provision of supply chain solution and worldwide coverage of its shipping network.

4.5 Respondent profiles

In May-June 2007 a questionnaire was sent to the 203 traders in Singapore with total trade value of S$10 million and above (SMU and EUR, 2008*b*). The ranking was obtained from the Top Singapore Importers and Exporters Directory 2005, published by IE Singapore. The objectives of the survey were:

- to better understand shippers' current practices in liner transportation and logistics services; and
- to understand how changes in the provision of these services impact shippers' demand and propensity for such services.

In all, 53 companies took part in this survey. This translates into an effective response rate of 27%. In terms of revenue, three out of five companies were medium-sized with revenues between S$ 10 million to 99 million. Companies with revenues above S$ 100 million accounted for a quarter of the sample (fig. 4). In terms of trade profile, more than half of the respondents declared an annual trade value between S$ 15 million to S$ 50 million. One in five companies can be considered a large trader with a trade value above S$ 50 million (fig. 4).



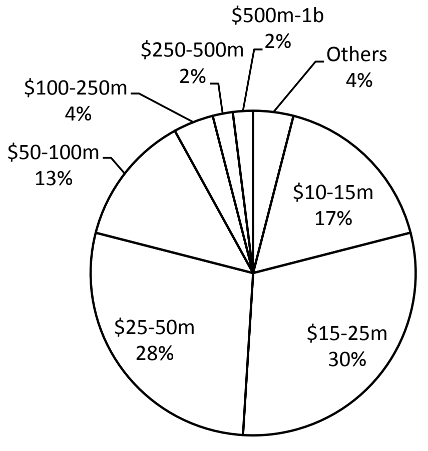


Figure 4: Profiles of the respondents in terms of revenue (left pie) and trade value (right pie).

Source: SMU and EUR (2008*b*).

Industries predominantly represented by the survey respondents are:

- Industrial Manufacturing;
- Food and Beverage;
- Electronic Parts and Consumer Electronics;
- Chemicals;
- Construction and Industrial Machinery;
- Retail;
- Automotive;
- Marine and Marine-Related;
- Textile and Garments.

4.6 Overall trends

The first part of the survey aimed at assessing the logistics needs of the respondents. On the entire sample, the most-required logistics functions were freight scheduling and routing, warehousing, inventory management, and customs clearance, with 9-out-of-10 respondents requiring such services (see table 8). These functions are clearly not entirely provided in-house, in fact, the top five functions that survey respondents appear to be most willing to outsource include customs brokerage, and in- and out-bound land transportation.

Table 8: Most- and least-required logistics functions.

	% of respondents
Most-Wanted Functions	
Freight Scheduling and Routing	94%
Warehousing	94%
Inventory Management	92%
Customs Clearance	90%
Rate Negotiation	88%
Least-Required Functions	
Reverse Logistics & Waste Disposal	67%
Procurement of Logistics	65%
Product Assembly / Installation	52%
Fleet Management	50%
Factoring	31%

Source: SMU and EUR (2008*b*).

The following activities are likely to be outsourced on a regular basis, but do not rank among the functions that are perceived as the most needed: *terminal handling and transhipment /relay* (table 9). For all the outsourced functions, the preference is for *direct liaison with providers* (rather than engaging third party logistics service providers). Outsourcing decisions seem to be motivated mostly by better service considerations (58%), costs savings from shared services (46%) and volume consolidation (44%).

On the other hand, the following functions are most likely to be provided in-house: customer and supplier compliance, order entry processing and customer service, and inventory management (table 10). This seems to be motivated by the desire to retain control over these activities (73%), ensure that service levels are not compromised (48%) and, to a lesser extent by the perception that these functions constitute company core competences (42%).

Table 9: Outsourced logistics functions.

Logistics Functions	*% of Respondents*
Terminal Handling	100%
Transhipment / Relay	92%
Customs Brokerage	89%
Outbound Land Transportation	82%
Inbound Land Transportation	81%
Customs Clearance	81%
Shipment Consolidation / Deconsolidation	68%
Freight Scheduling and Routing	59%
Reverse Logistics and Waste Disposal	51%
Carrier Service Selection	51%
Fleet Management	50%
Factoring	50%

Source: SMU and EUR (2008*b*).

Table 10: In-house logistics functions.

Logistics Functions	*% of Resp*
Order Entry Processing & Customer Svc	93%
Customer & Supplier Compliance	93%
Inventory Management	90%
Order Fulfilment and Distribution	81%
Warehousing	78%
Product Assembly / Installation	74%
Materials Flow Management	73%
Freight Bill Auditing / Payment	73%
Product Marking / Labelling / Packaging	72%
Information Technology	71%
Procurement of Logistics	71%
Rate Negotiation	70%

Source: SMU and EUR (2008*b*).

Sector Focus 1: Industrial Manufacturing

For respondents in the industrial manufacturing business, the top five logistics functions do not differ substantially from those selected by the average respondent (table 11). The only noticeable difference is *rate negotiation*, which appears slightly more important than for the average respondent, probably as a result of the larger cargo volumes that these shippers need to move.

Table 11: Sectors focus 1, logistics functions most- and least-wanted.

	% of Resp
Most-Wanted Functions	
Warehousing	100%
Freight Scheduling & Routing	94%
Inventory Management	94%
Rate Negotiation	94%
Outbound Land Transportation	89%
Least-Required Functions	
Order Fulfilment and Distribution	72%
Transhipment / Relay	67%
Product Assembly / Installation	67%
Fleet Management	56%
Factoring	28%

Source: SMU and EUR (2008*b*).

Table 12: Sectors focus 1, outsourced logistics functions.

Logistics Functions	*% of Resp*
Customs Clearance	100%
Customs Brokerage	100%
Terminal Handling	100%
Transhipment / Relay	92%
Outbound Land Transportation	81%
Inbound Land Transportation	79%
Shipment Consolidation / Deconsolidation	73%
Carrier Service Selection	69%
Reverse Logistics & Waste Disposal	64%
Fleet Management	60%
Factoring	60%
Materials Flow Management	54%
Freight Scheduling & Routing	53%

Source: SMU and EUR (2008*b*).

In terms of the outsourced functions, table 12 shows that *materials flow management* and *factoring* are more likely to be outsourced than in the case of the average respondent. This is in line with the general observation that respondents in the industrial manufacturing sector make a greater use of third party logistics service providers. Seven of the listed logistics functions, including the top five, are all outsourced to third party service providers by at least 70% of the respondents.

Table 13 lists the logistics functions provided in-house for this sector focus. 82% of the respondents prefer direct *rate negotiation*, compared to just 69% for the average respondent. This could be related to the higher importance industrial manufacturers place on this function.

Table 13: Sectors focus 1, in-house logistics functions.

Logistics Functions	*% of Resp*
Inventory Management	94%
Order Entry Processing & Customer Svc	94%
Customer & Supplier Compliance	94%
Rate Negotiation	82%
Product Marking / Labelling / Packaging	81%
Procurement of Logistics	80%
Order Fulfilment and Distribution	77%
Product Assembly / Installation	75%
Warehousing	72%
Freight Bill Auditing / Payment	63%
Information Technology	56%

Source: SMU and EUR (2008*b*).

Sector Focus 2: Food and Beverage

Respondents in the food and beverage industries are generally smaller both in terms of revenue and trade values compared to the average respondent. Amongst the key logistics functions required, *customs clearance* and *customs brokerage* are ranked much higher than for the average respondent (see table 14). This could be due in part to the complexities of trade and non-trade barriers in the import and export of this type of products. The respondents in these industries also appear to require a more limited number of logistics functions, since 6-of-24 functions are required by less than half the companies.

From table 15 it can be observed that the respondents in the food and beverage industries generally outsource fewer functions than the average respondent, with the exception of *freight scheduling & routing*. This is not surprising since only for smaller volumes outsourcing appears to offer cost advantages.

Table 14: Sector focus 2, logistics functions most- and least-wanted

	% of Resp
Most-Wanted Functions	
Customs Clearance	100%
Freight Scheduling & Routing	89%
Inventory Management	89%
Outbound Land Transportation	78%
Customs Brokerage	78%
Least-Required Functions	
Reverse Logistics & Waste Disposal	44%
Shipment Consolidation / Deconsolidation	33%
Product Marking / Labelling / Packaging	33%
Procurement of Logistics	33%
Factoring	33%
Product Assembly / Installation	11%

Source: SMU and EUR (2008*b*)

Table 15: Sectors focus 2, outsourced logistics functions.

Logistics Functions	*% of Resp*
Terminal Handling	100%
Outbound Land Transportation	86%
Transhipment / Relay	83%
Inbound Land Transportation	83%
Shipment Consolidation / Deconsolidation	67%
Factoring	67%
Freight Scheduling & Routing	63%
Customs Brokerage	57%

Source: SMU and EUR (2008*b*)

Sector Focus 3: Electronic Parts and Consumer Electronics

Respondents in the electronics industry are generally larger both in terms of revenue and trade values than the average respondent and the industrial manufacturing and the food and beverage respondents.

In terms of the key logistics functions demanded, all the respondents included in this sector focus functions demand 7 of the 24 logistics functions listed in the survey, as shown in table 16. This is more substantial than in the industrial manufacturing and the food and beverage sectors.

Table 16: Sector focus 3, logistics functions most- and least-wanted.

	% of Resp
Most-Wanted Functions	
Shipment Consolidation / Deconsolidation	100%
Outbound Land Transportation	100%
Terminal Handling	100%
Customs Clearance	100%
Warehousing	100%
Inventory Management	100%
Product Marking / Labelling / Packaging	100%
Least-Required Functions	
Fleet Management	43%
Product Assembly / Installation	43%
Procurement of Logistics	29%
Factoring	29%

Source: SMU and EUR (2008*b*)

Table 17: Sector focus 3, outsourced logistics functions.

Logistics Functions	*% of Resp*
Terminal Handling	100%
Customs Brokerage	100%
Transhipment / Relay	100%
Outbound Land Transportation	86%
Inbound Land Transportation	83%
Customs Clearance	71%
Freight Scheduling & Routing	67%
Fleet Management	67%
Carrier Service Selection	60%
Shipment Consolidation / Deconsolidation	57%

Source: SMU and EUR (2008*b*)

Table 17 lists *terminal handling*, *customs brokerage* and *transhipment / relay* as the logistic functions most often outsourced by the respondents in the electronic parts and consumer electronics industrial sectors. These functions are also outsourced directly with the logistics providers, similarly to what happens for the average respondent.

Among the four types of door-to-door logistics providers listed in the survey, the completely integrated asset-based liner operator is associated with the majority of the advantages of outsourcing, as shown in figure 5 below.

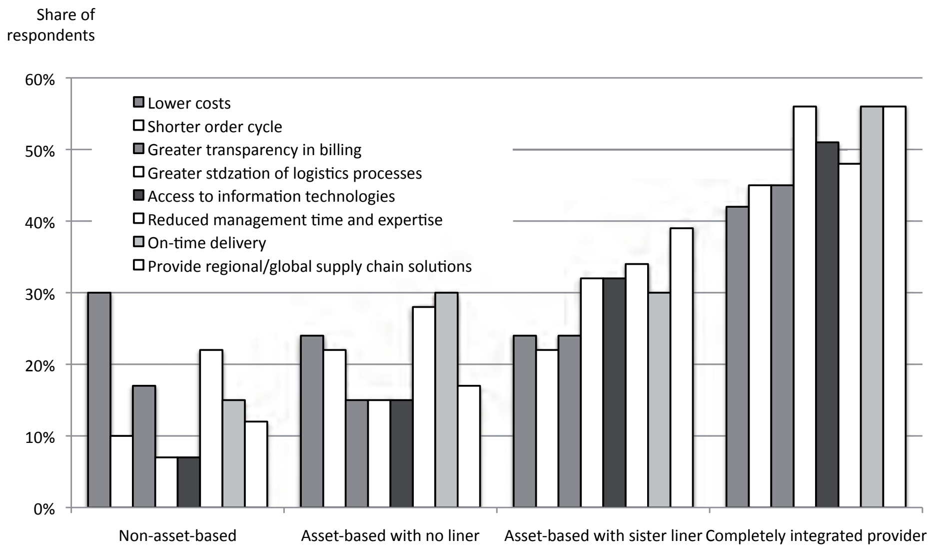


Figure 5: Perceived advantages of outsourcing.

Source: SMU and EUR (2008*b*)

Specifically, half of the respondents agreed that a completed integrated provider delivers *greater standardization of logistics processes*, *provides access to valuable information technologies, enhances on-time delivery, and has the ability to provide global / regional supply chain solutions*.

On the other hand, respondents are generally least favourable of the non-asset-based independent logistics provider. Disadvantages most commonly cited are: *higher costs* (59%), *higher risk* (49%), and *reduced flexibility in service provision* (49%) (figure 6). For the other two categories, respondents are generally indifferent.

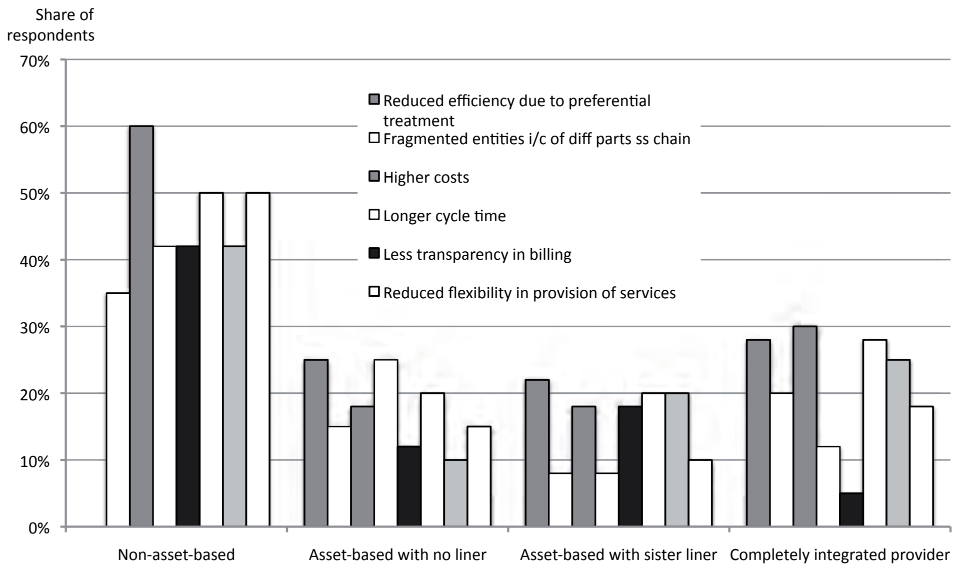


Figure 6: Perceived disadvantages of outsourcing.

Source: SMU and EUR (2008*b*).

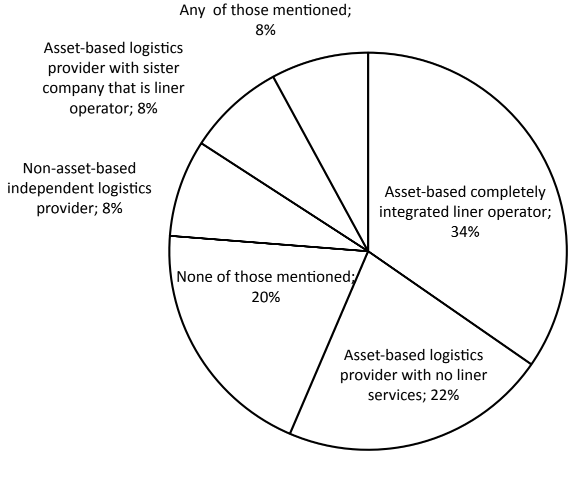


Figure 7: Potential outsourcing partner.

Source: SMU and EUR (2008*b*).

The next most favoured outsourcing partner is the asset-based operator with no liner services (22%). The reasons given for this choice appear to highlight the greater flexibility offered by this type of logistics service provider in selecting the ocean carrier that suits better the needs of its customer. Logistics service providers that are not associated with a liner company appear to offer "higher flexibility in choosing the liner operator" and "better services, lower costs and higher flexibility of services".

A set of questions in the survey aimed at investigating the relevance of pricing in the outsourcing decision. Almost the totality of the respondents (94%) indicates that price is an important consideration in their choice of service provider. If given a significant price discount, two thirds of the respondents would consider engaging a door-to-door service provider. The survey also required respondents to list the key factors regarded as crucial in the choice of a logistics service provider. Those more frequently mentioned include (in brackets the number of respondents who indicate this factor), level of service (16); reliability (7); price (7); efficiency (6); and commitment (3).

4.7 Carrier's survey results

This section presents a summary and an analysis of the results of a survey conducted by a major carrier on the preferences for bundled offers of logistics and ocean transportation services. The survey was conducted in 2007 and surveyed 355 customers from all over the world.

The first point of the survey analysed where does the interest of the shippers lie in bundled offers. The 355 shippers provided 542 choices. Approximately half of the customers rate bundling as an important concept, independently from their geographical location. Asian and North American shippers though rate bundling slightly higher than European ones, indicating that bundling attractiveness is not related to the maturity of the logistics industry. As far as the product verticals are concerned, automotives and technological products seem to lead, with almost 50% of the customers expressing an interest in bundling. The survey defines the following attributes as characteristics of bundled offers:

- cost efficiencies by working with one vendor;
- single account manager for complete services;
- one stop shopping for all needs under one contracts;
- door-to-door delivery;
- single invoice for all services.

Shippers seem to prefer bundled offers because of 'cost efficiencies' and 'single account manager', although no significant differences appear from the survey. Only the possibility of a single invoice for all services is rated somewhat lower than the other attributes. This result seems to indicate that the respondents regard bundling as being able to generate economies of scale effects.

Customers view bundled offering as appealing because working with one vendor will allow them to leverage the relationship for costs efficiencies as well as make it easy for them to handle transport/logistics matters.

The survey also investigates why shippers attach a higher value to bundled offers than to unbundled services. The survey indicated the following alternatives:

- production efficiency;
- cost efficiencies;
- ease of managing shipping;
- better service to customers.

Among the 355 respondents to this question, no significant preference for any of the four alternatives is indicated. The differences appear more evident at a geographical detail. North American shippers seem to care more for production efficiency and ease of managing shipping, while European shippers seem to prefer bundling for the cost advantages it can provide. For technical and consumer goods production efficiencies seem to be the most relevant while, ease to manage shipping is the most relevant attribute for garments. The automotive industry seems to be more concerned with costs savings deriving from bundling.

The survey also enquired how many products should be included in a bundle. The results show that shippers would on average favour bundles that include five logistics services. Products generally involve some form of transportation, warehousing/related product handling and customs. Asia/ISC tend to bundle the least products (4.4). Auto customers tend to bundle most products (6) while Garments bundle the least (4.2).

The following question in the survey focused on what products would shippers be most interested to see in a bundle. The results are presented in the following chart. The graph shows the propensity of bundling ocean transportation with pre-carriage and on-carriage. Please note that terminal handling is included for the purpose of the discussions already in ocean transportation, as this bundle is already established in the industry.

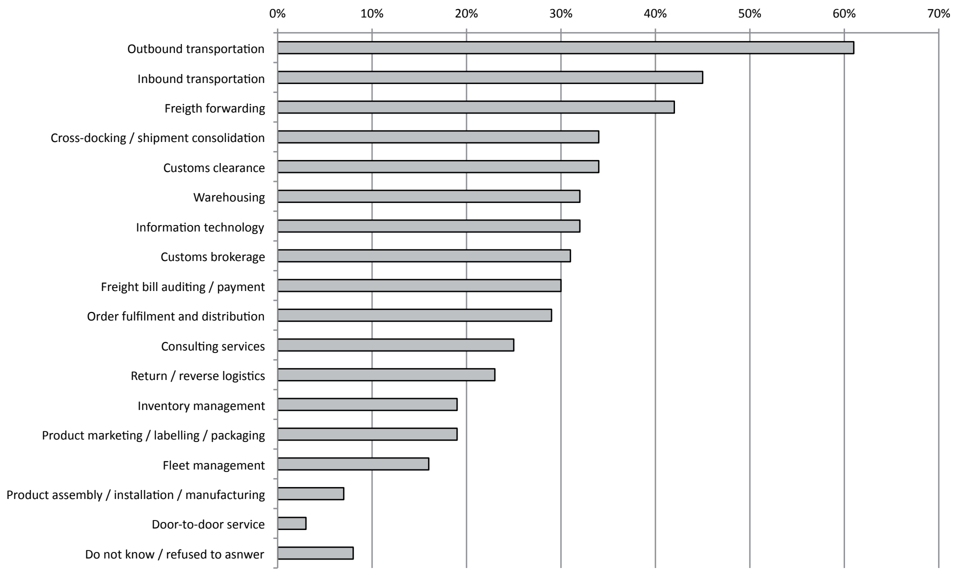


Figure 8: Type of logistics services and how likely they are part of a bundle.

Source: Carrier's customer survey.

The following question in the survey enquired what propensity would have shippers to pay a premium for the bundle. Except for Europe, at least a quarter of the customers across all regions indicate a willingness to pay a premium of more than10%, while in Greater China, more than a quarter of customers are willing to pay up to 16%-20% premium for "Bundled offering". From the point of view of product verticals, Auto and Tech customers have slightly more than a quarter of customers willing to pay premiums of more that 10%, but differences among product verticals are not significant.

Half of the customers refused to answer or does not believe any companies have a comparative ability in providing bundles. The alternatives proposed also included DHL Danzas and UPS that did not appear to be preferred. This answer to this question though might suffer from respondent bias, as the interviewees are customers of a shipping line.

4.8 Conclusions

Shippers may require a single rate including hinterland transportation on the basis of the traditional one-stop-shop arguments. In particular the costs associated with the finding the hinterland transportation suppliers, in addition to the better knowledge that the carrier may have of the market, as well as the necessity to be able to compare the costs of the entire route are all reasons for which a shipper may prefer a point to point rate inclusive of hinterland transportation. The frequency in the use of bundles depends very much on three aspects: the nature of the commodity, the trade line and whether the trade is a head-haul or a back-haul trade.

All-inclusive point-to-point rates are particularly common in certain market segments. For example the waste paper market is a case where rates are traditionally quoted all-inclusive. This is common among low value commodities and may be motivated by the fact that the margins for these commodities are so low that carriers opt for a bundle rate in order to disguise the very low ocean freight rates they have to offer to attract the cargo. In some circumstances on the paper market in the past rates might very well have been negative, but the carriers managed to hide this fact by proposing a bundle inclusive of Terminal Handling Charges (THC), Bunker Adjustment Factors (BAF) and pre carriage in the UK for example and hinterland transportation at destination.

One possible advantage is the use of bundle rates to reduce cost pressure for the shippers. According to some industry experts, bundled rates have been used in the case of increasing ocean freight rates in order to soften cost pressure for shippers. In the past for sure, an increase in the ocean freight rate through the conference public rates for example, might have translated in increasing pressure to lower hinterland transportation rates. This might have been achieved by reducing the price of the bundle. While the sum of ocean transportation, adjustment factors, surcharges and hinterland transportation was not attractive enough for the shipper, a bundle whose price was below the sum of the above mentioned components may well have been.

In general the attractiveness of the bundle may be related to the trade lines. It is likely that in head-hauls hinterland transportation will not be quoted unless specifically requested, but this may vary depending on the part of the world where the shipper is located. In addition bundles can be used by the logistics operator associated with the liner to attract new business for the ocean leg. This may be common practice with retail logistics, where in general prices will be quoted per box or per item and will be inclusive of a large set of logistics services including ocean transportation.

The recent survey of shippers operating out of Singapore, that has been discussed in this chapter (SMU and EUR, 2008*b*), however noted that shippers are more comfortable dealing with asset-owning service providers than non-asset owning service providers. The reason for this are not yet understood, and further research is ongoing.

5 The Practice of Bundling*

5.1 Introduction

Although carriers have been providing intermodal services since the 1980s, it is only recently that the major shipping lines have set up logistics operations, giving this type of activities a more central role in their group strategies (Midoro and Parola, 2006). In this way, carriers are increasingly competing with some of their own customers, notably freight forwarders and Non Vessel Operating Common Carriers (NVOCC) (Haralambides, 2007).

Bundling is also not a new concept in the liner shipping industry. However, its practice has not been the subject of any detailed analysis in the ocean transportation. Davies (1986*b*) provides one of the first references to bundling in his influential article 'Competition, contestability and the liner shipping industry':

> *In many ways the offering of multimodal services is an exercise in brokerage and they can be put together through the appropriate purchase of space on the requisite modes, much in the manner of the holiday packages put together by a travel agent. In this way then services can be tailored to the needs of individual customers and commensurate with demand, the number of product offerings is potentially much greater under a multimodal than under a port-to-port regime.* (Davies, 1986*b*: pg. 96)

* This chapter is based to a large extent on the results of a study conducted between 2007 and 2010 under the auspices of the NOL Foundation, in cooperation with Singapore Management University and a working paper of the author on the subject. Part of this study has been published in Acciaro and Haralambides (2007) and Haralambides and Acciaro (2010).

The reasons behind the decision of carriers to step into the logistics sector are motivated by increasing shipper demand for integrated supply chain solutions; service and price differentiation; revenue stabilisation, and long-run profitability and market share.

The increasing demand of shippers for integrated logistics solutions derives from the widespread these days importance of just-in-time and make-to-order production-distribution systems. Inter alia, such technologies help manufacturers cope with the vagaries and unpredictability of the business cycle, and plan business development in a more cost effective way (Haralambides and Acciaro, 2010).

The port-to-port ocean transportation service is highly homogenized. Competition among carriers is thus intensive and profit margins squeezed as a result. The provision of logistics services offers carriers the opportunity for service differentiation aiming at premium pricing. The predominance of long-term service contracts with shippers, based on volume discounts, attests to the relevance of such strategies. In addition, vertical integration along the supply chain and the bundling of logistics services around ocean transportation give carriers a strong comparative advantage (yet to be exploited) against 3PLs, NVOCCs and global forwarders.

Furthermore, logistics activities represent an additional source of a more stable revenue, compared to the high volatility of freight revenue, thus allowing carriers to hedge, in a way, freight rate risk. Finally, by tying ocean transportation customers to the upstream and downstream logistics services, carriers increase customer switching costs and can thus erect, purposely or not, barriers to entry for aspiring newcomers.

Carrier efforts towards greater supply chain integration have however been met with varying degrees of success. The various challenges facing carriers in such a strategy include:

- operational difficulties in combining two intrinsically different services: ocean transportation—a highly competitive asset-heavy activity of tight cost control and, in general, a business focusing on asset use maximisation—and logistics—typically asset-light and organisationally-heavy, with a distinctive focus on customer requirements;
- sceptical and suspicious shippers requiring cost break downs and more transparency;
- complications deriving from the rather unusual situation of carriers on the one hand competing with 3PLs and global freight forwarders, and on the other one supplying them, wholesale, with ship capacity in an effort to fill their increasingly larger vessels;
- regulatory jurisprudence, particularly in Europe, whereby tying arrangements and the ensuing reduction of competition are not looked at favourably by the competent authorities.

Notwithstanding all the above, the general perception of the industry seems positive, also encouraged by the successful examples of some leading carriers, such as NYK, Maersk and APL.

One of the possibilities offered by the closer control of the global supply chain is the ability of providing door-to-door services under a single, all-in, price. This strategy, known as bundling or tying sales in the literature, has shown to be very successful in a variety of industries, ranging from computer software (Microsoft Windows bundled with Internet Explorer); computer hard- and firmware (Dell computers bundled with Intel processors); mobile telephony (SIM-locked devices); tourism (package holidays), real estate (mortgage credit and life assurance); to various sectors of the manufacturing industry.

This chapter aims at presenting an overview of the practice of bundling in the liner industry. As the industry is changing rapidly and carriers perceive bundling as a highly strategic issue, empirical investigation on this topic cannot be done systematically. This chapter combines the results of a set of open interviews carried out in 2006 and in 2009 with representatives of major carriers. The companies contacted for an interview were: Maersk Line, NYK, APL/NOL, MSC, CMA-CGM, MOL, UASC, Hapag-Lloyd as well as representatives of ELAA and the major conference organisations. Not all companies and organisations contacted equally contributed to the information collected – some refused to discuss the issue as deemed strategically too sensitive. Most of the data collected has been provided under request of confidentiality. In what follows therefore, we will not refer to specific carriers or people although records of the interviews, and interview reports are kept by the author.

5.2 Bundling and vertical integration in liner shipping

In general, bundling does not require the company to be vertically integrated. As a matter of fact, most third party logistics service providers are non-asset based and provide bundles by insourcing part or all of their components. Similarly, shipping lines that offer an all inclusive rate between two inland locations do not necessarily have to own the trans-port means from the port to the inland location, nor the terminal where the container is handled. Instead, they can insource inland transport and terminal-handling services, to deliver an all-inclusive service to the customer themselves.

There is however one fundamental strategic difference between bundling by 3PLs and bundling by carriers. By insourcing ocean transportation, 3PLs are asset-light and thus in a better position to adjust their services to demand. Carriers on the other hand, asset-heavy due to the ownership of vessels, as well as to an intrinsic and often chronic overcapacity, have lesser capabilities of doing so, being thus more vulnerable to the vagaries of the business cycle. This difference has an obvious impact on the bottom line: logistics companies are able to ensure higher rates of asset utilization and, as can be seen in figure 9, in general they tend to achieve higher return on equity than pure transportation companies.

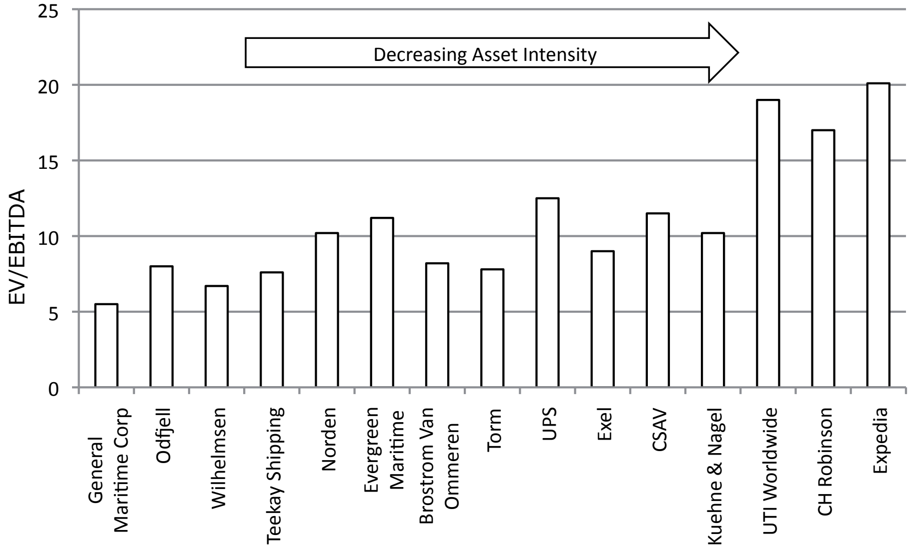


Figure 9: Asset intensity and return on investment.

Source: Bloomberg.

It is the basic tenet of this chapter that carrier strategies of building increasingly larger vessels, in the pursuit of the holy grail of 'economies of scale', and then selling the un-used capacity to their competitors (2PLs) is fundamentally flawed. Carriers, it is submit-ted here, should strategically use their unduplicated resource, the ship, and develop bundling strategies the pricing of which leverages around the ship. Economies of scale can then be achieved not by going-it-alone with larger ships but through better alliance co-ordination and uniformity in ship sizes.

It can be argued that shipping lines have always provided integrated services by means of selling intermodal transportation or quoting all-inclusive rates. In this sense bundling is not a new concept. What is new is the increased attention to the subject and the greater importance that has been given to the logistics business by the carriers, and their change in strategy that has transformed logistics from a marginal activity to an important component, even if yet ancillary to ocean transportation.

Bundling in the supply chain, from an ocean transportation perspective, naturally includes the provision of services such as terminal operations, feedering, warehousing, and hinterland transportation. Carriers tend to increasingly extend their business scope, integrating the aforesaid services. Vertical integration, at least partially, is thus a direct con-sequence of the carriers' decision to provide bundles and, analogously, bundles constitute the most logical outcome of a vertically integrated carrier.

Bundles involving ocean transportation may be provided in the following contexts, all competing with each other to a certain extent.

- Ocean transportation may be sold jointly with logistics services by a 3PL, not under the control of the shipping line. In this case, the logistics operator may or may not be asset based.
- Ocean transportation may be sold jointly with some logistics services by the logistics affiliate of the same shipping group, which often functions as an independent profit centre, pursuing its own business objectives. In this case, the ship-ping line presents a certain degree of vertical integration (at least within the group), although additional logistics services may still be insourced from third parties.
- Ocean transportation may be sold jointly with other logistics services by the shipping line directly. The shipping line may or may not be vertically integrated. If vertically integrated, the company will use its own trains or trucks or dedicated terminals, alternatively it will insource these services (Acciaro, 2009*b*).

The above distinctions highlight the complex market structure that the provision of bundles creates. As shown in Figure 10, the ocean carrier may be facing competition not only from other (integrated and non-integrated) carriers, but also by (asset and non-asset based) logistics service providers, which are also their customers; by cargo owners who may provide logistics solutions through their own shipping department; and even by the logistics affiliate of their own group.

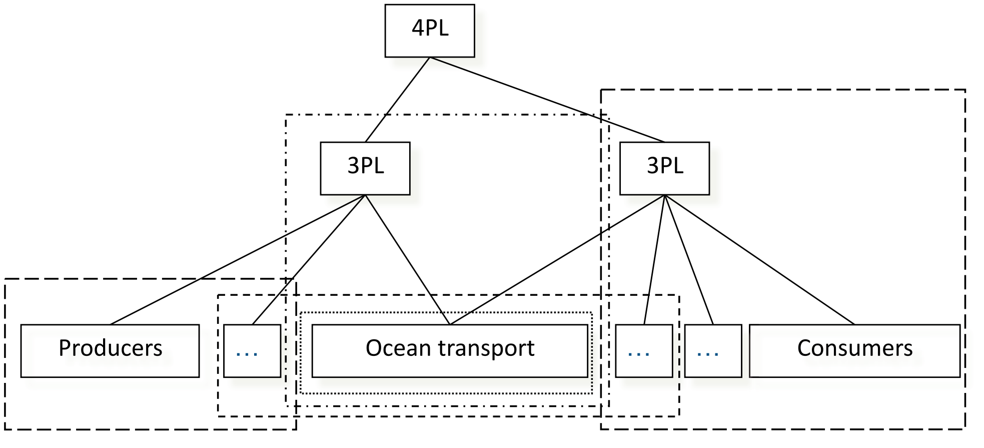


Figure 10: Integration alternatives in the supply chain.

Source: Acciaro and Haralambide, 2007.

It is clear that the degree of competition is related to the nature of the components of the bundle. Some bundles, for example ocean transportation and terminal handling, are more likely to be provided at a more competitive price by the ocean carrier than by the ship-ping department of large manufacturer. In essence, bundle competition boils down to the question of how good is the bundler in assembling the bundle. This involves not only strategic aspects such as marketing, promotion, corporate image and market share, but also tactical ones relating to the efficiency of bundle production; i.e. at what prices can the components be purchased, and at what cost can the bundle be assembled.

5.3 Market description and the *rationale* for bundling

Four major groups of players seem to exist in the provision of bundles involving ocean transportation and logistics services.

- *Pure liner companies.* These are companies whose main scope is ocean transportation. Although the number of these companies is decreasing, as the majority of carriers provide other services too, they may exist separately in the same holding group, together with a sister company that specialises in the provision of third party logistics services and to which the demand for logistics services of the liner company is channelled.
- *Integrated liner companies.* Some companies have extended their operations vertically so that they provide logistics services to some of their customers. These services are offered and charged directly by the liner company itself next to ocean transportation. Such activities have traditionally included hinterland transportation and short-sea distribution (feedering).
- *Third party logistics service providers connected to a liner company.* Some liner companies have created a subsidiary or a sister company within the same holding group that operates as an independent third party logistics (3PL) business, such as NYK Logistics, Maersk Logistics (now Damco) APL Logistics, etc. In general, these companies are independent operators and as such are not required to combine their logistics services with the ocean transportation provided by the group and vice versa. From the viewpoint of the logistics provider, ocean transportation is just another logistics service, and it might well be that in some cases, for some customers, this service may not be even required. The fact that the companies are in the same corporate group, does not necessarily imply joint provision of services.
- *Pure third party logistics service providers.* These are logistics providers who are not connected to a specific liner company and purchase ocean transportation independently from all carriers in the market.

It is generally acknowledged within the liner shipping sector that logistics does represent the direction in which business is expanding. Even Mediterranean Shipping Co (MSC), which has traditionally been looked at as a company not interested in logistics, recently announced that it is looking into expansion possibilities offered by the logistics sector.

In any case, it is hard to consider *logistics* as the core business of liner operators, and even if there is an indication that shipping lines are investing in logistics, we are surely still far away from considering this as the core component of the liner business in general. The logistics business is generally perceived to constitute 15-20% of the total revenues of liner companies, and generally no more than the 30% of group revenue (EUR and SMU, 2006). These findings conform to the general intuition that the involvement of shipping lines in logistics, even if this is a rapidly growing trend, still offers plenty of room for expansion, and the two should be seen as complementary activities.

Shipping companies do seem to be willing to expand their logistics activities as long as the marginal revenue from this is greater than marginal cost or, in the longer-term, if it affords the company a strategic advantage over competitors. Expansion into logistics is rarely perceived as a cost saving strategy, but as performing a support function to ocean transportation in the attempt to provide a better service to customers and differentiate the liner product.

On the basis of the significance of logistics in company strategy, shipping lines may be categorised at least in the following three groups:

- *Logistics enthusiasts*: those are companies that have invested heavily in logistics in an attempt to differentiate their service over that of their competitors. Among them one can list the AP Møller Mærsk group, the NOL group and NYK Logistics and Megacarriers.
- *Logistics functionalists*: companies that have invested in logistics in order to support the demand of some of their major customers. These include some of the major Japanese carriers such as MOL and K Line, that entered the logis-tics market in the early nineties to support the operations of their major Japa-nese customers in Europe and in the USA.
- *Logistics cautious*: are those companies that have invested in logistics, or are planning to do so, having realised that some of the market leaders are expanding in this sector and are thus gaining competitive advantage.

This categorization is similar to the one provided by Midoro and Parola (2006), distinguishing among *highly integrated, latecomers* and *de-verticalized* carriers. Their categorization points more to the direction of the stage of development, in terms of level of integration, rather than to strategic motivation.

Although carrier decisions to provide bundles seem to be motivated by a number of factors, it was never suggested by the companies interviewed in the context of this research that bundles were used strategically to improve market control (EUR and SMU, 2006). Instead, the great majority of reasons mentioned as being behind bundling and vertical integration strategies had to do with cost efficiencies and in particular with:

- the necessity to accommodate the demands of large customers in exporting countries that prefer to use the liner company also for their logistics operations, in the familiar on-stop-shopping formula;
- the attempt to countervail cyclicality in the liner industry, with a steadier source of revenue, as, in general, the logistics market is less dependent on the volatility of freight rates;
- the possibility of obtaining higher margins by jointly offering ocean and hinterland transportation;
- the necessity to improve coordination with hinterland connections, as increased coordination is required for effective delivery of door-to-door services, by shippers and logistics operators with whom the carrier works.

5.4 Bundling in practice

Before discussing how bundles are composed in practice, it is important to highlight the difficulty in univocally establishing the range of services that are provided in the logistics industry and their economic characteristics. In the EUR and SMU (2006) research, the following, non exhaustive, categorisation is proposed.

- *Terminal handling*: includes loading and unloading operations from ship to shore; to another vessel; to an inland vessel (e.g. barge), or another means of transport; stacking of containers in the yard; yard movements; other operations, characteristic of a container terminal;
- *Warehousing*: includes storage; cross-docking; components retrieval; sorting; and (limited) assembling operations that are usually performed in a warehouse;
- *Stuffing/Stripping of containers and cargo consolidation*: this includes the loading and emptying of cargo in containers and the collection of cargo from various shippers and vendors;
- *Container services*: they include all services that are necessary for the container itself, such as cleaning; pest control; fumigation; general maintenance; repairing; painting; etc. These services were traditionally performed by carriers, but they are also now carried out by terminal operators or specialised companies;
- *Container logistics*: they comprise all movements of containers from the terminal to the consignor/consignee and vice versa;

- *Cargo logistics*: involve all movements of cargo, from the moment it is unloaded from the container to its final destination; distribution centre or consumer. Cargo logistics also involve movements of cargo before it is stored in the container, from the production facility or the origin;
- *Value added logistics services*: these include logistics operations on the cargo, such as the instalment of chips, barcodes, RFID labels, labelling, dating, packaging, sorting, etc;
- *Hinterland transportation*: this refers to the simple movement of containers inland by means of truck, train or barge, as opposed to any other type of logistics activities performed on the container or the cargo.

The above categorisation is the first necessary step for all analyses on bundling. Bundles are feasible as long as they reduce costs for the customers, either by increasing the efficiency of the control of the transportation chain, or by lowering carrying (inventory) costs; in other words, by reducing transaction costs.

Ocean transportation can be provided successfully together with cargo-handling, container services, hinterland transportation and container logistics. Other services such as stripping and stuffing of containers; cargo consolidation; warehousing, etc., are often provided by logistics operators and not by the lines themselves. Cargo logistics and value added logistics do not seem, so far, to fall within the scope of bundling with ocean transportation.

Supply chain components that are priced jointly with liner services are cargo-handling, container services and hinterland transportation. Warehousing appears to be priced jointly with liner services only upon request and in general very rarely. Stuffing/stripping of containers and cargo consolidation services are provided by specialised companies, and al-though they can be priced together with ocean transportation, this also happens infrequently.

The frequency of certain types of bundles, compared to others, may also depend on customer preferences, common practice, geography and law. For example it is common practice for shipping lines to provide city-to-city rates in the US. These differences may be substantial even within the same region.

5.5 Bundle pricing in the liner sector

From the interviews carried out in the context of EUR and SMU (2006), it became fairly clear that the major determinants of *bundle pricing* are the value the bundle delivers to the customer and the cost of providing the bundle. One interviewee mentioned: '*Provided the value our bundled service brings [to the customer] exceeds the cost of our offering, we can sell*'. Another interviewee mentioned that bundles should be priced '*taking full recognition of the costs and revenue potential for all individual components. The intention of bundling is that this isn't a discount*'.

Although a bundle is generally expected to afford shippers a lower or at least equal price than the sum of the prices of the individual components, this is often not the case in the logistics sector and the price of the bundle could be higher. This would happen if the bundle is perceived by the customer as a better proposition than the individual components purchased separately[28]. When the price of the bundle is below the sum of the prices of the individual components, this is the result of the opportunity of the liner company to cross-subsidize bundle components, ideally leveraging on the ocean transportation price, as well as the result of the advantages obtainable from lower transaction costs. This, in the end, is the comparative advantage of those companies that have the skills to provide a larger set of services, *vis a vis* those whose capabilities are limited to the provision of a single service, either transportation or any other.

In practice, the price of a bundle is set in various ways, ranging from the sum of the costs of the individual components plus a margin, to what the market can bear. As said, such bundles can only be sold (see model below) if their price is lower than the sum of the prices of individual components plus the shipper's transaction costs in putting the bundle together himself. Bundles priced lower than this involve component cross-subsidization aimed at market entry and strategic long-term profitability based on service differentiation.

Of course this price increase can only be possible if the shipper values the provision of a bundle as a higher quality service than the pure combination of the stand-alone services. Often, this is because of a reduction in transaction- and coordination-costs and in this way the shipper may be willing to give up some of the savings obtained and compensate the 'risk' taken up by the carrier.

An additional point worth noting is that certain bundles may be unfeasible i.e. bundles whose cost is higher that the linear sum of component costs. Naturally, these bundles would not be offered. It seems though that the feasibility and profitability of bundles might depend on the characteristics of the supply chain in terms of cargo, geography, time sensitivity and policy related issues in most cases.

The discussion on the liner shipping industry presented in this section will be based on a set of expert and professionals interviews. In general it should be noticed that the companies interviewed are large carriers that engage in a form of another in the provision of logistics services in addition to ocean transportation. The choice of these carriers is particularly interesting as these companies are some of the industry leaders, and therefore understanding how they approach the issue of bundling imply understanding the industry best-practices.

Due to the companies concern for the disclosure of information, no company or interviewee names will be mentioned. It should be noted that four companies provided inputs for this discussion and seven experts or company representatives

[28] The case in which the price of the bundle is higher that the price of the individual components is known in the literature as premium bundling (Cready, 1991).

have been interviewed. The interviews have been done personally by the researcher on the basis of a semi-structured format and varied in length from several hours to thirty minutes. The interviews have been transcribed and then verified with the interviewees for consistency.

5.6 Pricing in practice

In general it should be noted that collecting information on this topic has been rather difficult so far as carriers often perceive pricing as strategically very sensitive. It is surprising to many of the interviewees that pricing is perceived as such, as the way a company sets prices is generally in the public domain.

One of the interviewees believes that one of the most critical issues in the management of a carrier refers to the way a carrier observes and evaluates its costs. Cost management and in particular costs apportion in the liner industry is particularly difficult, as a large part of costs are shared. It is therefore difficult to asses whether a new shipment is bring in money or not, as some costs elements may be actually hidden. The ability of each carrier to apportion shared costs in the right way to each shipment/customer may in the end be one of the distinctive factors that might guarantee a company survival when markets are against.

That is one of the reasons carriers constantly monitor their utilization levels. The utilisation level of the vessel, that is by far the most important asset of the company, is a good approximation of how well a carrier is doing in using his assets. Nevertheless utilisation levels are not enough in determining whether a company strategy is successful or not, nor is revenue per Forty-foot Equivalent Unit (FEU). This is because they do not provide an effective tool for steering the company strategy. Intercompany comparisons, however, should have something to say on efficiency.

A first important statement that emerged from the interviews is that prices in the this industry are lead by supply and demand or in other words that each carrier has limited if no influence at all in determining whether the freight rate for a container goes up or down. One interviewee mentions that small premiums might exist for some carriers in recognition of their ability to provide a more reliable service, accommodate customer demands better and maintain schedule integrity.

5.7 Types of customers

Traditional liner customers can be divided in three categories:

- Beneficial Cargo Owners (BCOs): they include direct shippers with sizeable volumes, such as Philips, Nike, etc. The relations with these customers are set on the basis of volumes, origin and destination of cargo, as well as other strategic considerations, such as increase in volume in the future, customer relations, customer loyalty, opportunities for sales of other related services. Typically contacts with those clients are negotiated yearly. In view of keen competition for such contracts, their 'prices' should closely reflect the cost of the service provided.
- Non-Vessel Operating Common Carriers (NVOCCs) or Non-Vessel Operators (NVOs): these are logistics service providers that reserve space on a ship and resell container slots either as part of integrated transport in an all inclusive rate basis, or jointly with other services but priced independently. NVOCCs handle containers referable to a BCO don't understand this and *Freight All Kinds* (FAK) neither this. Contracts with NVOCCs are negotiated quarterly. NVO rates are generally higher than BCO rates when markets are rising and lower than BCO rates when markets are declining, or in other words respond more rapidly to changes in the freight market.
- Scrap market. This consists mostly of scrap metal, plastic and paper. Contracts in this area are traditionally negotiated on an all-inclusive basis and this is an important market for backhaul trades.

In the Europe/Far East and in the US/Asia trades, the overall customer base is subdivided approximately as follows: BCOs approximately 30%, NVOs 55% and scrap commodies 15%. On the US-Europe trade scrap commodities are almost absent and NVOs count for two thirds of the trade.

Purchases in the liner industry are done through a network of agencies. The attempt to place orders on the internet has not been particularly successful so far (Lu, Lai and Cheng, 2007) even if web-based applications are commonly used for tracking and tracing the container and its cargo (in the supply chain). Next to containers booked on the spot, large shippers may have time contracts with a carrier of generally one year. Slots on board of a ship can be purchased either through a broker or directly through an agent of the carrier in the port of departure or in major locations, this can be done in person/by phone or through a IT booking system.

5.8 Pricing mechanisms

At this stage it is important to explain what type of services ocean carriers provide and what they quote when asked to do so by a customer. When requested for a price (*P*) for an integrated service a carrier will provide the following:

- Pre-carriage (*PC*) (if necessary);
- Ocean freight rate (*OF*);

- Feeder transportation at origin (*OFE*) (if necessary) (it includes *CAF*, *BAF* and *THC*);
- Origin terminal handling charges (*OTHC*);
- Currency adjustment factor (*CAF*);
- Bunker adjustment Factor (*BAF*);
- Destination terminal handling charges (*DTHC*);
- Feeder transportation at destination (*DFE*) (if necessary) (it includes *CAF*, *BAF* and *THC*);
- On-carriage (*OC*) (if necessary).

In case of transhipment, the shipper will not be charged extra Terminal Handling Charges (*THC*) in the port of transhipment that will be included in the *OTHC* and the *DTHC*. In case of feeder it should be noted that the bill of lading port determines the *THC* to be used.

The first quotation will be then

$$P = PC + OC + OFE + OTHC + OF + CAF + BAF + DTHC + DFE + OC$$

The following negotiations will most likely aim at a reduction in the quotation, but generally addressing only the Ocean Freight. It seems in this way that the carrier sets a sort of minimum tariff built up of all elements of *P* with the exception of *OF*. These elements might be perceived by the shipper as cost based and therefore non-negotiable, while the *OF* component seems to be the flexible part of the quotation open to negotiation. In this way the carrier is de facto setting a two part tariff, where the fixed component that is necessarily a function of the route and the location contains a certain mark-up that allows for pricing *OF* below marginal costs if necessary. In the case of the paper trade discussed later, the interviewee consistently referred to 'negative' ocean freights, in the sense that the all-inclusive prices quoted for the paper trade, if stripped of the price components other than the *OF* would generate a negative result. This can only be explained if all the components contain a mark up that at least covers the variable costs of the freight rate of repositioning an empty container.

If the carrier were to propose an all-inclusive price he would be willing to negotiate all the elements of *P*. Therefore he will not propose the use of all inclusive prices unless requested by customer or unless customary in the trade. This is the case of waste paper and scrap commodities. This type of trade has traditionally beet quoted on an all-inclusive basis, but the freight has always been very low. This trade on the Europe/ Far East route constitutes between 10% and 30 % of total volumes and although not remunerative in itself has been used by carriers as a way to reduce the empty imbalance and reduce the costs of repositioning. This type of trade is also particularly sensitive to changes in the price of the commodity. If the price of waste paper for example drops in China, due to a fall in demand, this is immediately reflected in the freight.

In addition the incorporation of certain price elements in the freight, might be consuetudinary in certain countries of the world. For example in some Middle Eastern countries ocean freight is quoted including *THC*. Similarly in Turkey and Poland THC are included in the feeder freight rates.

5.9 Price bundling

When discussing the issue of bundling, some of the interviewees mentioned that a bundling proposition is never perceived as too beneficial to the carrier, and they would therefore not propose bundles actively to a customer, but provide an all-inclusive price only if requested. In the Europe/Far East trade bundles are rather uncommon, and when starting negotiations the first quotation is generally an un-bundled price. In fact, the prices quoted may be different if the services were to be sold separately. In this sense the contacts will always provide a form of bundle, simply because the prices of the separate components, although independently quoted, would be higher if the services were not provided within the contract. If we consider pricing of contracts as bundle pricing by definition, then bundling becomes much more substantial, as contracts represent 80% of total. In the Trans-Atlantic Trade though bundles tend to be more common.

The benefits of bundling as a marketing tool to increase sales do not seem to apply in this case. The question remains on whether the benefits obtainable from price bundling are exploited by the logistics service provider associated with the liner. In the end price bundling is a well-known practice for third party logistics providers (3PL), which as a matter of fact do this as part of their daily job. The interviewee mentions several times that the role of the 3PL is principally that of generating business for the liner branch of the company. This is at variance with discussions had with the 3PL branches of the same organisation, that claim to act independently of the liner company in the market. It is hard to believe though that the association of a 3PL company with one of the carriers does not generate any benefit, as most of the customers will perceive the carrier to be somewhat behind the scenes and guarantees slot capacity to its associated 3PL. It seems that in some cases the practice of price bundling of ocean transportation and other logistics services is entrusted by the carrier to the 3PL branch of the group.

3PL and carriers alike mentioned in several occasions that many customers prefer to deal with carriers and 3PL that are independent from each other. In other words, customers that make use of the 3PL associated with an ocean carrier—either as part of the carrier holding group or as sister company—fear that the 3PL will make use of the associated carrier despite it being more expansive. Similarly, logistics operators, which represent a substantial part of the liners' capacity—in the case of APL for example on the Europe/Far East route they constitute 55% of the total trade volume—want to be assured that they are not treated differently from the 3PL associated with the group.

5.10 Product bundling

The interviewees were asked whether in their experience the combination of ocean transportation with hinterland transportation could generate cost savings and under which circumstances they would actively propose such bundles to a customer. From the interviews it does not emerge clearly that the carriers would actively propose bundles under a single price.

The interviewees referred to triangulations as a possible way to reduce costs and stated that this is a regular practice among carriers. Cost savings through triangulations are already embedded in the pricing mechanisms used by some of the companies. In general some of the companies make use of software that increases or reduces a base tariff on the basis of the costs savings achievable through, for example, container repositioning.

For instance, let us assume that containers are needed in Manchester for a large shipment to Singapore via Southampton (Shipment A) and that moving a container from Southampton to Manchester costs 300 GBP. If the carrier would be aware of a customer that would be willing to ship to Liverpool, it might propose to include on-carriage to Liverpool in a bundle together with ocean transportation to Southampton (Shipment B). Let's assume that the shipment to Southampton generates X GBP (Shipment B), while the shipment from Manchester to Singapore generates Y GBP (Shipment A).

The total revenue of the two shipments would be $X + Y$ minus the cost of bringing the container from Southampton to Manchester, i.e. $X + Y - 300$ GBP. If the carrier is able to include in the shipment B also the on-carriage to Liverpool for a increase in price L he will obtain from shipment B the amount $X + L$. Assuming the costs of moving the container from Liverpool to Manchester are negligible, he could then charge for shipment A as before, without though incurring the costs of moving the container from Southampton to Manchester. In this second scenario he will have $X + L + Y - 300$.

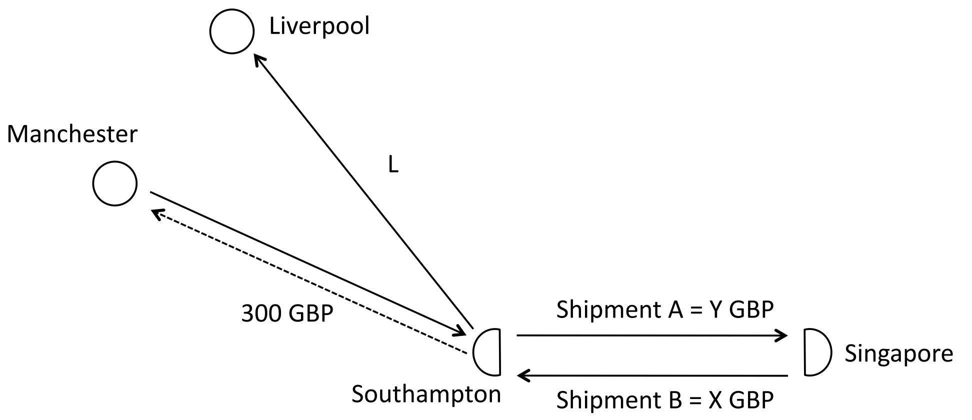


Figure 11: Example of triangulation.

The carrier could virtually set $L = 0$ for he would incur the cost of moving the container in any case, but it is likely that a shipper would accept L as high as *300* GBP, depending on his ability to negotiate hinterland transportation rates. In this case the bundle price $X + L$ would grant the carrier an increase in revenue, and it is a clear example of product bundling. Whether the two services would then be priced separately does not matter, as L is not representative of the cost of the service provided (road haulage from Southampton to Liverpool) but can only be explained through the overall understanding of the carrier strategy. Similar cases are common also in air transportation.

Through these types of mechanisms, product bundling may grant liner companies substantial costs savings. A second example involves the costs of feedering containers to a port that has a deficit in empty containers. Similarly to the previous triangulation case the carrier could virtually charge an extra cost for the service of bringing a container from a port to a feedering location that requires empty containers. What is more interesting in this case is that, THC excluded, the marginal costs of an extra container on the feeder service are negligible for the carrier if he already provides a feeder service to that location. Bundling feeder service with ocean transportation could in such cases virtually be done for free (or only upon the payment of the additional THC).

What the carrier should observe is whether the delivery of an extra container to a certain destination either through feeder or road haulage does not increase any other costs. Some of the carriers seem to have included also this type of considerations in their pricing software, that seem to be able to automatically calculate what are the cost advantages obtainable though triangulations on the basis of the existing bookings and is therefore able to offer a lower price for a specific shipment that favours repositioning.

A third case refers to the ability to balance eastbound and westbound cargo flows in the Europe/Far East trade. Let us assume that a shipper is interested to transport a certain amount of containers from Singapore to Rotterdam, and that the carrier is aware of a shipment of containers back from Rotterdam to Singapore with the same shipper that has not been booked yet. Assuming the revenue obtainable from Singapore to Rotterdam is R and that the costs of moving containers back from Rotterdam to Singapore is S, the carrier could offer a bundle of two shipments from Singapore to Rotterdam and from Rotterdam to Singapore at any price between R and $R + S$, as long as he is not subtracting capacity on the ship from Rotterdam to Singapore that could be sold at a price higher than S. The carrier could not charge anything above $R + S$ as it is likely that in that case he could offer the unbundled alterative that would cost the shipper $R + S$. This in the end boils down to the pricing mechanisms discussed by Jansson and Shneerson's *Liner Shipping Economics* (1987) among others, although bundling is not expressly mentioned there.

5.11 Terminal Handling Charges (THC)

A particularly interesting case refers to terminal handling charges and the way they are levied. Terminal handling activities and ocean transportation are a clear example of bundling (Acciaro and Haralambides, 2007). Terminal handling services are provided by the stevedoring company (or the port authority, in those cases where the two coincide) and are invoiced to the shipping line (exceptions exist in very special cases of ports directly invoicing the shippers, e.g. in Turkey). This cost (for the carrier) is passed downstream to the importer/exporter by means of THCs, or a through charge, i.e. all-inclusive charge, on the basis of the contractual agreement between shipping line, importer or exporter.

The estimation of the average proportion of stevedoring charges in the total price of transport from port gate to port gate is a difficult exercise even for the shipping line itself. This is because in addition to terminal charges, tariffs are parts of contracts and are also confidential for over 80% of total liner trades. Additional reasons contributing to the complexity of calculating terminal charges can easily emerge from the relevant contracts between terminals and carriers. They often include provisions that affect the total cost of a ship call, such as total volume discounts; discounts based on the size of the call; the modal split at which containers are transported out of the terminal; empty/full ratio; FEU/TEU ratio, etc. As a result, stevedoring costs may differ from call to call.

The only formal definition of THC was the one presented in the CENSA Code, agreed upon in the '80s (but not ratified by the shippers in the nineties), that includes a specification of services and a cost split known as the 80/20 rule, where carriers were accountable for 20 percent of terminal handling charges. The proposal was initially accepted by the ESC in December 1989. In June 1991, the ESC formally notified CENSA that it no longer felt bound to the 80/20 rule.

THCs have not been substantially modified (at least in Europe) in the last ten years. This is remarkable given that, for the carrier, THCs are (or in principle they should be), a cost to be passed on to the cargo owner and this cost, i.e. terminal charges, can vary considerably even among different ship-calls (see below). In this respect, 'stability' of THCs can be 'suspect' of tacit collusion and THCs may have been set at levels as high as to allow coverage of the most adverse cost changes (e.g. demurrage and other congestion surcharges).

It is also fairly well understood that carriers (conference or independents) used not to deviate much from conference THCs. This is also remarkable (and indication of possible collusive behaviour) given that different shippers have different needs and, in principle, they should be charged differently, the more so when carriers are being charged differently by terminals. THCs were collectively decided by conferences and protected under the antitrust immunity of tariffs.

Most of the time THCs as set up by carriers that did not adhere to a conference did not diverge significantly and consistently from conference THCs (FEFC; TACA and IPBCC). It is a general understanding in the industry that it is to the benefit of independents to abide by conference THCs, as they are often set well above terminal costs. It is also known however that independents often quote lower THCs, for competitive advantage. What matters to the shipper in the end, however, is the final door-to-door price, especially taking into account other rather intangible costs such as time; reliability; and security. In consultation with the Commission, non-conference THCs will be surveyed, reported and benchmarked to the extent possible.

THCs in non-EU countries are mostly charged by conferences or by individual lines. There are cases where THCs are charged by the port authority (traditionally in some countries in the Eastern Mediterranean, most notably Turkey). In and for trades from and to the United States, it is common practice to charge door-to-door tariffs that include ocean freight, THCs and hinterland transportation. Although THCs are not set by governments (other than public port authorities mentioned above), governments have interfered with the conference or individual line THC setting process, case in point being the Chinese government in 2006 prohibiting further increases of THCs to and from ports of China.

THCs are utterly predictable as they have remained virtually unchanged in Europe and are clearly mentioned in the contract with reference to conference surcharges as standard contractual terms. To what extent, however, THCs reflect the cost of terminal services, and they are thus just a pass-on cost, remains to be established. It is believed that, in a number of cases, THCs are set well above terminal costs and, therefore, part of them constitutes a successful revenue generating exercise on behalf of carriers. This supports the discussion of THC being a first form or bundle pricing in the industry.

The case has often been considered whether terminals would be willing to charge shippers directly. Although a distinct possibility, earlier discussions of the investigators with terminal management have shown that the latter would be rather reluctant, in view of the administrative burden involved in dealing with thousands of small shippers. Furthermore, shippers might end up worse off by losing the economies of scale achieved by carriers in view of their consolidated, large volumes and thus negotiating power against terminals. Again, and for as long as THCs continue to be charged separately, this assumes that THCs are cost-related and any volume discounts achieved by carriers are passed on to shippers.

For the carrier, THC is a pass-on cost. Each carrier (or group of carriers) has a contact with a terminal for cargo handling/terminal services. The costs of these are passed on to the shipper through THCs. At a port, it is possible that different carriers have different cargo handling contracts depending on the complexity and magnitude of the service they require: the length of the contract; the amount of carrier investments; and so on. It has however been observed that, despite cost differences, often carriers charge shippers the same THC. When this happens, this can be an indication of collusive behaviour, making THC non-cost related.

It is also possible that the same carrier charges different THCs to different shippers (or cargo) in the same port. This is legitimate, for shippers/cargo have different service requirements e.g. for storage; movement; refrigeration; etc.

5.12 Conclusions

As shown in the previous chapters, price bundling in the service sector is well documented, (see for example the airline industry, the joint provision of hotel accommodation and air travel, as well as air travel in conjunction with bus transfers, or insurance packages). Nevertheless it is hard to find references in the logistics literature of *bundling* of logistics services together. If on the one side it can be argued that logistics operators have been providing integrated logistics services such as warehousing and distribution, or packaging/labelling, or jointly with trucking, rail transportation, etc. for more than thirty years now, they have traditionally been priced separately.

In reality a closer look will reveal that most likely bundling has taken place in the industry but in a less evident manner. Although logistics services have been priced separately, their prices are set differently depending on whether the service is sold as part of an integrated service or as a standalone product. In this regard, we can talk of a form of cross subsidisation of services. In order to be able to fully understand the impact of price bundling in the logistics industry, it should be pointed out that (price) bundling is *not* a discount. In other words, the reduced price in one of the logistics services jointly sold derives from i) the ability of the logistics provider to either reduce costs in his supply chain (*product bundling*) or ii) the ability to sell an additional service that may not reduce the supply chain costs but may still be attractive for the shipper (*price bundling).* This is essentially different from a discount that may rise from high volumes, long-term relations with a client or strategic reasons.

In the liner shipping industry any attempt of bundling, such as in the case for example of ocean transportation and terminal handling services, have been perceived with diffidence by the customers. Nevertheless, the necessity for better responsiveness in the supply chain; the increasing demand for just in time logistics; and the general tendency towards a "one-stop-shop" could open opportunities for product bundling.

In the particular case of ocean transportation, a bundle seems to be the most logical option at least in the following two cases:

- the provision of ocean transportation and terminal handling;
- the provision of ocean transportation (including terminal handling) and hinterland transportation or feedering services.

The joint provision of ocean transportation and terminal handling services provides an interesting example of the analysis of carriers' decisions within the supply chain. The provision of transport together with terminal operations is one of the obvious forms of vertical integration in the shipping industry and represents the most immediate example of natural bundle. In fact, it would not be feasible if every shipper was to pay handling charges directly to the terminal operator. By having to act as intermediaries, carriers may have the possibility of using terminal handling charges as steering tool for shippers choices, in other words to provide price bundles. In addition carriers have the choice of using common users terminals or set up dedicated terminals[29]. Beyond the argument of being able to serve customers better through dedicated terminals, especially in times of port congestion, intuitively dedicated terminals may grant shipping lines even the possibility to provide product bundles. This is because the major advantages deriving from the development of dedicated container terminals seem to be the greater flexibility, reliability, short turnaround times and enhanced efficiency in the management of the global supply chain (Haralambides, *et al.* 2002; Cariou, 2001; Acciaro, 2009*b*), that can be easily translated in lower production costs for the integrated shipping line.

The second case of existing bundles is ocean transportation and hinterland transportation or feedering services. This grants the possibility of shipping lines to quote point-to-point tariffs as opposed to port-to-port tariffs. While point to point tariffs are a reality in the USA, they are not so common in Europe. The integration of ocean transportation with hinterland or feedering transportation as shown by the various examples of companies such as Maersk, NYK or APL is the first step to product bundling. It is likely that this practice will become increasingly

[29] For a more detailed analysis of the drivers behind the phenomenon of *dedicated terminals* refer to Haralambides, *et al* (2002) and to Cariou (2001).

common in the coming years as the conference system is dismantled and pricing mechanisms adapt to shippers requirements.

The development of a logistics operator that has the additional advantage of controlling the ship, considered as a strategic asset, may seem not so far away. Nevertheless, as clearly discussed by Heaver (2002*a*), even if shipping lines are increasingly becoming vertically integrated, the management of logistics services remains distinct from the management of shipping and so does pricing. This has also been observed in a survey conducted by Frémont (2006; 2009): even though a large number of shipping lines provide logistics services, these services are in most cases neither priced nor offered in conjunction with ocean transportation.

The limited use of this practice may still be explained on the basis of historical arguments (Midoro and Parola, 2006), the specific characteristics of the liner industry and, in the end, as the direct consequence of the contractual relations that have so far governed the shipment of containerized goods by sea.

The development of global integrated logistics though and the increasing necessity of supply chain visibility have begun to change the attitude of shippers towards price bundling. At least in the destination markets (Europe and the Unites States) where a large number of value adding logistics activities take place and the penetration of the container is substantial, the use of single price mechanisms would be beneficial both for the shippers and the carriers (Acciaro and Haralambides, 2007; Haralambides and Acciaro, 2010).

From the shippers perspective the advantages of price bundling are clear. They can be summarised under what is generally referred as one-stop-shopping principle. In addition, the following aspects could be considered in favour of price bundling:

- It would simplify comparisons among logistics suppliers;
- It would increase supply chain visibility;
- It would provide better choice to shippers;
- It would most likely increase competition among service provides and lower prices.

The major disadvantage identifiable for shippers on the use of price bundling becoming more common, are linked to the dependency for the entire supply chain on a single operators. If on the one side it would be possible to reduce risk by creating parallel chains entrusted with different suppliers, this would reduce the advantage obtainable for example from large batch sizes, inventory coordination, etc. Given the importance of supply chain strategies in the majority of modern production processes, it is rather unlikely that we will observe soon shippers entrusting their entire logistics and procurement activities to a single operator. Nevertheless middle solutions and a tendency towards integration are not unlikely to keep on appearing.

6 A Transaction Cost Perspective on Vertical Integration*

6.1 Introduction

Since the 80's several ocean carriers have invested in hinterland transportation and terminal facilities (Midoro and Parola, 2006). Although many carriers recognise the importance of providing integrated service at *door-to-door* rates, instead of pure ocean transportation (Acciaro and Haralambides, 2007; Haralambides and Acciaro, 2010), the 2008-2009 market downturn has forced many carriers to divest non-core assets (Hailey, 2009). Although offering *door-to-door* services does not require integration, an integrated carrier has the possibility of better controlling the transaction costs deriving from combining ocean transportation and other services (Williamson, 2008). Integration of course comes at a cost, but in practice, the cost of organising vertically integrated transportation may be outweighed by the gains obtainable from better coordination. At least in some cases.

The reasons behind vertical integration in liner shipping have been analysed since the 70's and 80's (Casson, 1986), and to many vertical integration seemed the only way forward (Frankel, 1999*a*; 1999*b*). More recent contributions (Heaver 2002*a*; 2002*b*; 2005; Evangelista, 2005; Frémont, 2009), although recognising the crucial impact of integration strategies on ocean carriers and shippers, are more cautious and stress the fact that integration along the supply chain raises a set of controversial issues, such as shippers perception (Heaver, 2002*a*; Acciaro, 2009*a*; Acciaro and Haralambides, 2007; Haralambides and Acciaro, 2010), or issues related to the different management skills required for ocean transportation and logistics (Frémont, 2009; Acciaro and Haralambides, 2007).

---

* This chapter is based on Haralambides, Acciaro and Karydis (2009), and Acciaro (2010*b*). We acknowledge reference to Karydis (2007) on which part of the chapter is based.

Among the key reasons in favour of vertical integration in liner shipping, Heaver (2002*b*) pointed out at demand complementarity, costs reduction and benefits accruing from increase of market control and business diversification. In a broader sense we can refer to these economies as new and better ways to serve customers. Using Porter's words, these economies grant firms competitive advantage since firms create value for their buyers through performing these activities (Porter, 1990). Using a different perspective, vertical integration is motivated by the advantages that accrue to ocean carriers and their customers from a different way of transacting (Klein, Crawford and Alchian, 1978). Vertical integration implies that the shipper (or the logistics service provider) transfers his control of the coordination of the chain to the ocean carrier.

The use of the transaction concept as a unit of analysis calls naturally for the paradigms developed in the context of transaction cost economics (TCE). Although a lot of common grounds can be identified between TCE and supply chain management, no applications have been made in the context of liner shipping, and limited reference even in the supply chain management literature by and large (Williamson, 2008). In the context of TCE, transaction costs are intended as the costs of using the market mechanism (Coase, 1937). The theory of transaction costs explains that in every economic transaction, in addition to the costs incurred in purchasing a product, a set of additional costs is relevant in explaining markets (Rao, 2003). Namely these costs are a consequence of asymmetries in information. In the case of integrated ocean carriers or of a third party logistics providers, their knowledge of the logistics service market may be better than that of the cargo owner.

The use of TCE can be particularly valuable in the context of ocean transportation and logistics outsourcing and constitutes a solid ground on which ocean carriers can engage in bundling strategies. Although bundling does not necessarily require vertical integration, when the transaction between the carrier and a logistics service provider are taken out of the market, carriers may have a better position to engage in bundling. This happens because of their better ability to harness transaction costs and reduce the impact of information asymmetries. This is the theme of the first part of the chapter. In section 6.2 to 6.4 we discuss the role of transaction costs in logistics and ocean transportation.

Vertical integration though comes at a cost, and some carriers may prefer to opt for contractual agreements or other forms of cooperation that do not entail full vertical integration. These forms are often listed as hybrid governance models and include the large spectrum of contractual agreements between market and hierarchical governance models. But what organisational alignment should a carrier opt for? Also in this case TCE provides a valuable guide in selecting the parameters that are relevant in explaining the organisational alignments we observe today in the industry. This is the topic of sections 6.5 to 6.10. In this part of the chapter we investigate how TCE can contribute refocusing the issue of liner companies vertically integrating along the supply chain. The chapter presents a set of possible alignments that are consistent with what is observed in practice and build on bilateral dependency and contractual safeguards. Finally the chapter discusses a simulation exercise to show how vertical integration reduces transaction costs

6.2 Transaction costs and information asymmetries

The concept of *transaction* is central to the new institutional economics. Transactions are fundamental in the economy since without adequate mechanisms to transfer rights, economic units do not have the possibility of taking advantage of the division of labour. The division of labour is at the basis of any form of economic specialisation that therefore cannot take place without transactions. Transactions, nonetheless, are not sufficient in explaining modern market economies. Once the possibility of transacting is there, economic units have to organise the production or provision of services, identify and select adequate technologies, factors of production, etc. This process entails also setting up property rights and the rules for their transfer. In a market economy, this acquires a more fundamental role, considering the special role property rights play (Ménard, 2004*b*).

The concept of transaction costs appeared in the article *The Nature of the Firm*, of Coase (1937) and is defined simply as 'the cost of using the price mechanism' (Coase, 1988: pg. 38). Allen (1999) explains that the concept of transaction costs has been interpreted in two different ways. On the one side there is the 'property rights' tradition that focuses on the role of transaction costs in determining property rights. In this sense, transaction costs can be defined as: '*the costs of establishing and maintaining property rights'* (Allen, 1991). On the other side there is the 'neoclassical tradition', that defines transaction costs in a narrower and more explicit way assimilating them to transportation costs, taxation and the like. In this sense, transaction costs are defined as: '*the costs resulting from the transfer of property rights*' (Allen, 1999). Coase (1937) and Williamson (1975) proposed a distinction between *ex-ant*e and *ex-post* transaction costs, where the former are those costs that occur before the transaction and include gathering information and contract negotiation, while the latter occur after the transaction has taken place and include monitoring and enforcement costs.

North (1990) introduced a distinction between *transformation* and *transaction* costs, the sum of which would make total production costs and shows that transaction costs are to a large extent the result of measurement problems and the resulting difficulty of enforcing the transfer of rights, particularly on extended markets dominated by impersonal exchanges. The underlying hypothesis behind transaction costs, independently of the stream of literature, is limited information. Negotiation, fraud, communication and contract stipulation all come about because knowledge is incomplete and not common (Allen, 1999). Information costs are prerequisite of transaction costs and are a necessary condition for their existence.

Information costs however are not always transaction costs. Barzel (1977) has been a strong supporter of this distinction and defines transaction costs as those costs that are required to formulate and police contracts. Information costs are at the heart of transaction costs because they lead to measurement (Barzel, 1982; 1985). This issue is addressed more in detail in chapter eight.

Information asymmetries occur when a party in a transaction has more or better information than the other (Black, 2002). The concept of information asymmetries and related concepts such as *moral hazard* and *adverse selection* have forced economists to review traditional market models. Principal-agent problems are common in economics and have been extensively studied since the introduction of the concept by Akerlof (1970). Spence (1973) introduced the concept of *signalling* as a possible solution to information asymmetries, but, in practice, observing and interpreting signals also bears a cost. Similarly, the concept of *screening* proposed by Stiglitz (1975) requires the agent to bear certain costs.

The existence of information asymmetries and transaction costs influences market outcomes as opportunisms and bounded rationality affect transactions. Bounded rationality implies that agents have limited capability of handling too much information (associated with a given transaction), whereas opportunistic behaviour is maximizing profit or utility against a third party (Williamson, 1985). The result of information asymmetries and transaction costs implies that contracts are fairly incomplete. Although the theory on incomplete contracts is far from conclusive, Tirole (1988) indicates contracting, bargaining and arbitration as a fist type of resorts in order to prevent or deal with unforeseeable contingencies. Two interesting concepts are used in theory as a substitute for contracts: reputation and dual sourcing. Reputation allows a firm to save on the costs of writing complete contracts, since a firm that cheats runs the risk of losing profitable deals in the future. Dual sourcing entails introducing a form of competition on some variable that cannot adequately be negotiated *ex ante* (such a quality). In this way the buyer can choose the supplier that best fits its needs after the transaction has taken place.

6.3 Supply chain transactions

Although the connection between transaction costs, information asymmetries and supply chain management seems natural, very few studies have taken up the challenge of analysing the traditional supply chain management problems though the lenses of transaction costs economics (Williamson, 2008). This is rather surprising, since transactions and contracts are at the core of supply chain management. In general, transaction cost economics focuses on a single transaction, while, supply chain management aims at understanding and managing related transactions grouped in chains.

The use of transaction cost economics is particularly interesting especially when outsourcing and procurement decisions are analysed. The existence of positive transaction costs is enough to justify inter-firm contracting mechanisms and to explain, in the limit, the case in which transactions are taken out of the market and are organised internally (Williamson, 1996). This leads to the emergence of different governance models, where market and hierarchy, i.e. full vertical integration, are the extremes. Between the market and the hierarchy governance models, we have what is referred to as hybrid models (Williamson, 1996). Hybrid governance models rely on the credibility of commitments, the cost effectiveness of which varies with the attributes of the transaction (Williamson, 1991; Ménard, 2004*a*) and are a possible way of looking at the organisational structure of integrated ocean carriers.

Within hybrid models, information plays a crucial role (North, 1990) as discussed in the previous paragraph. Information in the supply chain allows for cost minimization if appropriately linked to the ideal sourcing selection, and is fundamental in supplier-manufacturer relationship (Corbett and Tang, 1999). Lee, So and Tang (2000) quantify the value of sharing demand information to retailers and manufacturers, and literature has emerged on the strategic implications of information sharing (see Leng and Parlar, 2005). Özer and Raz (2006) provide a clear example of the link between information and transactions. Under symmetric information, when suppliers know each other's cost, they prefer split award contract, i.e. they both want to provide sourcing to manufacturer, whereas the manufacturer prefers sole sourcing (Özer and Raz, 2006). On the other hand when information is asymmetric manufacturers prefer split award contract in order to benefit from suppliers' differentiation in cost (and thus pricing) policy, since they do not know each other's cost (Özer and Raz, 2006).

Uncertainty plays a significant role also in determining the actual costs incurred after the transaction has taken place (see Shapiro, 2007). The higher the uncertainty involved in a transaction the higher the subsequent costs. In other words, asymmetry (the lack of free flow of information) causes uncertainty, which in turn causes transaction costs.

Supply chain management requires dealing with uncertainty (Chopra and Meindl, 2004). This uncertainty derives from the existence of unpredictable costs that occur in operational interactions between service providers, market conditions and customer characteristics. The level of uncertainty varies from market to market. If a provider operates alone in a competitive environment he deals with higher uncertainty than he would if he offered bundles of services. This statement refers to his internal/administrative transaction costs. For example, if he is offering sea transportation (carrier) and has to arrange inland transportation for his client, then he also has to gather information as to who is the more reliable provider for this service. And once he chooses a partner he needs to negotiate with him and (after the agreement) to monitor his operations. Extending this statement one step further, a greater minimization of uncertainty is to be expected if he is the aggregate efficient provider of multiple logistics services because, in this case, he doesn't have to negotiate with or monitor his sister company. Of course, the operations of his network are not without control but this is more administrative than market based.

We have identified three types of uncertainty in our system:

1) The first one appears at the shipper-provider stage. The shipper is somewhat uncertain regarding the reliability of the service provided in terms of existing and inevitable transaction costs (we assume therefore that there isn't free flow of information in the system). Various costs result from the endogenous uncertainty in transactions, as these take place in a network of asymmetric information.

2) The second type of uncertainty is inherent to the production process of each provider. Cost minimization and productivity maximization within the provider's intra-company infrastructure, may reveal numerous problems caused by unpredicted events in daily operations. In logistics this could be translated in delays in delivery, in container dwell time in terminal operations, and so on.

3) The third type of uncertainty occurs among service providers. Insufficient information about the quality of service that the competitors offer and the extent at which these differences determine each provider's efficiency, imply difficulties in strategic decisions. This type of uncertainty is perhaps the most important factor of the provider's survival as it indicates his ability to cope with competition in the long run.

6.4 Ocean transportation and logistics outsourcing

The importance of third-party logistics service provision also referred to as *logistics outsourcing*, has increased steadily in the last two decades and so has the attention that practitioners and academics alike have dedicated to the subject (Marasco, 2008). Firms have several options available to them as far as logistics services are concerned. They can provide logistics services in-house, they can have these activities provided by a logistics subsidiary previously purchased or set up, or they can simply purchase the service from an external company (Razzaque and Sheng, 1998).

Transportation in particular is one of those activities that are most likely to be outsourced (Selviaridis, *et al*. 2008). Some of the reasons for this are cost savings, problems associated with the internal administration of transportation functions, the fact that transportation is not a core competence for many firms, issues related to supply chain flexibility, or simply the complexity of managing certain transport services or the high investment costs necessary to set them up (Boyson, *et al.*1998). This is certainly the case for ocean transportation, for which the high costs associated with the provision of a regular, frequent and reliable intercontinental service would be prohibitive for most firms, and surely highly inefficient for society (Brooks, 2000). Outsourcing relationships between shippers and ocean carriers are central for international supply chains and globalisation by and large (Cullinane, 2005).

Since the 80's, ocean carriers have expanded the scope of their operation to include other logistics services, such as terminal handling, hinterland transportation and to the extreme supply chain management and value added logistics, in the phenomenon referred to as *vertical integration* along the supply chain (Heaver, 2002*a*). Since the extent to which a carrier embraces vertical integration is deeply rooted in its overall business strategy (Robinson, 2005), various degrees of integration can be observed in the industry (Frémont, 2009). The empirical review of the industry developments in the recent years (Slack and Frémont, 2008), reveals ocean carriers have developed their capabilities of providing logistics services along different paths.

On the one extreme there are those carriers that have marginally invested in logistics beyond hinterland transportation, such as MSC, while on the other there are those that have centred their activities on integrated *door-to-door* logistics solutions, such as NYK (Frémont, 2009). In between, we have carriers that have set up logistics services under the umbrella of the same parent company (APL and APL Logistics), and those who have built a considerable portfolio of parallel logistics activities (Maersk Line). In the recent months some ocean liners have divested participation in container terminals (e.g. CMA-CGM) and other chain investment raising doubts on the viability of maritime supply chain integration strategies especially in market downturns (Hailey, 2009).

The grounds on which an ocean carrier may be brought to opt for a certain logistics activity setup are still unclear, in particular in period of rapid business change. One of the core theoretical arguments used to justify vertical integration along the chain refers to the reduction in transaction costs that eventually it delivers (Haralambides, *et al.* 2010). Nonetheless, the role of transaction costs in shaping the organisational form of the logistics activities of a container carrier has not yet been satisfactorily explicated. What determines the degree of integration between an LSP and an ocean carrier? What are the attributes of the transaction governance models that make a carrier choose for a specific integration setup?

These questions call naturally for the paradigms developed in the context of transaction cost economics (TCE). But to date no attempts have been made to apply the frameworks of TCE to the liner shipping industry[30], and only few references can be found in the supply chain management and logistics literature by and large (Williamson, 2008). TCE however offered successful analytical perspective in a wide range of applied problems (Geykens, Steenkamp and Kumar, 2006), including outsourcing contracts (see Coltman, *et al.* 2009; Barthélemy and Quélin, 2006).

[30] Although no applications exist to liner shipping industry, in the article of Masten, Meehan and Snyder (1991), 'The costs of organization', the authors use the shipbuilding industry as an empirical estimation of organisation costs.

The purpose of this paper is to provide an alternative and original analytical approach to issues connected to vertical integration in liner shipping by making use of the lenses of TCE. The aim of the article is use TCE in order to provide a renewed research agenda on vertical integration.

The definition of logistics outsourcing provided in Chapter 4 highlights two important distinctions between third party logistics service provision and *arm's length* contracts. It implies some sort of long-term agreement between the parties (typically a year) and the provision of management and design activities.

Logistics outsourcing can be constructed on different forms of supply chain relationships. The spectrum of ways of building cooperation instead of adverse relations exclusively based on price negotiations, has been studied extensively and concepts such as cooperation, coordination and collaboration in the chain have emerged as effective ways of structuring supply chain relations next to market negotiations (Speckmann, Kamauff and Spaer, 1999). Nonetheless supply chain relationships are not yet fully understood (Hines and Samuel, 2007) and the organisational structure that is better apt at providing an array of logistics services is still open to debate (Selviaridis and Spring, 2007).

The benefits of outsourcing are multiple and can be summarised in strategic, financial and operational benefits (Selviaridis, *et al.* 2008), and refer mostly to the possibility of reducing costs and increasing competitive advantage (Razzaque and Sheng, 1998). Empirical analyses seem to point towards transportation and warehousing as the most outsourced services with respect to supply chain advanced solutions such as information management and process control (Lieb and Bentz, 2005*a*; Wilding and Juriado, 2004).

We hope in the next paragraphs to be able to show that TCE can offer another valuable perspective. Before looking at the application of TCE to the liner shipping industry, it is expedient to provide a background note on the theory of economic organisation in the perspective of TCE.

6.5 Economic organisation and transaction costs

The purpose of economic organisation

Using the lenses of transaction cost economics, the main purpose of economic organisation is adaptation (Williamson, 2008). Economic actors adapt spontaneously to changes in the market (Hayek, 1945: pp. 526-527), or pursue a '*conscious, deliberate and purposeful*' adaptation through administration in hierarchies (Barnard, 1938, pg. 9). Markets and hierarchies are the polar modes of economic organisation, each with distinctive strengths and weaknesses. In order to explain the connection between transactions and organisational adaptation that lead to certain forms of economic organisation, it is important to focus on specific attributes of transactions. Most of the literature on TCE focused on asset specificity, uncertainty and frequency (Williamson, 2008).

Asset specificity has been widely studied (Williamson, 1975; 1979; Grossman and Hart, 1986; Klein, *et al.* 1978). Williamson (1991) reports six asset-specificity distinctions:

- Site specificity aiming at economising inventories and transportation costs;
- Physical asset specificity that entail the development of technical relations n the transaction;
- Human asset specificity deriving from learning-by-doing and economies of experience;
- Brand name capital;
- Dedicated asset that entail the development of infrastructure or investment dedicated to a specific customer;
- And temporal specificity characterised by timely responsiveness.

Asset specificity is also the driving force behind bilateral dependency. Bilateral dependency though is not necessarily problematic if contracts were not incomplete and parties would not have to adapt to disturbances. Disturbances are the result of uncertainty and jointly with asset specificity they constitute the major objective of contractual action. Frequency of contracting actions becomes relevant when reputation effects are tangible and the costs of setting up a contract with a new party are substantial (Williamson, 2008).

Transaction governance attributes

Next to the transaction aspects, the TCE identifies a set of attributes of transaction governance structures. These attributes give rise to different adaptive strengths and weaknesses and can be categorised as incentive intensity, administrative command and control, and contract law regime. The relation among transaction attributes and governance structures can be summarised using the words of Williamson (2008: pg. 9):

> *'Transactions, which differ in their attributes, are aligned with governance structures, which differ in their adaptive strength and weaknesses, so that to accomplish a transaction cost economising result.'*

Incentives of decision-makers and other economic agents are the fundamental factors that distinguish among market and non-market organisations (Williamson, 1996). In particular market structures are characterised by high-powered incentives, little degree of administration control and legalistic contract law regime. Hierarchy in contrast features low-power incentives, high degree of administration and weak contract law regime, since the firm is its own dispute settlement forum (Williamson, 2008). Between the two extreme governance structures of hierarchy and market, Williamson (1991) proposes and analyses hybrid forms. Hybrid forms feature semi-strong incentives, an intermediate administrative control and a semi-legalistic contractual law regime (Williamson, 1991: pg. 281).

The important issue is how the alignment between transactions and governance structures is achieved. Asset specificity plays a crucial role on the definition of the desirable governance structure. Asset specificity with limited or no exogenous disturbances places internal organisation at a disadvantage with respect to market contracting, since hierarchies entail increased bureaucratic costs. When disturbances though become more frequent, the costs associated with asset specificity increase and the strong market incentives may impede adaptability, since parties try to appropriate adaptive gains as much as possible. In this setting hierarchy may provide better governance (Williamson, 1991).

The hybrid contracting is located in between hierarchy and market with respect to incentives, adaptability and bureaucratic costs. With respect to markets, hybrid governance is characterised by lower incentives but allows for better coordination among parties. With respect to hierarchy, hybrid governance reduces the ability to coordinate among parties but in turn increases the incentives intensity (Williamson, 1991). A clear example provided by Williamson (1991) of the differences between the various forms of governance is the sale of branded products by single brand shops (hierarchy), market and franchise (hybrid). Further examples come to mind in supply chain context, where backward integration of manufacturing into procurement is an example of hierarchy. A form of hybrid is provided by the selective policy towards suppliers applied by McDonalds restaurants.

It should be noted that vertical and lateral integration are considered forms of hierarchy. To the eyes of the transaction cost economist, these forms of integration come as a response to the necessity of parties to adapt. Williamson (1991) presents two forms of adaptation. Adaptation A, where *A* stands for ***A**utonomy*, corresponds to the neoclassical paradigm according to which consumers and producers respond to prices in order to maximise utility and profits. Adaptation C, where *C* denotes ***C**ooperation*, enters the picture when, because of disturbances, bounded rationality and opportunism, bargaining becomes costly and authority has adaptive advantages with respect to markets. Integration should then be employed when other instruments fails, since markets deliver better results in adaptation A respect.

6.6 The economic organisation of liner shipping

Transactions in liner shipping

How could the concepts presented in the previous paragraph be applied to the liner shipping industry in the quest of explaining the specific type of set-ups we observe in practice? Before proceeding with the discussion on the organisation of liner shipping, it is instrumental for a clearer definition of the problem to elaborate on the nature of the transactions we are focusing on.

We can identify the following transactions that are relevant for our discussions: the transaction of the carrier with a shipper (named B in fig. 19) and a transaction of a carrier with a logistics service provider (A in fig.19). In addition we will refer to the transaction of the LSP with the cargo owner (C in fig.19). It should be considered that the nature of transaction A is different is looked at from the side of the carrier or from the side of the LSP. For the former it is a customer transaction, while for the LSP it is one of the many outsourcing relations. In the rest we will refer to vertical integration as the situation in which the transaction A, instead of being aligned with a market is organised hierarchically or through a hybrid form of governance.

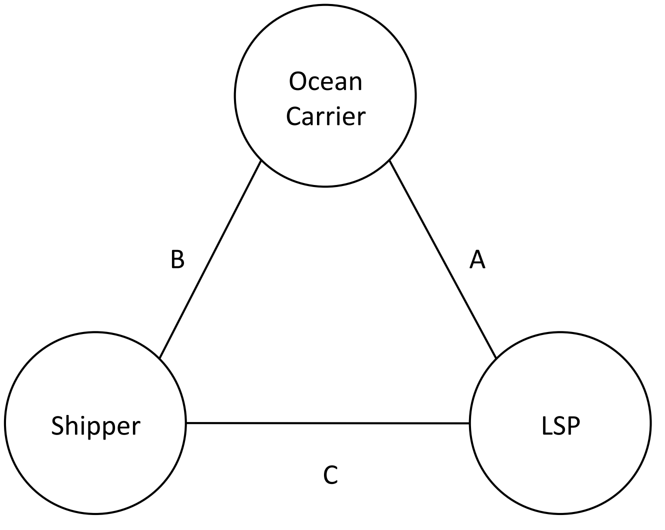


Figure 12: Transaction among shippers, LSPs and ocean carriers.

Source: Author.

Adaptation in liner shipping

In the rest of the discussion, in order to disentangle the issue of vertical integration along the supply chain, we will refer to the pragmatic methodology proposed by Williamson (2008). The pragmatic methodology is in line with the theoretical frameworks developed by the TCE and is built around three precepts: keep it simple, get it right and make it plausible. The theory develops on three steps, prioritisation, conceptualisation and operationalisation. With the first we focus on what are the central forces in the theory, with the second we proceed with describing those defining aspects of the central forces and the third is achieved by naming and explicating the attributes of the transactions and the governance structures that emerged in the analysis.

Starting with prioritisation, the main purpose of all economic organisation is adaptation (Williamson, 1991) as mentioned in the previous paragraph. In order to identify how liner shipping adapts to the market disturbances, it is useful to analyse the reasons for which vertical integration is likely to emerge. This provides an indication of the type of disturbances that affect contracting between ocean carriers and LSP.

Heaver (2002*b*; 2005) mentions demand complementarity, costs reduction and other benefits (mainly strategic market control increase and business diversification). Similarly Frémont (2009) expands on the argument of Heaver (2002*b*) explaining that shipping lines integrate vertically in the attempt to capture cargo. This would reduce the dependency on freight forwarders for volumes. In addition Frémont (2009) refers to an argument presented by Notteboom (2002; 2004*a*) and points at the necessity for carriers to reduce costs on the hinterland leg of *door-to-door* transportation since the use of larger vessels tends to increase the relevance of hinterland costs with respect to costs associated with the sea-leg.

These explanations refer to a large extent to changes in the demand requirements. The growth of the third party logistics service provision (Rabinovich, *et al.* 1999, among others), the increased centrality of supply chain management thinking (Horne, 1989) and the competitive pressure that characterises liner shipping in the last thirty years (Fusillo, 2006; Slack and Frémont, 2008), constitute some of the disturbances that influence the industry governance structure. Although in general disturbances in demand can be accommodated directly through the market (adaptation A), structural differences such as those we have witnessed may require adaptation of type C (Coltman, *et al.* 2009).

Shippers have been faced with changing market conditions and this has triggered the search for better ways of outsourcing their logistics (Berglund, *et al.* 1999; Notteboom and Merckx, 2006). But why should shipper entrust more than ocean transportation to an ocean carrier when they have a large number of third party logistics service providers that specialise in finding best logistics service solutions? Although a detailed answer to this question is not yet available, we can think of the following reasons: the shipper has already extensive relations with the ocean carriers and the shipper's chain is extensively based on ocean transportation. As the shipper is dependent on ocean transportation for the transaction, instead of using another party, he may find advantageous to make use of the same carrier. In high market conditions, the shipper may be under the impression that acquiring an integrated service from a carrier may even offer discount opportunities on the chain with respect to purchasing services from a third partly logistics service provider.

Midoro and Parola (2006) try to explain from a business development point of view the reasons behind vertical integration. The major driver for some companies seemed to be business diversification and build on investment opportunities in related markets. For other companies, generally part of larger industrial conglomerates, the decision to invest in logistics is motivated by the desire at a group level to better control distribution and marketing in expanding markets. This is most notably the case for vertical integration in the 80's for the major Japanese carriers and has been confirmed by a number of interviews done on the topic by Acciaro and Haralambides (2007). In this case, the disturbances influencing the industry structure are connected to the change in the global production system, i.e. globalisation, and the business diversification opportunities this opened.

Vertical integration, nonetheless, could also be motivated by operational considerations. In addition to the relevance of container logistics (in combination with vessel logistics and freight logistics) as a source of operational efficiency, as clearly discussed by Frémont (2009), integration in the terminal industry would grant a carrier advantageous conditions in terms of slot availability and increased flexibility (Haralambides, *et al.* 2002; Heaver, 2005). The emergence of a global stevedoring industry represents also a disturbance factor, by changing the nature of competition for terminal handling and by providing further business opportunities (Midoro, *et al.* 2005; Olivier, *et al.* 2007). The complete discussion on the issue of integration between terminals and ocean carriers though would require a more extensive analysis that what is the case here.

The reasons discussed refer to specific types of disturbances that intervene to affect the organisational asset. We can summarise these disturbances around demand, technical economies, competitive environment, and internal company strategy.

6.7 The Issue of transaction costs

Types of transaction costs

The issue of transaction costs is often listed as an important concept to explain and justify vertical integration. Excluding conglomerate integration, that may be relevant for shipping groups (e.g. AP Møller Mærsk), vertical integration in the traditional meaning occurs when transactions are taken out of the market and become organised by one firm. Using Coase's words, where by *combination* the author intends lateral integration (see text note in the original article):

> *'There is a combination when transactions which were previously organised by two or more entrepreneurs, become organised by one. This becomes integration when it involves the organisation of transactions which were previously carried out between the entrepreneurs on a market.'* (Coase, 1937: pp. 397-398).

In this sense, forms of vertical integration in the liner industry would include upstream, shipbuilding, container building and agency services, freight forwarding downstream. Transaction costs reduction opportunities seems obvious, mostly connected to contract negotiation and search costs, similarly to the case of railroads described by Coltman, *et al.* (2009). Nonetheless no empirical measurement has been performed so far in the liner industry. The integration between logistics service providers and ocean carriers on the other side, is somewhat different, since we have hardly witnessed full integration and most carriers will keep on selling capacity to competing LSP (Slack and Frémont, 2008; Frémont, 2009). In this sense, transaction cost reductions, although possible, might not be enough to justify vertical integration.

In addition to transaction costs, reasons for vertical integration are the technical economies and group synergies obtainable between an ocean carrier and a logistics provider, in terms of marketing, increase chain visibility and shared cost reduction. The issue is whether these economies are strong enough to grant the new integrated entity a competitive advantage with respect to other ocean carriers and LSPs. Although no conclusive answer is available in the literature or empirically, it is likely that the existence of these economies depends on shipper type, product and geographical circumstances. As pointed out by Frémont (2009) synergies between container logistics (essentially terminal and hinterland transportation) are rather obvious, while synergies at the freight level of the chain are more difficult to justify. Nonetheless, recent interviews conducted by the author, seem to suggest that although rare, these synergies are possible. This is also in line with the survey performed by Selviaridis, *et al.* (2008) on the type of services outsourced to LSP.

Asset specificity and bilateral dependency

In the case of the transaction between an ocean carrier and LSP the relevant level of transaction costs depends on the asset specificity and the level of bilateral dependency in the transaction. This level is bound to depend on the type of supply chain we are dealing with. If we analyse the list of categories of asset specificity provided by Williamson (1991), the following interpretation with reference to the liner and LSP industry and can be worked out.

- Site specificity aiming at economising inventories and transportation costs; in this category the definition of network paths and the locations for terminals, warehouses, and distribution centres.
- Physical asset specificity that entail the development of technical relations in the transaction; This may related to the development of specific coding and RFID technologies, or, for the example the technical relation between post-panamax vessels and post-panamax cranes.
- Human asset specificity deriving from learning-by-doing and economies of experience; this relays on the ability of accommodating customers requests.
- Brand name capital; this refers to the association of a carrier and its logistics service provider.

- Dedicated asset that entail the development of infrastructure or investment dedicated to a specific customer; the development of terminals or hinterland gateways.
- And temporal specificity characterised by timely responsiveness; fundamental in logistics to favour just-in-time responses for example.

6.8 Alternative modes of governance

Governance models

If we define transaction cost as the costs emerging from a specific alignment between a transaction and a governance model, we can develop a conceptual testable comparison of three situations:

- The transaction between an ocean carrier and a LSP takes place on a market (no-integration);
- The transaction between an ocean carrier and a LSP takes place within the boundaries of an integrated firm (hierarchy). This corresponds to the case of a carrier that has the full capabilities of a LSP or of an LSP that has acquired vessels (full-integration).
- The transaction between the ocean carrier and the logistics service provider is of a more hybrid nature. This can materialise in practice through long-term contracts, partnerships, integration of the logistics service provision and transportation under the same group management.

If we work out the possible models nested in the last case, we can propose the categorisation presented in the following table.

Table 18: Vertical integration models in liner shipping.

	Model	Description
C	Carrier	Pure carrier: the carrier focuses exclusively on ocean transportation
CL	Carrier + LSP	The carrier is associated with a LSP that operates as a completely independent company but is under the control of the same holding or group. Ocean transportation has a dominant role on the strategies of the group.
I	Carrier/LSP	The carrier offers a full range of logistics services. Further distinctions in this category could refer the extent of the range of logistics services provided, e.g. hinterland transportation or freight logistics.
	LSP/Carrier	The LSP offers a wide range of logistics services and acquired the capability of offering ocean transportation by directly operating vessels.
LC	LSP + Carrier	The LSP and the ocean carrier operate under the same holding or group. In this case the LSP is the primary focus of the group
L	LSP	The LSP does not offer ocean transportation by directly operating vessels.

Source: Author.

Pure ocean carriers and pure LSP (C; L)

The advantages in terms of transaction costs of this form of organisation relies on the high incentives it provides. This organisation form allows for rapid change in strategy and a strong focus on the bottom line. Business opportunities may be foregone and synergies between activities cannot be exploited. This organisational form may not be able to respond effectively to changes in customer demands. Transactions between carriers and LSP take place on the market.

Intuitively the structure of the liner industry was characterised by C until the 80's, when the disturbances connected with supply chain thinking allowed for other forms of transaction governance. Although carriers have more and more moved in some forms of integration, examples still exist of carriers focusing exclusively on ocean transportation.

Integrated carriers (I)

The main focus of integration is to take advantage of the cost reduction deriving from control *vis-à-vis* market transactions. Integration should be favoured when managing the critical chain interfaces on the market becomes more expensive than the cost of higher degree of control and decrease of incentives. The assessment of the effectiveness of this form of governance requires adopting the perspective of an LSP. Does the availability of an asset like ships grants the LSP a stronger competitive advantage with respect to a non-asset-based LSP? Does the provision of logistics services grant the carrier that chain competitive advantage as proposed by Robinson (2005)?

Full integration naturally sacrifices incentives in favour of better administrative command and control. The reduction in incentives deriving from integration may be compensated by the gains obtainable through coordination. Coordination though also comes at a cost. In general terms high coordination is recommended for high level of bilateral dependency, so in those cases where the LSP and the carrier work hand in glove. In our categorisation, we propose integration centred on logistics and centred on ocean transportation. These can be considered as transitory arrangements, until full integration is achieved. An example of companies that has come close to full integration could be NYK Logistics and Mega-carriers.

Hybrid (CL; LC)

The last set of possible outcomes refers to hybrid forms of integration that has been defined in the table above as CL and LC. In these circumstances the ocean carrier and the LSP are independent companies, although under the same control of a holding company or group. This type of construction seems to be the most frequent in the industry, although the costs of hybrid models can also be substantial (Williamson, 1991).

6.9 Efficient alignments between ocean transportation and logistics

After the description of the possible governance models, it is useful to proceed deriving refutable implications the lead to efficient alignment between the economic organisation of ocean transportation and logistics service provision and the type of transactions involved between carriers and LSP. This phase of the analysis is referred to as *operationalisation*. Using the words of Williamson (2008: pg. 8):

> *'Operationalisation is accomplished by naming and explicating the key attributes of both transactions and governance structures, by working out the efficient alignments between transactions and governance and by empirical testing. What is required is identifying bilateral dependency'.*

The theory calls for identifying those transaction costs that rise as a result of organisational maladaptaion. This is the result of a dimensionalisation phase, where the variation of costs is connected with the attributes of the transaction.

Dimensionalisation

Reviewing the various models developed in the previous paragraph, what is the level of asset specificity, uncertainty and frequency connected with each of the transaction governance model? A reasoned summary of the level of asset specificity is tentatively provided in the following table.

Table 19: Governance forms in liner shipping.

	Asset specificity	Uncertainty	Frequency of the transaction
Market (C and L)	Low asset specificity High powered incentives	High uncertainty	High importance of reputation
Hierarchy (I)	High asset specificity Low powered incentives	High uncertainty	High importance of setup costs
Hybrid (LC and CL)	Different levels of asset specificity Medium incentives	Lower uncertainty	Reputation and setup costs are relatively negligible

Source: Author.

The success of hybrid governance models is connected the level of efficacy of credible commitments (Williamson, 1983). When transactions become highly uncertain, setup costs are high and the role of reputation is crucial for the transaction, then credible commitment is not effective in ensuring a successful transaction and hybrid models may lead to increase in costs.

Predicted alignments

Given the dynamic nature of the outsourcing relations, it is unlikely to be able to provide a *one-size-fit-all* type of solution. On the contrary, the observation of the changes taking place in the liner shipping industry point towards a very different approach. It is important then to identify key parameters that may contribute to read the adaptation efforts made by carriers and LSPs.

A first type of distinction points to measures of asset specificity. In some forms of vertical integration, asset specificity may play a crucial role. Let us consider the case of terminal integration. The transaction we are referring to is between a carrier and a terminal. The issue of asset specificity would lead to answer the question, how crucial is the terminal in the provision of the service given the characteristics of the carrier network? Let us assume that this level of asset specificity is k. If k is 0—i.e. there is no bilateral dependency—we may assume that the terminal does not respond to any specific needs of a carrier. In other words, the terminal can be easily replaced. In this context then it is advisable not to increase administrative control on the terminal (i.e. integration), and transact terminal services under unassisted market (e.g. multiuser terminals).

Naturally integration is not the only option to reduce the exposure of a carrier-terminal bilateral dependency to disturbances. Terminals and carriers have developed a large variety of safeguard measures, ranging from long-term contracts to joint ventures. Williamson (2008) calls the level of these safeguard measures as s, where $s=0$ corresponds to unrelieved hazard. In those cases in which both k and s are positive, all forms of hybrid governance are possible, up to the extreme of integration. The level of inter-firm contractual safeguards is bound to increase as the complexity of the transactions increases. Integration should be opted for only when contractual breakdowns become frequent and costly and unified ownership is the only alternative to cooperative adaptation (Grossman and Hart, 1986).

High frequency of disturbances in transactions, with an increase in contract breakdowns, might lead to preferences for market organisation or hierarchy with respect to hybrid organisations depending on the level of asset specificity (figure 13). This observation would justify the 'decoupling' of logistics and ocean transportation trend that is taking place under the current more 'uncertain' market conditions and provides an interesting explanation of increase integration of ocean transportation and logistics that took place in more stable markets.

The implications of this approach to organisation are far-reaching. Consider for example the impact on the viability of bundle pricing for door-to-door transportation, or even integrated logistics services. Since transaction costs savings are offset by higher variability, bundling propositions may be less attractive in highly variable markets. As an example, assume a customer interested in an integrated proposition. This requires from the side of both parties some degree of bilateral dependency. In the moment in which markets become unstable, the costs associated with the adaptation of the contract to the requirements of the parties increase so that to offset the costs advantages granted by the flexibility offered by the hybrid governance. Therefore either the parties move to a market governed transactions, characterised by the ability to renegotiate contracts, or full integration takes place, reducing incentives and at higher bureaucratic costs. The distinction between the two depends on asset specificity, therefore terminals and hinterland transportation – that are components in the chain characterised by high asset specificity will be fully integrated, consumer logistics or value added logistic on the other side, will be governed by market transactions, to the extreme even in the case of the same group, e.g. Maersk Line and Damco, APL and APLL. Those companies nonetheless retain the cost saving associated with certain asset specificities, such as brand name.

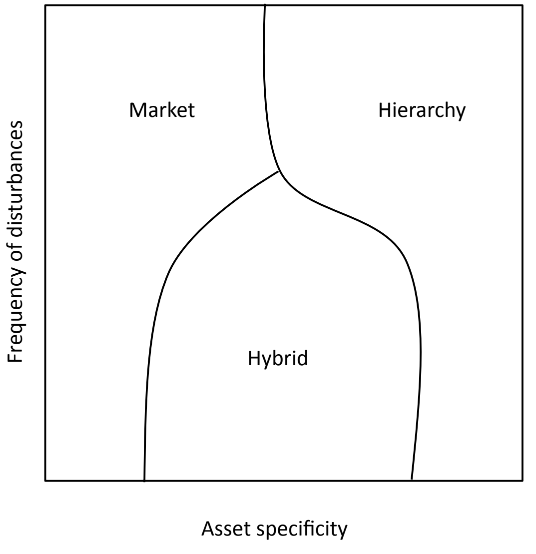


Figure 13: Organisation form responses to changes in frequency of disturbances.

Source: Williamson (1991)

6.10 Entropy

In the following paragraphs a theoretical model is presented aiming at explaining the effects of supply chain integration on transaction costs. The aim of the model is to show how supply chain integration provides better alignment in the case of uncertain transactions and contributes to reducing transaction costs. A previous version of the model appeared in the work of Karydis (2007).

Let us consider a transaction between a shipper and a logistics service provider. In addition to the price for the service p, the shipper is faced with the ex-ante transaction costs (y) of collecting information about the provider and negotiating the contract. Once the transaction takes place, the shipper may have to deal with the ex-post transaction costs (z) of monitoring the performance of the logistics provider and enforcement in case the cargo is damaged or lost. In every transaction a shipper incurs:

$$p + y + z \geq p$$

The shipper does not know the values of y and z that are in fact unobservable. The aim of the model is minimising the uncertainty over the sum $y + z$. We can model the two costs as random variables, that we will call Y and Z. The uncertainty in a complex system of heterogeneous agents can be measured by Shannon's Information Theory (Shannon, 1948). Shannon's Information Theory deals in general with the problems connected with the reproduction at one or more locations of information produced elsewhere. Supplying information is equivalent to removing uncertainty, or in other words information is given by the difference between prior uncertainty and the posterior uncertainty.

For a random variable X, we define x as the possible value of X and $\mathscr{X}$ as the set of all x. The a priori knowledge about x is given by the probability distribution $\{p_X(x), x \in \mathscr{X}\}$, where $p_X(x) = \Pr[X=x]$. The a priori uncertainty is defined as a functional H of the probability distribution $\{p_X(x), x \in \mathrm{X}\}$, that for simplicity can be denoted $H(\{p\})$, that should satisfy certain axioms.

Shannon proposes for the functional $H(\{p\})$, the formula:

$$H(\{p\}) = -\sum_{x \in \mathscr{X}} p(x) \log p(x)$$

The quantity $H(\{p\})$ is called the *entropy* of $\{p\}$. Entropy is a measure of the uncertainty associated with a random variable. Whilst conducting a random experiment there is always an amount of information connected with a random variable that is missing. Entropy measures the amount of the information content associated with the outcome of a random variable. It is expressed in *bits* (or *nats*) per event, which is the unit of information.

For two outcomes of a random experiment (e.g. tossing a coin), the entropy function is given in the figure below:

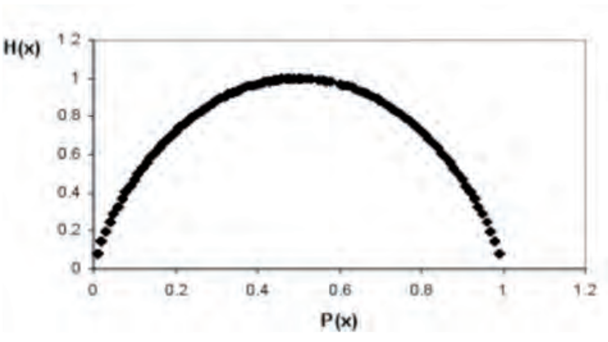


Figure 14: Entropy curve.

The curve is a parabola, which rises to a maximum when the two events are equally likely at (0.5) and falls towards 0 whenever one event becomes dominant at the expense of the other. The above figure derives from the binary entropy function:

$$H(x) = -P(x)\log_2[P(x)] - [1-P(x)]\log_2[1-P(x)]$$

For mathematical proofs and Entropy properties see the original article of Shannon (1948).

The entropy indicates the amount of uncertainty in probability distributions (Soofi, 1992) or it is the lack of knowledge about a random event (Denbigh and Denbigh, 1986). Entropy has a long standing tradition in statistics (e.g. Kolmogorov,1959; Khinchin,1957), but is has also been used in economics (Theil, 1967; Theil and Fiebig, 1984), political sciences (Darcy and Aigner, 1980) and voting (Gill, 2005).

Entropy can also be used to quantify uncertainty in a supply chain network, although no examples of this application appear in the literature. In a transaction between a shipper and a logistics service provider, we can consider the event transaction fulfilment (T). We can define a probability distribution Pr on the transaction fulfilment, as follows: Pr is the probability that the transaction is successful. In the rest of the formalisation the focus is not on the distribution of T but on the distribution of Pr. As the probability of the event is unknown, we can define a random variable Pr and we assume that $Pr \sim U[0,1]$.

The ex-ante and ex-post costs are defined as functions of Pr, so that Y and Z are a function of the probability of the transaction fulfilment. The rationale behind this assumption is that transaction costs will be the highest the more unlikely the event T becomes. In the simple case we assume that Y is distributed independently from T and from Pr, and specifically $Y \sim U[u^-,u^+]$ and then we assume that Z, that indicates the ex-post transaction costs, is a function of Pr. If $Pr \leq 0.5$, where 0.5 is an arbitrary value, we assume that $Z \sim U[v^-,v^+]$ otherwise $Z \sim U[w^-,w^+]$, with u, v and w real non negative numbers and $v \leq w$.

In the simple formulation we can assume that the supply chain consists of four components and five agents, i.e. a shipper and four independent logistics service providers that need to be combined. For each component, we can define a random variable Pr_i, $i=1,2,3,4$ that indicates how likely is a transactions to end successfully. We indicate with Pr_i the probability that transaction T_i is completed successfully. The random variables, Pr_1, Pr_2, Pr_3, Pr_4, are independent and uniformly distributed on $[0,1]$. For each of these random variables the corresponding Y and Z variables can be obtained.

In our analysis we will assume that a transaction cost is a function of the information possessed by a shipper at the moment of the contract stipulation. If we consider entropy to be a measurement of this information, we can quantify transaction costs for a set of hypothetical situations characterised by different degree of integration. We assume that full information corresponds to no uncertainty. Therefore if the shipper possesses full knowledge a priori of the result of the transaction (complete contract), there is no uncertainty, and no information is transmitted. If, however, disturbances are present, then contracts are incomplete, and hierarchy or hybrid governance may be a better form of transaction alignment. The next paragraph provides a validation of this statement based on simulation.

The probabilistic formalisation presented above accounts for the existence of uncertainty in the presence of disturbances in the transaction fulfilment random variable. It should be noted that in what follows no assumptions are made on the change in the variability of the disturbances, or in the quantity of uncertainty associated with the random variable transaction fulfilment, i.e. the results are not based on changes in the variance of *T*. Williamson (1991) suggests that an increase in uncertainty would favour extreme governance forms, i.e. market or hierarchy, against hybrid governance.

6.11 Simulation

The higher the degree of integration, the lower the level of uncertainty associated with a transaction and the lower the costs associated with the transaction. It should be noted, before proceeding to the actual simulation exercise, that the costs deriving from integration are excluded from the analysis. In order to fully disentangle the link between transaction costs and integration along the supply chain, also assumptions on the nature and size of costs associated with the integration should be made (see Masten, *et al.* 1991).

The simulation examines three different cases. In the first case the shipper interacts with a non-integrated supply chain. This case reflects the circumstances in which supply chain transactions are aligned with market governance. In the second case partial integration occurs. In the simulation we have assumed that the chain is managed by two logistics service providers that offer two distinct and complementary services each. The last case entails full vertical integration of the chain, that implies that the shipper transacts with one single vertically integrated logistics service provider. Case two and three are hybrid governance forms; hierarchy being a fully integrated shipper that manages its own supply chain.

The simulation system is a multistage and complex network of intermodal transportation, which comprises five components. We could assume these components to be the shipper, the ocean carrier, the terminal operator, the rail carrier and the trucking service provider. The probabilistic input of the model is the random variable that represents the probability of transaction fulfilment (*Pr*). *Pr* is a (pseudo) random number between 0 and 1 generated using Monte Carlo simulation.

The *ex ante* and *ex post* transaction costs are endogenously determined and are assigned conditional probabilities given *Pr*. No feedback is provided, in the sense that the results of each stage simulation is not re-input to the model. This implies that if the *Pr* is smaller or equal to *0.5*, its value is not modified at the next trial. In this sense the system should be regarded as an open-loop non-feedback system. The system components behave as if they had no memory. Although restrictive, this hypothesis is justified by the fact that the focus of the present analysis is the change in the level of uncertainty and transaction costs and not shippers' behaviour and their ability to modify their choices on the basis of experience.

A simulation model can be either static or dynamic, depending on whether time is taken into consideration, and deterministic or stochastic depending on whether it contains a random variable. The model presented here is static with dynamic expansion and stochastic. The term static with dynamic expansion refers to the fact that transaction costs are considered from the perspective of the shipper during the 1,000 repetitions of the transactions in period t. The simulation is then repeated 50 times (dynamic expansion).

For every different level of integration we always begin with the hypothesis that the transactions take place at $t=1$ while repeated 1,000 times (that is 1,000 trials). The expansion of the model takes into consideration the factor of time as it is expressed in $t=1, 2, 3\ldots 50$ periods. In this case we attempt to simulate a situation where the shipper signs contracts with the providers so as to transport his cargo in more than one time periods. The essential reason for this generalized approach was the necessity to test the model's reliability after the insertion of the time period sequence assumption.

One final point concerns the logical connection among *ex-ante* transaction costs and the probability of failure Pr in the dynamic setting. In period $t=1$ the shipper incurs information and bargaining costs but he cannot readjust. The *ex ante* transaction costs are therefore random numbers between 10 and 100—*ex-ante* costs can be low but never 0 as they may take the form of non-monetary opportunity costs, in the simulation this is represented by the fact that the random number cannot be below 10—. However, the expansion allows the possibility of bargaining re-adjustment. If in period t the carrier fails to deliver, in $t+1$ the shipper will spend more time on bargaining and negotiating incurring simultaneously higher *ex ante* transaction costs than those in period t. Therefore, the dynamic version has the advantage that it permits partial memory for the shipper unlike the static case. Even if he is not satisfied with the logistics provider at t he will continue doing business with him as he has no other choice. The difference, however in this case is that the *ex ante* transaction costs in period $t+1$ will depend on the carrier's performance in period t.

Model results

In the non-integrated case, we assumed a network of four logistics service providers and a customer that interact a completely non-integrated network. The market interface is imperfect meaning that there is not free flow of information neither downward nor upward. The entropy is the sum of the entropy of the four different transactions. The sum of the transaction costs accounts for the total amount of costs that burden the shipper during each trial. The *ex ante* costs take random numbers between (10,100) whereas for *ex post* transaction costs it is assumed that, depending on *Pr*, they might be between 10 and 45 if $Pr \leq 0.5$ or between 45 and 100 otherwise (the amounts are arbitrary). Analytically, the higher the *Pr* the lower the transaction costs. For the *ex ante* transaction costs however we suppose that they take random numbers between (10,100). This decision depicts the fact that the shipper arrives at the network only once and therefore his transaction costs, before the transaction itself, are unknown and unrelated to the provider's performance.

In the partially integrated case the initial invariability of time still applies. We assume that a partial integration has taken place. For example a carrier owns a terminal and a rail carrier owns his own trucks. When *Pr* is less than or equal to we assume the transaction has not been completed successfully. The opposite happens if the *Pr* is greater than *0.5*. The joint entropy in this case is given by the sum of the entropy of the two semi-integrated components. The *ex-ante* and *ex-post* costs in the second case occur exclusively at the integrated levels. Ex ante transaction costs take random numbers between 10 and 100, whereas for ex post transaction costs it is assumed that they are between 10 and 45 if $Pr \leq 0.5$ or between *45* and *100* otherwise.

In second partially integrated case, we assume that a full-scale vertical integration has taken place among the logistics providers. For example a carrier that provides integrated transportation through its own terminal, rail and trucks. When the *Pr* is less than or equal to *0.5* then the transaction is not fulfilled. The opposite happens if *Pr* assumes values greater than 0.5. In this case the system's entropy equals the entropy of the integrated logistic service provider. The sum of the transaction costs accounts for the total amount of costs that burden the shipper during each trial.

In all three cases we run the simulation 1,000 times using the Crystal Ball Professional Version 7.2. The simulation yielded the results reported in table 20.

Table 20: Mean and standard deviations as reported by the simulation.

	Entropy		Transaction costs	
	Mean	St. dev	Mean	St. dev.
Non-integration	1.45	0.31	419.67	74.71
Integration case 1	0.72	0.22	210.14	52.60
Integration case 2	0.36	0.15	105.81	38.08

Source: Karydis (2007)

The mean in the case of partial integration has substantially decreased compared to the case of non-integration. Partial integration returned lower uncertainty and lower transaction costs than the fully non-integrated network. Essentially, the number of market participants has reduced and so did the number of transactions in the system. If we compare the entropy charts in an overlay chart we can observe that for all different levels of vertical integration the levels of entropy decreases as the integration increases. The more integrated a system is the less uncertainty it will exhibit.

As far as the transaction costs are concerned, we observe that also in this case they are reduced as integration proceeds further. Their variability also reduces. The third case exhibits the lowest mean105.8, compared to 210.14 of case 1 and 419.67 of non-integration.

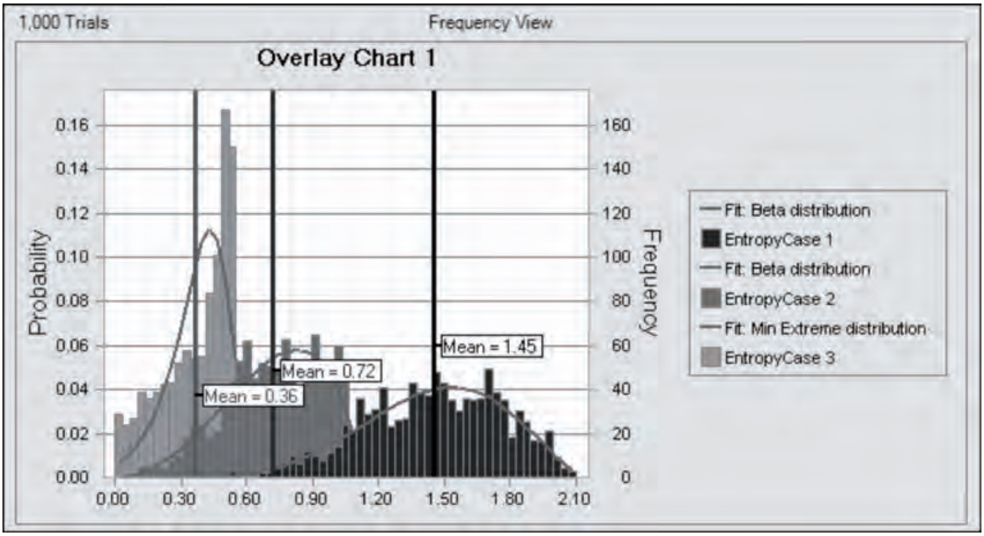


Figure 15: Entropy overlay chart.

Source: Karydis (2007)

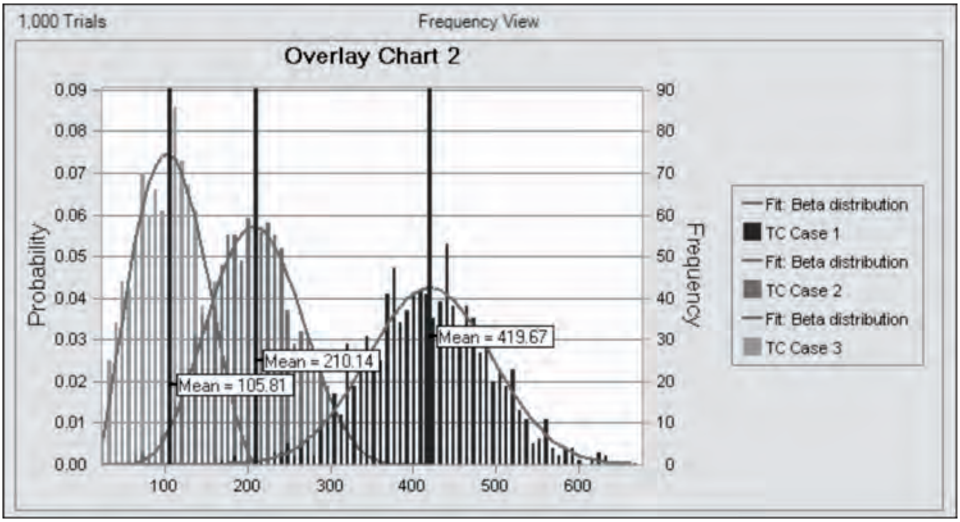


Figure 16: Transaction costs overlay chart.

Source: Karydis (2007)

In the simulations we assumed that our input data are uniformly distributed. This means that after *n* trials the shipper will always have to deal with a situation where his chances of having his cargo successfully transported will be on average 50%. This assumption is rather counterintuitive, as we would not expect logistics service providers to be so unreliable. We can show that under different distribution assumptions the results still hold. We tried repeating the exercise using the triangular distribution. This distributional form is typically used as a subjective description of a population for which there is only limited sample data, and especially in cases where the relationship between variables is known but data is scarce. Instead of assuming 0.5 probability of success, the triangular distribution is based on knowledge of the minimum and maximum and an "inspired guess" as to the modal value. Thus, the simulation using a triangular distribution for the probabilistic input with 0% as a minimum and 1 as a maximum and a 0.7 success rate delivers similar results. We present the simulation results for the three cases described before after 1,000 trials assuming a triangular distribution for the probabilistic input.

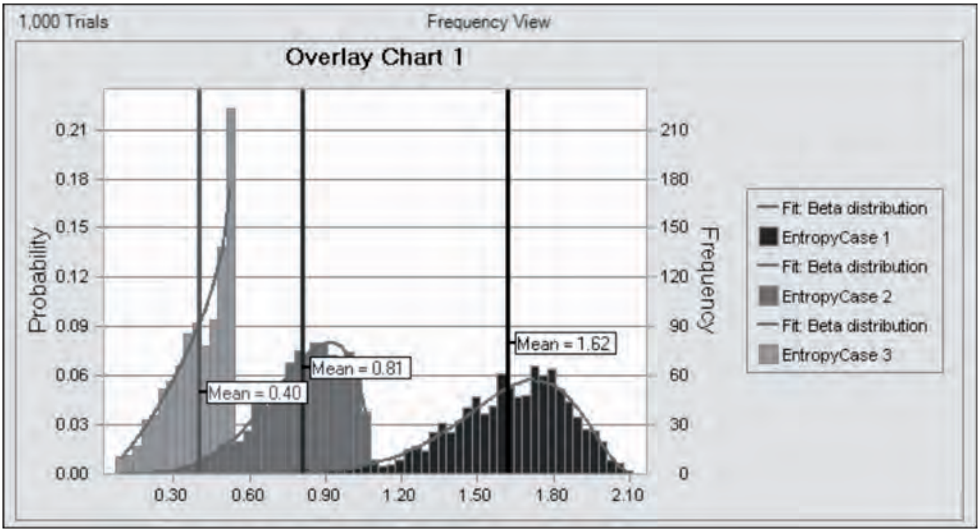


Figure 17: Entropy graph overlay (triangular hypothesis).

Source: Karydis (2007)

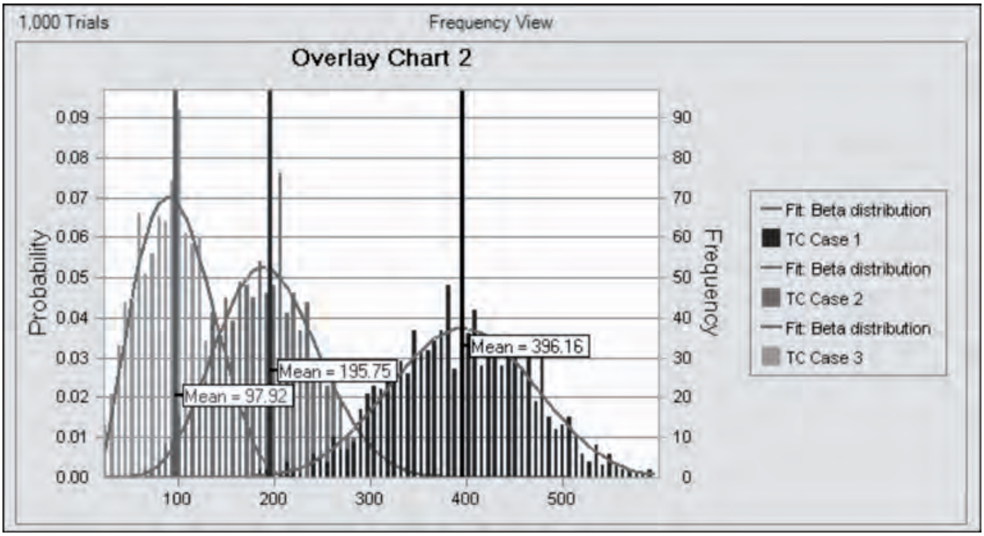


Figure 18: Transaction costs graph overlay (triangular hypothesis).

Source: Karydis (2007)

Model conclusions

The starting point of our analysis is the observation that a great deal of transactions within the supply chain can be investigated using the lenses of transaction cost economics. Key concepts in this area of research are transaction costs and information asymmetries and we have explained how these concepts contribute in shaping supply chain relations, most notably in outsourcing and procurement problems. Asymmetries in information in particular are fundamental in justifying how contractual relations within the supply chain are shaped and why most of supply chain contracts are incomplete. We provided a formalisation of information using the concept of entropy developed in the context of information economics. Making use of Monte Carlo simulation, we have explored how transaction costs and information are affected by integration.

In the simulation model we assumed a supply chain made up of four components. A cargo owner is faced with three alternatives: dealing with four non-integrated logistic service providers, two semi-integrated logistics service providers or one fully-integrated logistics service provider. Each transaction is characterised by the uncertainty of how successful the transaction will be. Under our assumptions, and assuming that the expectations on the success of a transaction are distributed uniformly between 0 and 1, we have shown that an integrated logistics service provider offers a higher level of transaction reliability, since the information associated with the transaction of a single integrated service provider is by definition higher. This also results not only in a lower mean for the entropy, but also in reduce of variability. *Ex-ante* and *ex-post* transaction costs are also reduced.

These results are in line with the advantages presented in the literature on integrated supply chain service providers. Nonetheless, our analysis does not model the costs deriving from integration, nor does it distinguish among the various types of logistics activities. It is likely to expect that integration results in a successful strategy as long as the costs associated with it do not exceed the advantages associated with the reduction in transaction costs and the increase in information. The resulting trade-off is an interesting topic for further research.

The simulation could have been more accurate if the availability of real time data had been feasible. The model can be tested for its validity if the random probabilities are substituted by actual performances of logistics service providers. Nevertheless this task would require an extensive survey into the actual transaction costs figure. The hypothesis employed in the model, along with the general assumption of no information and therefore random selection of providers, are functional in highlighting the gradual minimization of uncertainties at every level of integration, that was the core focus of this part.

The topic of vertical integration in the maritime and transport industry should be analysed further. The frameworks provided by transaction costs economics offer an interesting perspective on the problem and we trust that the dialogue between supply chain management, maritime economics and transaction cost economics can be a fruitful one.

6.12 Conclusions

The chapter presented an alternative explanation to vertical integration between ocean transportation and other logistics services based on TCE. We explained that TCE offers valuable insights in analysing the issues connected with vertical integration in the industry. We proposed alternative models of governance and discussed their characteristics in terms of asset specificity and contractual safeguard measures. The paper aimed at opening a dialogue between the branch of maritime economics that studies integration in liner shipping and the theory developed by transaction cost economists.

The obvious extension of this chapter would imply the empirical estimation of the transaction costs and organisation costs. There are several examples of studies that attempted successfully this type of exercises (see Geyskens, *et al.* 2006). Further problems that would be worth investigating empirically refer to the quantification of the technical economies deriving from group synergies between ocean carriers and LSP. This analysis would require undertaking an analysis of these economies on the basis of geography, product vertical and customer characteristics.

Further issue for investigation refer to the impact of vertical integration on competition and on customer relations. Vertical integration is bound to have effects that go beyond the specific transaction that is internalised within the firm. Instruments to assess this type of problems though are still under development in the apparatus of TCE. A further interesting point of further research relates on how could global carriers and LSP leverage on the eventual synergies delivered by integration. The efficacy of the alignment between transactions and governance lies in the degree of bilateral dependency between the ocean carrier and the LSP. The characterisation of bilateral dependency in this industry is an urgent area open for investigation.

7 Methods for Optimal Bundling*

7.1 Introduction

As discussed in the previous chapters there is a lack of empirical and theoretical research of the practice of bundling in the context of logistics and container transportation. This lack of investigation has at least three important consequences: firstly the limited ability to assess the potential and benefits of product bundling internally for a carrier that decides to engage in this practice; secondly the limited ability to assess the impact on shippers and society by and large; and thirdly limited insight on the competitive effects on other carriers and logistics service providers. In connection with the first limitation an important issue is the selection of procedures and techniques that allow for the assembly of bundles that deliver the highest advantages for the firm, generally measured in terms of profit.

With the exception of Fürderer (1999), in general the literature has dealt with the problem either as specific form of optimal non-linear pricing (Armstrong, 1996; 2006; Shy, 2008; Armstrong and Vickers, 2010) or as an effective way to price discriminate (Bakos and Brynjolfsson, 1999; Eppen, *et al.* 1991; Guiltinan, 1987). It should be clear that the concept of optimality in this case refers to profit of revenue maximisation and leads to two conceptually distinct, albeit interlinked, problems: the determination of optimal bundles in view of internal firm economies and the determination of optimal bundles in view of customer firms preferences. The issue of internal firm production economies has been partially discussed in chapter 6, while the issues related to the latter problem, i.e. the selection of optimal methods based on customer preferences is the subject of this chapter.

In general optimal bundling techniques require behavioural inputs and customer surveys are a proven method used for collecting reservation price data.

* This chapter is based on Acciaro (2010*d*).

However, performing a firm customer survey in the case of bundling of ocean transportation and logistics services revealed to be unfeasible within the constraints of the current research project. Confidentiality issues and the sensitive strategic nature of service contracts do not place an independent researcher in the best position to effectively survey reservation prices in this sector. In addition the limited applied research in this area implied that most of the work was bound to be exploratory in nature. It was decided therefore to limit the scope of the research to investigating the applicability of existing techniques to the bundling of ocean transportation and logistics, and leave the empirical testing of these techniques for future research. This chapter therefore will not present an empirical application of most of the techniques discussed.

This chapter provides a synthesis and critical review of the findings of the marketing literature on product bundling with a particular focus on the container industry. The chapter contributes to the existing literature at least in three ways. First, it proposes an operational framework for managers in the container industry based on the existing theory aiming at highlighting the conditions under which the sale of bundles delivers benefits to a firm. This framework, structured in a set of key propositions, indicates the aspects that should be looked at by a container carrier before entering a product bundling strategy. Second, the article contributes to the general literature on bundling by providing a new set of examples, with high potential for further exploration. Although it is generally widely recognised that logistics offers multiple angles for the application of bundling among other price discrimination techniques, very limited empirical work has been done in this area. Finally, the discussions presented in this chapter will build on the existent methodologies to provide a set of techniques whose applicability to the liner shipping industry seems particularly appropriate.

The rest of the chapter is structured in the following way. The next section will provide a review of the determinants of optimal bundling strategies and introduce key concepts such as conditional reservation prices and asymmetry and variability in their distribution. The section will conclude with a set of twelve general propositions that can help to determine cases where a bundling strategy can be considered optimal. These propositions are used in section 7.3 to determine on the basis of the data from the survey presented in chapter 4, what bundles of logistics services are likely candidates to optimality. The rest of the chapter is more general and methodological in nature and aims at presenting the description of the most common techniques employed in other industries to determine optimal bundling strategies. Particular attention will be given to conjoint analysis as it has revealed itself as one of the most effective methodologies. A proposed step-by-step methodology for bundling strategy is provided in section 7.7. Considerations related to customer profiles in shipping and transaction costs is the object of the following section. Section 7.9 concludes.

7.2 Conditional reservation prices

The determination of the optimality of a bundling strategy depends on the distribution of conditional reservation prices or customer's willingness to pay. '*A reservation price is the amount a consumer is willing to give up to acquire an extra marginal utility of some good*' (Talluri and Van Ryzin, 2004: pg. 661). On the basis of the theory of choice the reservation price v_i for an additional unit of good i is given by:

$$v_i \equiv \frac{\partial \tilde{u}(x^*)}{\partial x_i}$$

where $\tilde{u}(x)$ is the monetary utility of a consumption alternative $x = \{x_1, x_2, \ldots, x_n\}$ and x^* denotes the optimal solution of the consumer budget problem. The consumer's reservation price for goods that are currently consumed is simply the current market price. In general to entice a consumer to purchase a product, its price should drop below its reservation price. Reservation prices depend, like utility, on consumer preferences, wealth, current consumption levels, and the price of other goods consumers may buy (Varian, 1992).

Although consumer theory in its original formulation (e.g. Hicks, 1946) refers to direct purchases of products by individual consumers, we can extend its application to economic agents in general that make consumption decisions, i.e. firms too. This is also the approach that has emerged, although on the basis of different considerations, in the context of Post-Keynesian behavioural theory (see for example Downward, 2004). This comparison, in the case of logistics services reflects the different logistics needs specific of each shipper and their production process or strategies, similarly to the differences in preferences of consumers. Their decision process therefore can be assimilated to those of a consumer. This generalisation allows us to make use of the frameworks and techniques developed in the marketing management literature.

On the basis of the framework presented by Stremersch and Tellis (2002), we can define the concept of conditional reservation price as the '*reservation price of a product, conditional on the consumer buying another product*'. In the case of logistics services, the conditional reservation price of service is the willingness to pay for a service under the assumption that another service is required. A *segment* is an identifiable group of customer firms that shows a similar distribution of conditional reservation prices. The relations among the reservation prices for the bundled services determine under what conditions the bundling of container transportation and logistics services might be an optimal strategy for ocean carriers.

Guiltinan (1987) explains how the provision of bundles of two products may lead to the subdivision of consumers on the basis of different sets of reservation price distribution. The author argues that when a firm considers the option of providing a bundle of two products (X and Y), it is confronted with the following four market segments:

- Segment 1: consumers who only purchase product X;
- Segment 2: consumers who only purchase product Y;
- Segment 3: consumers who purchase X and Y;
- Segment 4: noncustomers.

Depending on the strategy the firm adopts, each segment may acquire more importance. In particular Guiltinan (1987) distinguishes between the following two different strategies: cross-selling, i.e. sell an additional service to customers that only purchased one service, and the acquisition of new customers, i.e. customers in segment 4. Guiltinan then proceeds analysing demand conditions that must be met if a bundling programme is to influence customers behaviour in the desired direction, i.e. favour cross-selling or customer acquisition. Although in general managers do not know the distribution of reservation prices for the two services A and B, they can usually estimate the demand levels in the absence of bundling within each segment in a specific period of time. That is why Guiltinan makes reference to actual quantities sold.

In this respect Guiltinan distinguishes between *mixed-leader bundling* and *mixed-joint bundling*, where with the former he indicates bundling intended at cross-selling in a situation where one of the two products is substantially more demanded than the other, while with the latter a situation when the volume gains from selling a bundle to customers that are already purchasing a product are close to those obtainable from selling a bundle to customers that are already purchasing the other product. The key to effective demand response is the type of complementarity among products.

Stremersch and Tellis (2002) expand the analysis of Guiltinan on the basis that the heterogeneity of consumer reservation prices has two dimensions: asymmetry and variation. The dimension used by Guiltinan (1987) and others (Adams and Yellen, 1976; Tellis, 1986) is asymmetry. An asymmetric distribution of conditional reservation prices for two products X and Y occurs when consumer segment *a* has lower conditional reservation price for product X than segment *b*, and at the same time segment *b* has lower conditional reservation prices for product Y than segment *a* (Stremersch and Tellis, 2002). This corresponds to a negative correlation of conditional reservation prices between the two products across segments (Adams and Yellen, 1976).

For example let us consider the demand for transport services and let us assume that a segment of customer firms have high conditional reservation prices for truck transportation with respect to rail transportation, for example because they demand small order batch sizes, while another has high reservation prices for rail transportation with respect to truck, since they require bulk deliveries at a railroad terminal. In this case the distribution of reservation prices is said to be asymmetric.

Variation instead refers to the difference among consumers' reservation prices for the bundle of products. As an example let us consider that an LSP providers decides to offer a piggyback multimodal service comprising of rail transportation and trucking. It is likely that although a certain consumer segment may demand such a service, others may show no interest. On the basis of the distinction between asymmetry and vaiability, bundling focus (price or product bundling) and bundling form (pure or mixed bundling), Stremersch and Tellis (2002) present twelve propositions that summarise the conditions certain bundling strategies are preferable to others. These propositions are listed below while for a detailed discussion and proof of the propositions we refer readers to the original article. The next paragraph will discuss the applicability of these propositions in the context of ocean transportation and logistics services.

P_1 A price bundling strategy (either pure or mixed) yields higher revenues than unbundling if conditional reservation prices are asymmetric.

P_2 Mixed price bundling yields higher revenues than pure price bundling only when reservation prices for the bundle vary across consumers. In all other cases, pure price bundling yields at least the same revenues.

P_3 A product bundling strategy (either pure or mixed) yields higher revenues than unbundling for both symmetric and asymmetric conditional reservation prices, though the difference in revenues will be larger when reservation prices are asymmetric.

P_4 Mixed product bundling can yield higher revenues than pure product bundling only when reservation prices for the bundle vary. Pure product bundling yields equal or higher revenues than mixed product bundling when reservation prices do not vary.

P_5 Combining a product with a price bundling strategy is superior to mere product bundling if consumers' conditional reservation prices (a) for the separate products and (b) for the price bundle and the product bundle are asymmetric.

P_6 When a firm's goal is to maximise market penetration first and profits second, pure price bundling either is the best strategy or is no worse than any other strategy.

P_7 When a firm's goal is to maximise market penetration first and profits second and a product bundle is possible, pure product bundling is as good as, if not better than, any other strategy; the only exception is when consumers' conditional reservation prices (a) for the separate products and (b) for the price bundle and product bundle are asymmetrically distributed. In the latter case, combining a pure price bundling strategy with a pure product bundling strategy may be optima.

P_8 In competitive markets, a mixed price bundling strategy dominates pure price bundling strategy.

P_9 In competitive markets, if the supplier can introduce a product bundle, mixed product bundling strategies dominate unbundling and pure product bundling strategies.

P_{10} The profitability of price bundling is likely to be higher than that of unbundling (a) the higher the relative contribution margin and (b) the stronger the economies of scale and scope.

P_{11} If costs of product bundling are subadditive, a product bundling strategy is always superior to an unbundling strategy, irrespective of consumers' reservation prices, the firm strategic objectives, or the nature of competition.

P_{12} For price information, it is optimal for companies to (a) integrate all prices information in a single bundle price rather than present it in a list of separate product prices and (b) separate the bundle discount in multiple savings rather present it as a single saving.

7.3 Optimal bundling strategies in global supply chains

On the basis of the survey data presented in chapter 4 we can comment on the propositions of Stremersch and Tellis in the context of bundles of ocean transportation and logistics services. In chapter 4 data had been collected for three sectors: industrial manufacturing; food and beverages; and electronic parts and consumer electronics. Let us assume that a sector may well be considered as a separate consumer segment, since it can be argued that the logistics requirements of companies engage in the production of similar products or group of products are similar.

In what follows it is assumed that demand can be reasonably used as a proxy of the unknown reservation price distribution. This might not necessarily be the case and a more thorough analysis should consider collecting data directly with the aim of estimating reservation prices.

From the results of the survey we observe that *inventory management* and *outbound land transportation* rank as the most demanded logistics functions in all the three sectors under analysis. This could lead one to think that these three segments do not show a high level of asymmetry in reservation prices for these two functions. Similarly *warehousing*, *customs clearance* and *freight scheduling & routing* emerge as most demanded functions for two of the three sectors. In particular sector 1 and 2 appear to differ only on *rate negotiation* and *customs brokerage*, *warehousing* and *custom clearance*, the last two also demanded by sector 3, while sector 3 is the only one to seem to highly value *terminal handling*.

If we look at the least demanded functions clearly *factoring* and *product assembly/installation* are not considered as highly required functions across all three sectors, followed by *procurement* and *fleet management* that appear among the least required functions in two of the three sectors. These functions are likely to have similar distribution of reservation prices. Interestingly, two functions, *shipment consolidation/deconsolidation* and *product marking/labelling/packaging* appear as highly demanded by sector 3 and among the least demanded by sector 2. This leads to believe that the distribution of the reservation prices for these two functions for both segments might reveal to be asymmetric.

If we look at the activities that are mostly outsourced (table 21) we observe that the following functions are outsourced in all three sectors: *Terminal handling*, *Outbound land transportation*, *Transhipment / relay*, *Inbound land transportation*, *Shipment consolidation / deconsolidation*, *Freight scheduling & routing* and *Customs brokerage*. With the exception of *Terminal handling* and *Transhipment / relay* that more than 80% of respondents declare to outsource, we observe that for *Customs brokerage* is highly demanded in Sector 1 and 3, but only by 57% of respondents in Sector 2. Similarly *Shipment consolidation / deconsolidation* seems to be highly demanded (73%) in Sector 1, but less in Sector 2 (67%) and even less in Sector 3 (57%).

Table 21: Most- and least-demanded logistics functions across three trade sectors.

	Sector 1 *Industrial manufacturing*	Sector 2 *Food and beverages*	Sector 3 *Electr. parts & consumer electr.*
Most-demanded functions	- Warehousing - Freight scheduling & routing - Inventory management - Rate Negotiation - Outbound land transportation	- Customs clearance - Freight scheduling & routing - Inventory management - Outbound land transportation - Customs brokerage	- Shipment consolidation / deconsolidation - Outbound land transportation - Terminal handling - Customs clearance - Warehousing - Inventory management - Product marking / labelling / packaging
Least-required functions	- Order fulfilment and distribution - Transhipment / relay - Product assembly / installation - Fleet management - Factoring	- Reverse logistics & waste disposal - Shipment consolidation / deconsolidation - Product marking / labelling / packaging - Procurement of Logistics - Factoring - Product assembly / installation	- Fleet management - Product assembly / installation - Procurement of logistics - Factoring

Source: SMU and EUR (2008*b*).

Table 22: Outsourced logistics functions.

Sector 1 *Industrial manufacturing*		Sector 2 *Food and beverages*		Sector 3 *Electr. parts & consumer electr.*	
Customs clearance	100%	Terminal handling	100%	Terminal handling	100%
Customs brokerage	100%	Outbound land transportation	86%	Customs brokerage	100%
Terminal handling	100%	Transhipment / relay	83%	Transhipment / relay	100%
Transhipment / relay	92%	Inbound land transportation	83%	Outbound land transportation	86%
Outbound land transportation	81%	Shipment consolidation / deconsolidation	67%	Inbound land transportation	83%
Inbound land transportation	79%	Factoring	67%	Customs clearance	71%
Shipment consolidation / deconsolidation	73%	Freight scheduling & routing	63%	Freight scheduling & routing	67%
Carrier service selection	69%	Customs brokerage	57%	Fleet management	67%
Reverse logistics & waste disposal	64%			Carrier service selection	60%
Fleet management	60%			Shipment consolidation / deconsolidation	57%
Factoring	60%				
Materials flow management	54%				
Freight scheduling & routing	53%				

Source: SMU and EUR (2008*b*).

On the basis of proposition 1 we could argue that bundles that include *Customs brokerage* and *Shipment consolidation / deconsolidation* in conjunction with a service jointly demanded by all sector would be a good candidate for a price bundle, since the distribution of conditional reservation prices are likely to be asymmetric across the three sectors. Similarly bundles of *shipment consolidation/deconsolidation* and *product marking/labelling/packaging* may be candidates of good bundles.

On the basis of propositions 2 and 4, we can argue that a mixed bundling strategy is preferable in the case of liner shipping as it is unlikely that the conditional reservation prices do not vary among the various consumers. Notwithstanding the integration of logistics processes the interest of shippers in a specific bundled proposition will necessary vary on the basis of the geography where the shippers is active, product verticals and shippers own logistics capabilities. In this case though, we would be discussing of product bundling, which, following proposition three would generate higher revenues. This is the typical case of ocean and hinterland transportation by rail for example.

Proposition 3 and 5 suggest that those bundles that result in a reduction of transaction costs will yield benefits to the carrier. If the conditional reservation prices among the unbundled components and the bundles are asymmetric, then a combination of product and price bundles should be preferred (proposition 3 and 5). As previously discussed, the integration of ocean transportation with hinterland transportation and to a certain extent warehousing and distribution seem to be the bundles that allow for lower transaction costs, through better coordination along the chain, reduction in repositioning costs and imbalances. Mixed bundling strategies in this context should be preferred. Further empirical analysis would be required to assess whether propositions 5 is applicable in the context under examination, but it is unlikely that a bundle of ocean transportation and hinterland transportation for example will have asymmetric conditional reservation prices with respect to ocean transportation or hinterland transportation alone.

Propositions 6 and 7 would require more analysis on the objectives of liner companies. It is likely, given the network characteristics of the liner industry, that proposition 6 is more likely to describe the integrated liner sector, while proposition 7 the non-asset based logistics sector (3PL). For the way the markets are operating now, it is though commercially unfeasible to offer ocean transportation only in conjunction with other services. In addition following propositions 8 and 9 mixed price bundling is a dominant strategy in the integrated liner shipping industry. Proposition 10 may give a good benchmark of the liner industry with respect to other sectors. Since, as explained EOS and EOSC are substantial in the industry, there is scope for the implementation of bundling strategies in the liner shipping industry.

Proposition 11 provides a criterion to evaluate in what cases a bundle of a specific logistics service and ocean transportation is surely a superior strategy. Unfortunately it is difficult to imagine too many examples of subadditive costs for product bundles in the case under examination. Finally, proposition 12 provides a clear marketing advice to shipping lines on how to proceed with proposing bundling strategies to their customers. This issue has been addressed indirectly in chapter 5 with respect to surcharges.

7.4 The implementation of optimal bundling

The discussion in the previous sections has addressed the issue of optimal bundles of ocean transportation and logistics services in general terms. Although the propositions of Stremersch and Tellis (2002) revealed very useful in general, an important point of analysis is the determination of optimal bundling strategies in the case when a more accurate analysis is required. This problem can be addressed at two levels. At the one level there is the necessity to observe and take account of customer preferences. At a second level the question is how to elaborate and combine this information with cost elements and come with an optimal, i.e. profit maximising, bundling strategy.

The first problem is generally addressed by surveying customers and collecting reservation prices. If the reservation prices are collected directly (Hanson and Martin, 1990; Venkatesh and Mahajan, 1993; Simonin and Ruth, 1995) we refer to *direct methods*. Direct methods have various disadvantages (Simon, 1989; Monroe 1990; Monroe and Lee, 1999) since consumers tend to quote unrealistically lower prices, feeling obliged to act as conscious buyers (Morton, 1989) and prices are evaluated in isolation. In order to overcome the difficulties with this approach, a set of techniques have been developed that are generally referred to as *conjoint analysis* (Green and Srinivasan, 1990). Conjoint analysis is a technique that measures consumers' tradeoffs among multi-attribute goods and services (Wübker and Mahajan, 1999). Limited application of conjoint analysis has been made in bundling so far (Wübker Wübker and Mahajan, 1999) although the number of research studies has considerably increased in the last decade (Green and Srinivasan, 1990, etc.).

The second type of problem refers to the elaboration of the consumer reservation price information and the determination of an optimal bundling decision. It should be noted that an optimal bundling strategy entails the determination of the type of bundles to be sold (pure or mixed bundling), the set of bundles to be marketed and the pricing scheme(s) that maximises profits or any other firm objective. This is generally obtained either through direct enumeration of the possible bundling strategies and corresponding profits or by means of linear programming techniques. The next sections aim at presenting some of the techniques that are available to determine accurate bundling strategies for integrated liner companies.

7.5 The use of conjoint analysis in the determination of optimal bundles

This paragraph describes how to use conjoint analysis to obtain optimal bundling strategies in the case of ocean transportation combined with other logistics services. This is done by providing a detailed hypothetical case study. In general we will focus on unbundled sales, pure and mixed bundling.

Knowing consumers preferences for alternative products can be very useful when a company wants to bring a new concept to the market. To measure these preferences for different product concepts or alternatives, companies can use a marketing tool known as *conjoint analysis*. The method derives utility values that consumers attach to varying levels of product attributes (Kotler and Keller, 2006). Consumers are confronted with different types of offers formed by combining varying levels of the attributes. The results are indexed and then management can identify the most appealing offer and the estimated market share and profit the company could realize when introducing this new concept.

According to fundamental marketing principles, the aim of the services provided by a supplier must be to satisfy the existing and latent wants of consumers. The requirements of the client should determine every single detail of the marketing activities initiated by a service provider, since it is the response of the market that in the final analysis determines the new concept's success or failure. At first sight, this notion of service bundle design appears easy to transform into practice (Fürderer, Huchzermeier and Schrage, 1999).

From the point of view of the consumer, the price represents the equivalent value of the service provided. Consumer conceptions of utility with regard to bundled services should therefore be placed at the centre of all pricing and product-policy decisions. This approach has two advantages as compared with an analysis of respondents' individual judgments of specific facets of the service package: first of all, it is possible to determine the value attributed by the clients to each of the components that make up the bundle of services. Secondly, the utility of the services offered by the supplier can be enhanced by means of selective modifications, thus raising the probability that more consumers will wish to take advantage of them. It is consequently crucial to establish the client's utility expectations in relation to the service bundle (Fürderer, Huchzermeier and Schrage, 1999).

In 1973 Green and Wind used conjoint analysis for developing a new spot-removing, carpet-cleaning agent for home use (Green and Wind, 1973). The paper was a major breakthrough in marketing research. Green and Wind could form 108 different product concepts but this was clearly too comprehensive for consumers to rate; it will therefore be illustrated with an easier example.

Instead of 108 different concepts, consumers can choose between 10 different concepts. Consumers can rank the concepts from 0 to 1, where 0 indicates that the consumer derives the least utility and 1 that the consumer derives the highest utility from the specific attributes. When all the desired data is collected a marketer can use a statistical program to derive consumers' utility functions of each of the 10 attributes. The derived functions are simple to analyse and the marketer can conclude that the function with the highest utility will probably cause highest profitability or a bigger market share.

In order to explain the technique let us consider the following products and attributes as summarised in table 23. For the sake of simplicity we are assuming only three logistics services: ocean transportation, on-carriage, i.e. transportation from the port of arrival to final destination, and pre-carriage, i.e. transportation from the origin of the shipment to the port of departure. For simplicity we assume that the purchase of pre-carriage and ocean transportation only is not possible.

Table 23: Services and bundles currently on offer.

Bundle	Price level in US$
Ocean transportation	1000
On-carriage	30
Pre-carriage	40
Ocean transportation and on-carriage	1100
Integrated service: Ocean transportation, pre-carriage and on-carriage	1200

Source: Author.

The question that we aim at answering is: is the integrated service price of ocean transportation, pre-carriage and on-carriage optimal? In other words are there any other pricing schemes that would increase the firm's profit?

Let us assume that the firm has the possibility of proposing seven alternative feasible stimuli, i.e. combinations of different level of attributes—in our case bundle composition and price—. The stimuli are listed in Table 24.

Table 24: Stimuli.

	Attributes	
	Bundle	Price level in US$
1	Ocean transportation	1000
2	On-carriage	30
3	Pre-carriage	40
4	Ocean transportation and on-carriage	1100
5	Integrated service: Ocean transportation, pre-carriage and on-carriage	1100
6	Integrated service: Ocean transportation, pre-carriage and on-carriage	1200
7	Integrated service: Ocean transportation, pre-carriage and on-carriage	1500

Source: Author.

What is the best pricing strategy for the integrated service? The answer to this pricing question depends on the willingness to pay of the customer firm for the integrated service. This willingness to pay, reservation price, is represented by the utility the buyer would obtain from the most preferred bundle type or item among all bundle offerings.

Assuming that the data relatively to the attributes, i.e. combinations of bundles and prices, have been collected, and following the example of Wübker and Mahajan (1999), the preference model is specified by:

$$U_k = \sum_{i=1}^{2}\sum_{j=1}^{5} X_{kij}\beta_{ij} + \varepsilon_k$$

where U_k is the preference score (total utility) for stimulus k; X_{kij} is the dummy variable for presence ($=1$) or absence ($=0$) of level j in attribute i, for stimulus k; β_{ij} is the path worth utility associated with level j of attribute i; and ε_k is the usual error term for stimulus k.

In our example we have seven stimuli, but from the previous equation we have to estimate 8 part-worth utilities. This is possible through Adaptive Conjoint Analysis (ACA). The advantages and disadvantages of ACA and the process of estimating part-worth utilities are described in Agarwal and Green (1991), Green, Krieger and Agarwal (1991) and Johnson (1991).

Let us consider $u_m{*}$ to be consumer m's highest estimated total utility of any currently available stimuli, that is made op of the part-worth utility of the two attributes bundle and price. Let B denote the index of the three-item bundle for which the reservation price is to be assessed. Let $u_{mB\ |\sim p}$ denote the part-worth utility of the three item bundle, where the notation emphasizes that the utility contributed by price is not included. We assume that consumer m refers the three item bundle B at price p to any other available stimulus if the following equation is satisfied: $u_{mB\ |\sim p} + u_m(p) = u_m{*} + s$, where $u_m(p)$ denotes the part-worth utility of price p and s defines an arbitrary small positive number. This equation is satisfied for price p_{mB}.

Table 25: Estimated part-worth utilities.

a	
Price (US$)	**Utility**
1,030	35
1,040	30
1,000	20
1,100	10
1,200	8
1,500	2

b	
Bundle	**Utility**
On-carriage	20
Pre-carriage	0
Ocean transportation	45
Ocean transportation and on-carriage	50
Integrated service	55

Source: Author.

Table 26: Total utilities for the bundle propositions on offer.

Bundle	Price level in USD	Total Utility
Ocean transportation	1000	65 = 20 + 45
On-carriage	30	55 = 35 + 20
Pre-carriage	40	30 = 30 + 0
Ocean transportation and on-carriage	1100	60 = 10 + 50
Integrated service	1100	65 = 10 + 55
Integrated service	1200	63 = 8 + 55
Integrated service	1500	57 = 2 + 55

Source: Author.

Assuming that the individual part-worth utilities have been estimated as in the table above, where the estimated part-worth utility for prices is listed in part *a* of the table, while the part-worth utility for the bundle or unbundled service is listed in part *b* of the table. From the sub-tables *a* and *b* of table 24 we can calculate the total utility for the seven stimuli provided in the table 25.

In the example above we observe that the customer firm is indifferent between buying the integrated service at 1,100 US$ or only ocean transportation at 1,000 US$. Assuming that the customer firm will purchase the bundle that maximises its utility, it will purchase the bundle at 1,099 US$. Through this procedure we can derive the distribution of reservation prices for the integrated service and maximise the firm's profit function given by:

$$\Pi = \sum_{n=1}^{5}(p_n - c_n)D_n$$

where Π indicates overall profit; p_n, c_n and D_n are respectively the price, the cost and the demand for item n. As an example we can consider that from a survey of 100 company customers we have obtained the distribution below of buyers of the different products.

Table 27: Example of optimal price calculation for a bundle.

Price of the integrated service (USD)	Number of buyers of different bundles or items					Total Profit
	Integrated service	Ocean transportation and on-carriage	Ocean transportation	On-carriage	Pre-carriage	
$900	79	5	16	0	0	$92,600
$1,050	76	6	18	0	0	$104,400
$1,100	72	7	19	2	0	$105,980
$1,150	65	10	20	3	2	$105,930
$1,200[a]	60	14	21	3	2	**$108,580**[a]
$1,300	42	26	22	6	4	$105,560
$1,400	32	28	26	10	4	$102,120
$1,500	20	35	26	15	4	$95,220

[a] Optimal price and maximum profit.

Source: Author.

7.6 The determination of optimal bundles

The traditional approach towards the selection of optimal bundles would entail enumeration of all possible bundle configurations, price assignment and measure the profitability of each configuration. Enumerative approaches are still used in practice, although they may be rather cumbersome in terms of calculation as the number of bundle configurations grows exponentially and for each configuration several price propositions need to be tested and profits calculated. As discussed by Fürderer (1999) the advantages of more advanced methods are substantial against more straightforward simulation methods only when the complexity of the problem is large enough.

In order to overcome the computational complexity of the optimal bundle determination problem, several authors have proposed a set of OR based models aiming at the selection of the bundle. One of the most well known techniques is the one proposed by Hanson and Martin (Hanson and Martin, 1990; Eppen, *et al.* 1991), aiming at solving the optimal bundle pricing from the side of a monopolist.

The customers observe the bundles and their prices and make purchases that maximise their consumers surplus. These decisions are taken into account in the maximisation of the company profit function. The model assumptions are as follows (Fürderer, 1999: pg. 50):

- The benefit including the same component more than once in the bundle (duplication) is zero, and components resale is not possible;

- A single profit maximising firm determines the price of every bundle;
- Given these prices, every customer maximises his/her consumer surplus. Consumer surplus equals the reservation price minus product price.
- Purchasing nothing yields 0 consumer surplus;
- All consumer segments face the same prices;
- The reservation prices of all customer segments are known for all bundles
- There is free disposal of unwanted components;
- Marginal costs of a bundle are sub-additive;
- Customers have zero assembly transaction costs for creating bundles from separate offered sub-bundles.

In this model, unlike the model of Stigler (1968) or Adams and Yellen (1976) there are no restrictions on the number of components offered, the structure of reservation prices (i.e. strictly additive), or customer segment sizes. Nonetheless the model has the following limitations (Fürderer 1999):

- Segmentation according to the same reservation price structure may result in as many segments as customers in case of product categories with a brand customer basis of heterogeneous preferences;
- There may be correlation among the various bundles, since many product line items may be complements or substitutes;
- The model does not account for competition;
- The decision to provide a bundle is influenced also by the costs of developing and setting up the product lines to be bundled deriving from the costs of acquiring the capabilities to provide the service to be bundled or engineering, testing, production preparation and various planning or structural activities necessary for producing a certain product.

The parameters of the model are:

S	=	$\{1,\ldots,n\}$ is the index set of component items.
h	=	index of components, $h=1,\ldots,n$.
i	=	index of component bundles, $i=1,\ldots,L$ where $L = 2^n - 1$.
k	=	index of customer segments, $k=1, \ldots, m$.
R_{ki}	=	reservation price of customer k for bundle i, $R_{k\{h\}}$ denotes the reservation price of the bundle which consists of only component $\{h\}$.
c_{ki}	=	cost of supplying one customer of segment k with bundle i.
N_k	=	number of customers in segment k.
$B(i)$	=	the set of components which define bundle i.
$I\subseteq\{1,\ldots,L\}$	=	is the index set of bundles.

The decision variables of the model are:

p_i = Price assigned to bundle i;

θ_{ki} = 1 if customer k selects bundle i, 0 otherwise;

s_k = Consumer surplus obtained by customer segment k;

and the auxiliary variables are

s_{ki} = Consumer surplus of a customer in segment k if that customer selects bundle i.

z_{ki} = Marginal revenue generated from a customer in segment k if that customer selects bundle i.

p_{ki} = The price a customer in segment k pays for selecting bundle i.

The objective of the bundling offer is to maximise profit, therefore the objective function (OF) is given by:

$$\max \sum_{k=1}^{M} \sum_{i=1}^{L} N_k z_{ki}$$

The optimisation is constrained by the fact that each consumer is expected to maximise consumer surplus, s_k. This is accounted for by the following constraint:

$S_k \geq R_{ki} - p_i,\ i = 1,\ldots, L,\ k = 1,\ldots,M.$

Hanson and Martin (1990) assume that prices are sub-additive, and therefore they introduce the price sub-additivity constraint as:

$$p_i \leq \sum_{i=1}^{L} \left(R_{ki}\theta_{ji} - p_{ji} \right),\ s.t.\ U_{j\in I}B(j) = B(i),\ i = 1,\ldots,L,$$

Hanson and Martin (1990) assume that the firm cannot price discriminate between customer segments, so this implies that if a customer from segment k buys bundle i and a customer from segment h buys the same bundle, then $p_{hi} = p_{ki}$. This condition is enforced by the single price schedule constraints:

$$p_{ki} \geq p_i - \left(\max_{\substack{k=1,\ldots,M \\ i=1,\ldots,L}} \left\{ R_{ki} \right\} \right) \left(1 - \theta_{ki} \right),\ i = 1,\ldots, L,\ k = 1,\ldots,M.$$

$p_{ki} \leq p_i,\ i = 1,\ldots, L,\ k = 1,\ldots,M.$

In order to be able to solve the problem it is required to include a tightening constraint:

$$s_k \geq \sum_{i=1}^{L} (R_{ki}\theta_{ji} - p_{ji}),\ k = 1,\ldots, M, j = 1,\ldots,M.$$

Finally Hanson and Martin (1990) assume that each customer purchases only one bundle. In order to ensure that this assumption is maintained they introduced the single purchase constraints as follows:

$$z_{ki} = p_{ki} - c_{ki}\theta_{ki}, \quad i = 1,...,L \quad k = 1,...,M,$$

$$s_{ki} = R_{ki}\theta_{ki} - p_{ki}, \quad i = 1,...,L \quad k = 1,...,M,$$

$$s_k = \sum_{i=0}^{L} s_{ki}, \quad k = 1,...,M,$$

$$\sum_{i=0}^{L} \theta_{ki} = 1, \quad k = 1,...,M,$$

$$p_i, p_{ki}, s_{ki} \geq 0, \quad s_{k0} = 0, \quad \theta_{ki} \in \{0,1\}.$$

Hanson and Martin (1990) proposed also a relaxed bundle pricing model which only grows linearly and not exponentially as the number of components grow. Notwithstanding the popularity of the Hanson and Martin model, its formalisation revealed to be restrictive in practice. Fürderer, Huchzermeier and Schrage (1999), proposed an extended formulation of the bundling pricing problem that accounts for longer forecasting horizons and uncertainty in reservation prices. The proposed *stochastic bundle pricing problem* is conceptually similar the Hanson and Martin formulation, but differs from it since it allows for the choice of several bundles or individual products within a product line and accounts for costs deriving from the creation of multiple bundles (variant-dependent costs).

7.7 Optimal bundling strategies in practice

Although the model presented in the previous section is rather restrictive in its assumption its application would reduce the computational complexity of selecting bundling strategies in practice. More complex liner formulations are not yet available to encompass the complexity of setting up an optimal bundling decision in the case of global supply chains. In particular no current formulations account for EOSC and EOS; all models developed so far do no account for strategic interactions with competitors; and finally the substitutability among bundles and its impact and influence on customer decisions is not accounted for.

A practical solution is to refer to the conjoint analysis techniques illustrated before. The rest of the section will present a discussion of the practical steps required to implement a bundling strategy in the case of global supply chains. This discussion will be loosely based on Gustafsson, Hermann and Huber (2006), to which we refer for a more detailed explanation of the theoretical aspects discussed. The first step is the definition of the underlying preference function between the different bundle components. The following models can be used depending on attribute scaling: partial benefit value model; ideal vector model; ideal point model. The difference among these three alternatives depends on the distribution of the preferences on the attribute level. A second decision refers to the data collection method. In the example used in section 7.5 we referred to ACA, but other methods, such as the profiles method or the two-factor methods are commonly used as well. The difference among these various methods refer to how incentive are presented, e.g. as a full description of the bundle, or as a sequence of trade-offs.

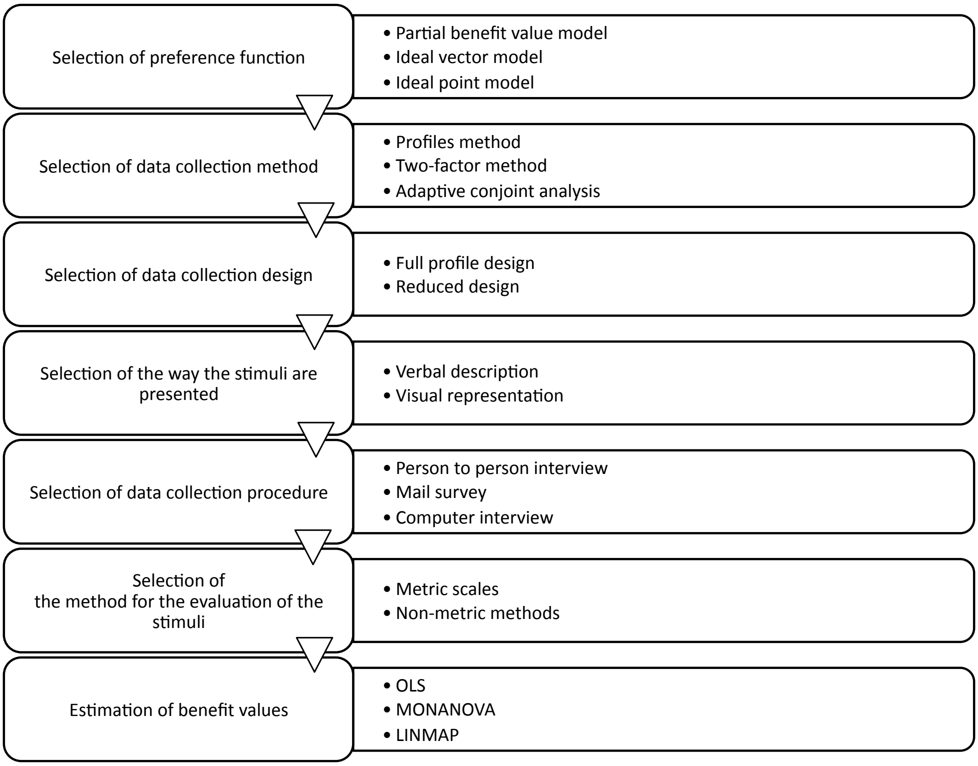


Figure 19: Conjoint analysis decision steps.

Source: Gustafsson, *et al.* (2006).

The third step in a conjoint analysis study requires the selection of a data collection design. This is done in practice either with the full (or complete or factorial) profile design or the reduced design. The former entails listing all conceivable bundles, and mostly because of data collection expenses and the risk of wearing out respondents, the latter is generally preferred. A reduced design results in a random sampling of the possible incentives, or, more commonly in systematically reduced design, generally so that orthogonality, i.e. independence of factors is retained. Since in general there is no independence of attributes, particular attention has been paid in the literature to data collection designs that take into account interaction effects.

The use of conjoint analysis assumes the studying of datasets of categorical variables. Most applications of conjoint analysis require specific assumptions on the interaction effects between these variables. If the relationship between the response variable and the predictor variables is linear, the analysis of variance (ANOVA) can be used effectively for analysing interaction effects. When the relationship is not linear, as is often the case, more general models have been proposed (see Nelder and Wedderburn, 1972). In practice this issue is not yet fully resolved, and the result of conjoint studies may be affected. This is one of the various technical issues that are still open in the application of conjoint analysis in general.

The third important step in the determination of a conjoint analysis study entails the decision on how to present the stimuli to respondents. This area has not been the subject of through examination, although a survey is presented by Vriens (1995). In particular the effective presentation of bundles of services such as in the case of global supply chains is an intriguing issue worth further exploration. This is also linked to the issues connected to the relation between the way incentives are presented and interviewee responses. In particular the selection of the procedure used to collect respondents statements may have significant implications on the validity of their answers. The fourth decision that needs to be taken is therefore the selection of the appropriate data collection means, i.e. telephone, e-mail, in-person interviews, etc.

The scale to be used by respondents for evaluating the incentives is a further issue that needs to be addressed when setting up a conjoint study in practice. Scales can be metric or non-metric. The most common methods used are rating scales, ranking scales and paired profile comparisons. In the first case respondents are asked to rate the perceived benefits obtainable from a bundle on a numerical scale, while with the ranking method they are asked to order the bundle propositions in terms of preferences. In paired profile comparisons, respondents are requested to choose between two stimuli and the rankings are then inferred afterwards.

A further set of important problems refers to data analysis once the date has been collected. The selection of the appropriate algorithm depends substantially on the preference model selected and the scale level of the preferences data collected. A large amount of literature has been devoted to the determination of inferences that is not here the right place to review. The aim of these techniques is that of estimating benefit values, and, through the part-worth utilities, determine which are the individual characteristics of a bundle that contribute to a specific set of preferences. Classic conjoint analysis methods make use of hierarchical cluster models that aim at grouping individuals on the basis of conditional reservation prices.

7.8 Product bundles and the issue of transaction costs

Clearly the discussions presented above on the optimality of bundles refer to techniques developed in the context of consumer behaviour studies. As mentioned it would not be difficult to reconsider the discussion and the methods present above in terms of cost preferences for the customer firm. Clearly we can picture every customer firm as very different from the other. The preference for a bundle or separate components and the decision to purchase or, more appropriately outsource, a certain service, is deeply rooted in the logistics strategy the company has adopted, and, in the end in its overall strategy.

Further reference to the measurement of the logistics performance of a firm and to the importance of fine-tuning its logistics decision with its logistics strategy are given later in this study, for the moment it is important to highlight the role of costs in the determination of different bundling strategies. Intuitively, in fact why would a firm have an interest in purchasing a bundle of, for example ocean transportation, on-carriage and pre-carriage, at a higher price, when it could purchase the various separate components independently at a lower price? The answer to this fundamental question is the fact that, as it has been shown above, bundles are not simply the result of a random combinatorial exercise. A successful bundle has a higher value in the eye of the firm, similarly to the case of a customer.

What determines the difference in value between a bundle and the purchase of the separate components is the knowledge that the logistics service provider offers in terms of efficiencies, ability to exploit economies of scope, reduction in negotiations time and costs, etc.—what we will refer to in the rest of the thesis as *transaction costs*—that transforms a set of products into a bundle, or, a group of logistics services, in a supply chain solution. The way each customer firm perceives its logistics transaction costs, or, even more fundamentally, the logistics necessities of the customer firm, will determine in the end the different customer profiles, that in consumer theory are represented by the distribution of reservation prices.

When logistics service providers analyse a product vertical or typify a certain type of customer firm, are essentially engaging in market segmentation. When they group together certain type of logistics services they are engaging in discrimination, in the same way and airline differentiates between business class tickets and last minute deals, and all the differences in between. The claim that logistics service providers, and hopefully also those associated with a shipping line, have not engaged in effective price discrimination, is actually not grounded. On the contrary they have managed to almost perfectly price discriminate, since they are required to acquire a deep understanding of the logistics demands of each and everyone of their customers.

7.9 Conclusions

The aim of this chapter was that of providing an overview of the available techniques that are used in practice to select optimal bundling strategies. Since most of the bundling literature has been developed in the context of consumer products, reference have been made in the chapter mostly to marketing techniques that have been specifically targeted for this purpose.

In particular the chapter elaborates on a set of propositions proposed by Stremersch en Tellis (2002) advancing optimal bundles proposition in the context of global supply chains based on the results of the survey presented in chapter 4. From the proposition it emerges that mixed product bundles appear to be the most appropriate bundling strategy for ocean transportation. The conclusions are necessarily general and, we argued, the accurate determination of optimal bundles would entail a more detailed study that could only be performed by a ocean carrier / LSP making use of its customer information and contacts.

For this purpose we provide an example of a study based on fictitious data that makes use of one of the most commonly techniques employed for bundling: conjoint analysis. The advantages and specific operational characteristics f conjoint analysis are presented also in this chapter. Reference is also made to an alternative approach that has been proposed in the determination of optimal bundles through liner optimisation. The chapter also presented the Hanson and Martin (1990) model and argued that further research would be beneficial in this area.

8 MEASUREMENT AND PERFORMANCE*

8.1 Introduction

This chapter is based on the consideration that in order to be able to make use of product bundling strategies ocean carriers need to have a very clear picture of where the cost advantages are in the supply chains where they operate. For this to happen they are required to have insight in the supply chains of their customers. This responds to two objectives, on the one side provide better information to their customers (visibility) on the other identify those cost savings opportunities that are at the basis of product bundling.

Liner shipping operators have traditionally dedicated particular attention to efficiency and cost control. This is not surprising as liner shipping is a capital-intensive industry, and cost related performance indicators such as vessel utilisation are of paramount importance. In particular, in market downturns, only those companies that manage advanced cost control practices are able to compete. Cost control and performance management are at the foundation of key carrier decisions such as whether to reduce sailing speed, restructure networks, reduce the number of available services or cut down human resources.

Container carriers' performance can be traditionally assessed through a large number of financial and operational indicators that allow management to evaluate the impact of management decisions and of changes in external factors. Typical measures are vessel utilisation, port delays and slot bookings. The selection of adequate performance measures is intrinsically connected to the overall strategy of the company and to its corporate values.

---

* This chapter is based on Acciaro and Liu (2009; 2010), Acciaro (2008*a*; 2010*a*).

The development of integrated logistics and the increasing involvement of carriers in terminal and hinterland transportation operations have broadened the scope of the activities of container carriers and have necessarily affected the evaluation of their performance. If on the one hand cost issues remain important, on the other hand the decision of providing logistics services as part of integrated logistics solutions requires broadening the management perspective to include a more conspicuous role of the customer service dimension. All major companies evaluate customer satisfaction, but very limited discussions at academic level exist on the topic in the context of ocean transportation.

This is rather surprising as so much attention has been paid in the literature to cost minimisation, network and vessel scheduling optimisation, optimal speed, optimal vessel size, the vessel bay plan problem and berth allocation problem—see for example Christiansen, Fagerholt and Ronen (2004; 2007) for a literature review for routing and scheduling problems—. This wide range of problems has been analysed in general with the use of operations research techniques that are particularly suited to limited resource allocation problems. It is clear that the approach taken in these studies is that of cost control and that, if they were to be translated into a management approach, these studies point in the direction of improvements in operational efficiency.

At the same time, a large corpus of literature has been developed on the increasing importance of supply chain integration strategies for container carriers. Although this is clearly a prolific research stream, the nature of the majority of the academic contribution is to describe *ex-post* the change that has been taking place in the liner industry and explain what factors have influenced the development of such strategies. Shippers and consignees increasingly require the responsibility for all logistic activities to be assumed by global supply chain specialists and logistics integration has become a common strategy of transport providers (Frankel, 1999*b*). Shipping lines seem to have been the most dynamic organisation in exploiting the advantages deriving from vertical integration (Notteboom and Merckx, 2006).

Globalisation of liner shipping has offered opportunities for total integrated management and operation of the supply and delivery chain (Frankel, 1999*b*). Heaver (2002*a*; 2002*b*) supports this perspective and indicates that there is an increase in vertical integration among shipping lines and logistics service providers. Haralambides and Acciaro (2009) explain the reasons behind vertical integration and discuss product bundling strategies in the liner sector. The development of logistics integration in liner companies is the subject of a paper from Midoro and Parola (2006), where the development of logistics activities within ocean carriers is framed in the overall development of the liner industry. The case of dedicated container terminals (Haralambides, *et al.* 2002; Soppé, *et al.* 2009) provides evidence of the theory underlying supply chain integration in the industry and is one of the few cases that has been discussed more in detail in the literature.

Notwithstanding the obvious importance in the academia of supply chain integration strategies in ocean transportation, limited academic contributions have tried to explain how supply chain integration can be incorporated in liner operation strategies and how carriers should modify their processes to view ocean transportation in the supply chain perspective and act accordingly. If the supply chain integration perspective is not included next to cost and financial control in the company performance assessment and benchmarked, it is difficult to understand how supply chain integration strategies can be successful in this industry.

Inclusion of the supply chain perspective in the company performance assessment requires the identification of representative key performance indicators (KPIs) in line with the overall company strategy. Examples of supply chain integration KPIs can be drawn from the supply chain integration literature and to a large extent can be easily adapted to the liner industry. In the literature in general, more than providing examples of specific KPI, academics have provided directions on how and why the supply chain perspective should be incorporated in the performance assessment processes. In a recent paper from Wong and Wong (2008), the authors review the existing literature on supply chain performance measurement and call for a more rigorous approach.

Also in this literature stream there is no reference to the liner shipping industry, but the framework in which supply chain integration is discussed is always that of a third party logistics service provider or that of a supply chain manager. This framework though is applicable to ocean carriers only to a certain extent as one of the distinctive features of a liner company is its reliance on ships as key asset to its business. As metrics drive behaviour, the identification of performance metrics and frameworks against which liner companies can benchmark is essential.

The chapter argues that for this to happen ocean carriers need to look beyond their traditional company boundaries, focusing on *transcorporate* performance measures that are characteristic of supply chains. This approach requires the modification of traditional performance measure indicators to include also transcorporate performance measures. This, it is argued, should not only take place at the carrier level, but also within the other members of the container supply chain, such as terminals, ports, hinterland transport providers, distributors, warehouses and third party logistics providers. The chapter aims in essence at explaining how carriers, and other members of the container supply chain, can make advantage of the cooperative nature of modern supply chains.

The chapter is structured as follows. The next section will introduce the concept of transcorporate performance measurement. Section 8.3 will discuss the traditional performance measures used in the liner shipping industry. Section 8.4 will dwell upon the importance of adopting a supply chain perspective in liner shipping and section 8.5 will discuss some suggestions on how this perspective should be implemented. The remainder of the chapter will focus on the application of transaction performance measurements to the port and terminal industry. Section 8.6

will explain why the adoption of this approach is particularly urgent. Section 8.7 will discuss the methods used generally to assess performance in terminals, while section 8.8 and 8.9 present the application of the supply chain perspective in these areas. The last section concludes and indicates further directions for research.

8.2 Transcorporate performance measurement

Every company has some form of measurement system. Companies can benefit from performance measurement in the following ways (Harbour, 2009):

- Determine where they are;
- Establish goals based on their current performance;
- Determine the gap between a set of desired goals and current performance levels;
- Track progress in achieving desired performance goals;
- Compare and benchmark performance measure against competitors;
- Control performance measurements within specified boundaries;
- Identify problem areas and possible problem causes;
- Better plan for the future.

In general, as companies are required by law to report financial key figures to authorities or shareholders, a large amount of financial key figures is available to management. Financial figures are often seen as synonymous of performance in the company and this can be true in a stable industrial environment, but could be questioned in a period of rapid change.

Performance measurements should be consistent with the goals of the organisation. As Sink and Tuttle (1989) point out, it is not possible to manage what is not measured. A framework for performance measurement should start therefore from the definition of the purpose of the measurement (Bredrup, 1995). In general performance metrics are developed around the three dimensions of performance:

- Achievement metrics – direct metrics for business achievement;
- Diagnostics metrics – indirect metrics for business achievement;
- Competence metrics – capabilities for future business achievement.

This traditional approach to performance measurement though has its limitations. Globalisation and the increasing expectations concerning customer service quality have forced companies to look beyond their organisational boundaries. The building of global alliances and partnerships (Womack, Jones and Ross, 1990) and the development of information and communication (ICT) technologies have enabled companies to improve their performance in a globalised world, but have also led companies to embed the transcorporate perspective in their management more urgently. This is particularly evident in the management and coordination of the company supply chains, that have increasingly become *transcorporate supply chains* (Hieber and Schönsleben, 2002).

The recognition of the importance of supply chain management in an organisation has contributed in expanding the focus of performance from internal measures to external or transcorporate measures. This is because, as Van Hoek (1998) clearly explains, "*the supply chain concept fundamentally changes the nature of organizations; control is no longer based on direct ownership and control, but rather based on integration across interfaces between functions and companies*" (pg. 187). Improper use of performance measurement systems and the lack of supply chain performance indicators can be a barrier to the implementation to transcorporate logistics concepts (Lee and Billington, 1992).

As Hieber and Schönsleben (2002) point out, the major difficulties in the development of performance measurements in the supply chain perspective are essentially the lack of performance metrics aiming at the trancorporate processes in logistics networks, and the lack of measures that address the combination of integrated and non-integrated indicators.

As far as the first point is concerned, most indicators are related to single activities and functions in the supply chain. In general it is not possible to simply add corresponding indicators of subsequent activities or functions in the network with the objective of joint optimisation. A joint approach is necessary in order to avoid piecemeal optimisation and to consider potential consequences in other points of the network (Bechtel and Jayaram, 1997).

With reference to the second difficulty, by providing to all supply chain members a combination of information, not only on their performances (non-integrated metrics) but also on the performance of the whole network (integrated metrics), each member can assess the overall competitiveness of the network as a whole while still being enabled to focus on improvement efforts for their own performance.

If only non-integrated metrics are in place, the result is the isolated optimisation of single segments of the entire network. This is likely to happen, especially because although network performance is a result of the actions of each network partner, each segment of the network is managed independently with its own performance indicators and optimisation objectives. The consequence will be isolated optimisation, which can be even counterproductive to overall performance of the network.

In general overall performance indicators are seldom in place and when the overall performance is measured, this is done in oversimplified and sometimes counterproductive (cost reduction based) terms (Handfield and Nichols, 1999). The lack of appropriate performance measurement has been cited as a major obstacle to effective collaboration in logistics networks (La Londe and Pohlen, 1996; Lee and Bilington, 1992).

In transport logistics, timely and accurate assessment of overall system performance as well as individual system component performance is of paramount importance. An effective performance measurement system provides a basis for understanding the system, influences behaviour throughout the system, and provides information regarding the results of system efforts to network members and outside stakeholders (Fawcett and Clinton, 1997)

Given the central role of ocean transportation in global supply chains and the key function that carriers play in the supply and distribution networks, the overall system performance cannot be complete without including the performance of the liner industry. In addition the key position of ocean transportation at the core of global supply chains grants ocean carriers a privileged position in observing and influencing the performance of the chains. Probably also for this reason, carriers have increasingly expanded their business scope to include supply chain management service provision and coordination. The importance of performance measurement in the container liner industry and in the port and terminal industries cannot be overstressed, as this is relevant not only for the industry itself but also for the global supply chain system.

8.3 Performance measurement in the liner industry

Traditionally, liner shipping performance has been measured by a variety of cost related indicators. This is not surprising given the large capital costs necessary to provide global regular ocean transportation services as well as the characteristics of demand for these services (Haralambides and Veenstra, 2000; Haralambides, 2007). Vessel utilization is one of the most important metrics employed in the industry since it provides managers with information on the actual use of capital employed and on the movement of demand. In addition the use of larger vessels delivers cost advantages (economies of scale) only under the condition that the vessels operate at level close to full operational capacity (Imai, *et al.* 2006).

Further metrics related to the utilisation of the vessel include sailing speed, port turnaround time, dry-docking overruns, numbers of accidents, mechanical failures, etc. All these metrics provide management with information on the utilisation of capital and in the end contribute to the fleet size decision.

A second set of metrics refers to variable costs. Typically managers will monitor fuel consumption and fuel prices, crew wages, insurance premiums, etc. Operational variable costs influence the decision on whether to operate the ship, at which speed and what margins can be obtained from a specific trade. The steep increase in fuel price in 2007 and 2008 made enormous impact on liner shipping and global trade. At over US$140 a barrel in June 2008, some trade observers even suggested that globalization was being hindered and trade patterns changed. High fuel prices can influence transport costs so much that these, and not tariffs or quotas, become the largest barrier to global trade. The industry reacted by reducing sailing speed and by sailing schedules reorganization. A 10% reduction in speeds can lead to 25% reduction in fuel consumption, but normally in order to maintain service frequency, more vessels needed to be added in the fleet.

A third set of metrics relates to the changes in demand. Vessel utilisation provides partially also information on demand fluctuations, but variables such as the number of bookings, or the type and size of containers demanded, the destination and information on the cargo transported provide better insight on demand characteristics and the customer base of the company.

The majority of international containerized cargo is transported by regular liner shipping services structured in networks. Therefore, the composition and structure of these networks is a determinant of the competitiveness of the company. Liner shipping connectivity includes the number of available services and the number of shipping lines operating direct services between pairs of destinations. The construction of more efficient routes and networks for the fleet is clearly a key challenge, since the ever-growing competition among carriers has squeezed the profit margin to a minimum level. A ship involves a major capital investment and its daily costs can easily amount to thousands of dollars. Therefore significant savings can be expected if routings are optimized.

Another set of metrics relates to the fleet container boxes. The shipping industry has witnessed an overwhelming growth in recent years mainly due to China's economic boom. If we take Asia-Europe trade as an example, greatly unbalanced cargo flows have generated significant number of empty containers. Container fleet size, container utilization and empty/full balances are hence other important performance metrics. In general container managers try to maximise the use of their container fleet, and reduce the number of empty moves.

The metrics described so far are traditional cost base metrics, but as already mentioned, ocean transportation can no longer be considered in isolated terms. Liner shipping should be viewed and evaluated as a part of a global supply chain system, which provides door-to-door seamless service from the suppliers to the end customers. Following this approach, liner shipping companies had to adjust to respond to this change.

Since the eighties, container shipping lines have been confronted with new challenges such as the rapid growth of containerized cargo volumes, heavier competition among carriers, demand by customers for greater reliability of container shipments at lower total door-to-door cost, port congestion and increasing environmental regulation and volatile bunker prices. All these challenges required shipping mangers to rethink their strategies and, consequently their performance assessment indicators.

One of the greatest issues that have emerged in recent years is that of schedule integrity. According to a survey conducted by Drewry Shipping Consultants in 2006 and data from Containerization International, 40% of the vessels deployed on worldwide liner services arrived one or more days behind their schedules. This causes difficulties with coordination at terminals and with hinterland transportation modes, it increases pressure on terminal operators and generates complains from the customers. Although strong variations were observed between different carriers and different liner trade routes, this seems to be a particularly relevant issue overall across the industry.

Schedule integrity has clearly an impact on liner costs, as clearly summarised by the former CEO of Piraeus Port Authority: "*the name of the game of all major container lines is their ability to meet their schedules, as they incur enormous costs in case they do not*" (Psaraftis, 2004: pg. 195). But it has even a more important impact on customer satisfaction given the centrality of time in transportation (Notteboom, 2006; De Langen, 1999).

Terminals have a crucial role to play in this context. It goes without saying that choosing the most efficient terminal operators guarantees better overall performance. At present, required terminal productivities of 120 TEU per ship per hour are no longer an exception, leading to high expectations both in terms of gantry crane availability and the speed of quayside operations. In addition, especially in those ports where congestion is more frequent, timely availability of space at berth can be a critical factor for the carrier competitiveness. The necessity of higher terminal performance and guaranteed space at berth has led shipping lines to acquire interests in terminals and engage in partnerships with terminals and ports (Haralambides, *et al.* 2002).

Increasingly, some ocean carriers have realised that their competitiveness lies in their ability to differentiate beyond the traditional boundaries of the liner shipping industry. For this reason many of them invested beyond the terminal into hinterland transportation and are able to provide, generally through sister companies, door-to-door integrated supply chain management solutions by and large (Heaver, 2002*a*; 2002*b*; Frémont, 2006; 2009).

8.4 The importance of the supply chain perspective in liner shipping

A first reason to proceed with the analysis of container carriers' performance from a supply chain point of view lies precisely in the increasing efforts that carriers have made in integrating along the supply chain; that was briefly discussed in the previous paragraph. In particular ocean carriers have been directing their integration efforts on terminals and hinterland transportation. Beginning with the transpacific trade-lane, aiming at securing access to their most important markets, carriers increasingly offer a variety of logistics activities that were previously not considered as core activities and naturally have been subcontracted (Cariou, 2008; Midoro, *et al.* 2005).

As David Lim, president of NOL, suggests[31], there are two basic models of liner shipping. On the one side there is the low cost option and on the other containers are treated as part of a packaged service. For the liner companies that operate under the second model, the challenge is to find ways to product differentiate in order to support premium pricing (Stopford, 2009).

As discussed by Stopford (2009), for those carriers aiming at service differentiation the following seven characteristics are likely to be relevant:

- Vessel on-time arrival;
- Transit time door-to-door;
- Carrier cost per move;
- Cargo tracking;
- Frequency of sailing;
- Reliability of administration;
- Space availability.

Being able to differentiate on the basis of these characteristics comes of course at a cost, and not all carriers are able or willing to pursue such strategy. The major issue for liner companies lies on whether customers would be willing to pay a premium for a better service and how to reconcile the customers requesting highly integrated services with those customers requesting low costs, typically for low-value, high-volume cargoes (Stopford, 2009).

The reasons for the increasing efforts to further integrate along the supply chain are manifold but rooted in the desire to efficiently coordinate supply chains whose complexity is continuously increasing and offer customers a single point for contracting. Panayides (2002) further assesses the pursuit of integration by applying a transaction costs approach. It is found that in industries with high levels of asset specificity, uncertainty, complexity, frequency with which transactions occur, integration is more likely to occur. It is argued, that the decision to integrate depends on whether a different governance structure would result in larger benefits in production and transaction costs. This is likely the case in the container industry, at least for high value commodities.

A more general reason for the development of a supply chain perspective in the evaluation of carrier performance relates to the fact that the assessment of the overall performance of the supply chain is connected with the ability of the system to progress in the future through benchmarking. This aspect is embedded in the *delivery, recovery and stewardship model* (DRS) developed by the Logistics Consulting Partners Ltd and is consistent with the *Plan, Do, Check, Act* (PDCA) framework originally formalised by Edward Demming and often referred to as Shewhart cycle (Braithwaite, 2007).

[31] As quoted in *Containerization International*, August 2006, pg. 32.

Benchmarking delivers better performance and is an essential tool for performance measurement (Rolstadås, 1995*a*; Fawcett and Cooper, 1998). Benchmarking techniques have been widely in use besides the evaluation of supply chain performance measuring results, and are common practice for shipping lines as well. Gillen (2001) advances the identification of best performers not only internally and historically, but on each step of the value chain and among companies.

8.5 Supply chain performance measurement in liner shipping

As already mentioned, the performance metrics predominantly employed by ocean carriers refer to cost control, such as vessel utilisation, fuel consumption, dry-docking overruns, accidents and mechanical failures. Beamon (1999) points out that the two major weaknesses of this type of approach relate to the lack of measurement of all pertinent aspects (inclusiveness) and ambiguous representation of costs.

As far as inclusiveness is concerned, considering the complexity and inter-firm dependencies within a supply chain, it is unlikely to find a one-fits-all-approach as the traditional cost-related measurement systems suggest. Lacking this quality, cost-related metrics may lead to misjudging the performance of the company, as inter- and intra-firm linkages are not considered. In addition, basing company performance solely on costs runs the risk of misrepresentation due to the various potentially distorting accounting practices.

To circumvent the above problems, Beamon (1999) suggests basing the supply chain performance system on three key pillars: resource measures, output measures and flexibility measures. Similarly Chan (2003) defines seven criteria to evaluate performance in the supply chain perspective: costs, quality, resources utilisation, flexibility, visibility, trust and innovativeness.

This approach has considerable implications on ocean carrier performance measurement. In fact next to traditional resources measures, output and flexibility are given substantial importance. Output-related measures may include metrics such as volumes transported, delay reduction, customer satisfaction and network growth, while among flexibility metrics one may list the ability of the company to accommodate customers request of changes in unloading port or destination, or mode of on-carriage. The number of metrics can be expanded in accordance to the suggestion of Chan to include quality metrics (damaged shipments, delays), or visibility (container traceability, information availability), or innovativeness (new and better ways to deliver competitive advantage to customers).

Visibility in particular is an important aspect in the definition of a performance measurement in the supply chain perspective. As Bartlet, Julien and Baines (2007) indicate, improving visibility may deliver substantial advantages to the supply chain performance. This relates to the case of container supply chain where the issue of visibility has been identified as one of the major challenges for ocean carriers[32].

Another approach that could be easily applied to liner shipping, suggests styling a performance measurement system according to the balanced scorecard (BSC) framework developed by Kaplan and Norton (1996). The basic idea of the balanced scorecard framework is to better and more effectively link the top-down strategic goals of the overall firm strategy with the objectives identified to be relevant by a bottom-up process. As such, the BSC propagates a balanced performance measurement system that takes into account various performance indicators from four different areas:

- Customer perspective,
- Business process perspective,
- Innovation and learning,
- Financial perspective.

By adopting this methodology for measuring supply chain performance, three main advantages can be distinguished (Gillen, 2001):

1. The interlocking nature of (maritime) supply chains is taken care of by focusing on effective intra- and inter-firm collaboration and integration;
2. Chances are increased that a balanced management approach is practiced along the supply chain and its partners;
3. It stimulates and is open for the creation of new firm or supply chain specific performance measures;
4. The advanced approach in measuring supply chain performance will focus management and employees on goals beyond the traditional supply chain performance measures.

Braithwaite (2007) suggests the use of the supply chain diamond reproduced in the figure on the next page and indicates that supply chain performance measurements should be built on the combined use of adequate metrics, balanced scorecards and the delivery, recovery and stewardship model framework presented before.

Braithwaite (2007) also indicates the following six key points to hold in focus when developing a supply chain management framework:

- No single measure defines supply chain performance – there are many dimensions to measure;
- Measures can be in conflict – accentuating rather than breaking functional differences;
- The need is to obtain balance throughout the supply chain and be prepared to change;

[32] See for further references and a definition of *visibility*, Francis (2008).

- Measuring the overall performance at input and output levels is a key first step to making improvements;
- This requires considerable investment in time and commitment;
- Measurement and its interpretations are valuable and difficult skills that organisations should develop and nurture.

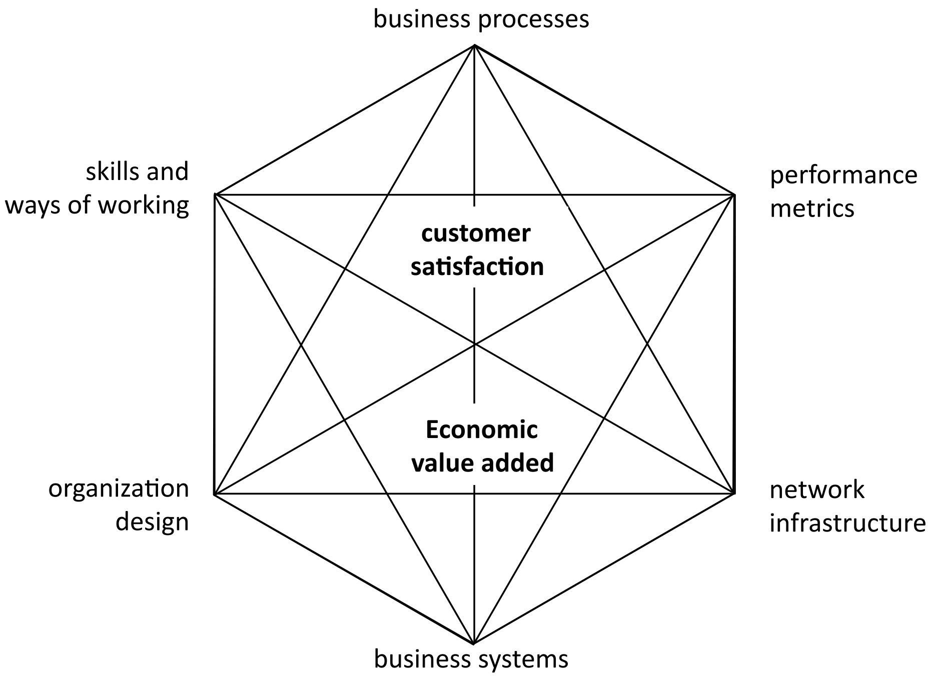


Figure 20: The supply chain diamond.

Source: Braithwaite (2007).

It should be noted that given the complex and nested intra firm processes of which today's supply chains are composed, the measurement of a company's performance in the supply chain perspective has to be multifold and may generate measurements that are conflicting (Beamon, 1999). This is particularly true for shipping lines, where the internal company processes may be directed towards objectives that differ from those of the supply chains where they operate. For example, in order to maximise vessels use, a carrier may decide to make concessions to schedule integrity instead of chartering in an additional ship. But for some shippers, schedule integrity is essential.

In addition, ocean carriers may connect to several networks at the same time, so that the role of the carrier in each network may translate differently and conflicting objectives may coexist. So for instance, a shipper dealing with fresh products may be more sensitive to time disruptions in the chain, than a shipper dealing with chemical products, or may value the provision of container traceability information from the carrier more than others.

Performance metrics then, if aiming at improving the overall performance of the supply chain, should be associated with the understanding of the role the carrier plays in the various supply chains it belongs to. This leads to the necessity of each carrier to understand and specialise on certain commodity verticals that are not only representative of a certain customer base, but provide the carrier with valuable insights to the characteristics of the supply chains they are active in.

On the basis of what was explained in the previous paragraph we can recommend two types of supply chain metrics for ocean carriers. On the one side we have intra-chain metrics that reflect the contribution the carrier delivers to each of the supply chains where it operates, or in other words the contribution to the achievement of the customer supply chain objectives. On the other side we can consider inter-chain metrics that refer to the ability of the carrier to respond to the requirements of all supply chains. The precise definition of the metrics depends on the company strategy but should embed concepts such as flexibility, innovativeness, visibility and customer satisfaction among others.

8.6 The issue of performance in ports and terminals

The recent slowdown in container traffic growth seems to have decreased the pressure on container terminals to increase capacity and rationalise the use of infrastructure. Nonetheless terminals are still striving to reach high performance levels. This is not only because customers demand it, but also because port capacity cannot be developed as rapidly as increases in demand (Haralambides, *et al.* 2002), overcapacity may be quickly exhausted and episodes of congestion may rise even in the most efficient terminals.

With larger vessel sizes becoming a common trait of the industry, it has been argued that the number of calls these ships will be able to make will be smaller (Cullinane and Khanna, 1999; Imai, *et al.* 2006). They will concentrate on a limited number of calls a larger number of containers, in turn impacting the berth and crane productivity of the terminal. The use of larger vessels is bound to have a cascading effect also on those terminals that are not suitable to berth very large container carriers, either for limitations in the availability of infrastructure or because they occupy a different position in the trades (i.e. feeder ports).

The expected increase in transhipment associated with larger vessel size, is likely to impact the terminals not only by means of requiring them to handle higher volumes in the same period of time, but also to reduce the variability of its operations (i.e. increase reliability) in order to guarantee seamless flows of cargo among transhipment ports and/or transhipment port and feeder ports (Gilman, 1999; Midoro, *et al.* 2005).

These changes take place in the context of ever increasing competition among terminals. As logistics and hinterland transportation develop further, shipping lines may be virtually indifferent between loading and unloading at certain terminals and try to secure capacity in various terminals to be able to maintain flexibility. Inefficient terminals lose rapidly their competitive edge, as slow terminal operations result in higher inventory costs and have repercussions on the entire supply chain (Heaver, 2002*b*).

As a consequence, shipping lines, logistics service providers and port authorities continuously assess the performance of the terminals they have or intend to have relations with. This is generally done on the basis of the variables observed by shipping lines (e.g. ship-to-shore productivity, crane productivity) or on the basis of the information the terminals supply directly.

This information provides also critical inputs for terminal managers. Key performance indicators (KPI) are useful tools to benchmark the performance of the terminal with respect to the past and its competitors. The selection of indicators to be collected is an important step in shaping a terminal management philosophy and it can substantially affect its performance.

These considerations become even more important considering the crucial position that terminals occupy in the supply chain. As containerisation provides the essential link for modern production systems, and terminals are central to containerisation, their role in the supply chain cannot be overstressed. This in turn increases the competitive pressure on terminals to improve the reliability of their operations. Terminals are expected to act as buffers and accommodate the requests of their clients (i.e. primarily shipping lines) concerning last minute schedule changes, delays, break of calls, yard storage, etc. (Notteboom, 2006).

This is the consequence of the indispensable role that supply chain management has acquired in modern production networks. In the network, cost reduction advantages deriving from relocating production processes can only be enjoyed as long as the supply chain supporting these processes is able to enrich them by delivering value. In fact supply chains work well when they are able to generate value and, consequently, terminals perform well when *they* are able to generate value in the supply chains they serve. As such, when assessing container terminal performance we should refer to the position the terminal occupies in the supply chain and to its ability to create value. The performance of the terminal should be seen in this perspective.

For this to happen, the chapter argues that a terminal performance paradigm in the supply chain perspective needs be based on a holistic approach, where next to the performance of the terminal sub systems, more attention is dedicated to the relations between the terminal and the other agents in the supply chain, as this is crucial and is what ultimately determines the ability of the terminal to generate value. These interactions can be measured by means of transcorporate performance metrics.

Since the terminal is only one of the agents involved in the supply chain, its ability to add value is constrained by the actions of the other agents in the supply chain. The actions of the other agents may be determined by the creation of value elsewhere in the supply chain networks, as some of them may be operating in different locations, and may be part of supply chains that are directly competing with those of a specific terminal. This can be a source of friction.

In order to overcome this friction, the chapter argues that one of the options is increasing supply chain visibility, so that the best paths in the network can be identified by all agents and terminal strategies can be adapted to best serve the supply chains where they operate. This is clearly a dynamic process, so that as soon as bottlenecks emerge (e.g. congestion, lack of capacity, lack of coordination, etc.), terminals and ideally also other supply chain agents can adapt to the new situation.

8.7 Container terminal performance

In the last thirty years the literature on efficiency and productivity measurement in the container terminal industry has become substantial. UNCTAD (1999) distinguished between two categories of performance indictors in the context of ports and terminals: macro performance indicators that focus on aggregate impacts of port activities and micro indicators that aim at quantifying input-output ratios. Among the micro indicators, notable are the contributions of UNCTAD (1976), UNCTAD (1983), De Monie (1987), Tongzon (1995), Talley (2007), Germanischer Lloyd and Global Institute of Logistics (2008), Ständer (2008). In particular the report of Germanischer Lloyd and Global Institute of Logistics (2008) refers to the Container Terminal Quality Indicator Standard (CTQI), recently developed to benchmark container terminal performance. The standard embeds in its assessment system, next to productivity and resource utilisation metrics, a component dedicated to service quality offered to the users of the terminal. Total and partial factor productivity approaches have been widely used in the terminal and port sector, most notably in the 80s. Some of the reference publications include UNCTAD (1976), Bendall and Stent (1987), Kim and Sachish (1986), De Monie (1987), Frankel (1991), as well as some more recent articles (Talley, 1994; Sachish, 1996; Fourgeaud, 2000; Talley, 2007; Bichou, 2007).

More recently the literature has focused on aggregate methods that aim at assessing container terminal performance by estimating directly or implicitly the container terminal production function. A first type of approaches makes use of the direct estimation of the production frontier through econometric techniques on the basis of cross sectional data. These techniques generally refer to stochastic frontier analysis (SFA) although the production function could also be estimated deterministically. In SFA the estimation of a production function through usual econometric techniques is extended to include two random terms, one capturing inefficiency and one the probabilistic nature of the estimation (Coelli, *et al*, 2005). The method has been used in the evaluation of container terminal efficiency quite extensively in the literature (Cullinane and Song, 2003; Cullinane, Song and Gray, 2002; Coto Millan, Banos Pino & Rodriguez Alvarez, 2000; Wang, Cullinane and Song, 2005; Trujillo and Tovar, 2007; Notteboom, Coeck and Van der Broeck, 2000). The advantages of the SFA is that it is a parametric method, able to handle irregular data sets and it takes into account the heterogeneity of the production function in the port sector. The major disadvantage is that is requires the statistical specification of the probability distribution on the error term.

A large portion of the literature has focused on frontier methods known as Data Envelopment Analysis (DEA). DEA estimates the efficiency of a set of production units relatively to the frontier. It does not therefore require the specification of the production function. This technique has been used quite extensively for port and terminal efficiency estimations (Roll and Hayuth, 1993; Martinez-Budria *et al*, 1999; Tongzon, 2001; Cullinane, 2003; Barros and Athanassiou, 2004; Wang *et al*, 2005; Wang and Cullinane, 2006; Cullinane *et al*, 2006; Cullinane, Song & Wang, 2005; Haralambides, *et al.* 2010; among others). The major advantages of this not parametric technique is that it does not require any probability assumption, it is rather flexible, it can easily account for a multiple inputs and outputs, it makes account of the heterogeneity of the production function and it can account for increasing, decreasing or constant returns to scale (Daraio and Simar, 2007). Major disadvantages thereof are that it does not provide any error measurements being deterministic in nature and is subjected to rather heavy bias from outliers. Wang, *et al.* (2005) provides a critical comparison of DEA with respect to other techniques, while Cochrane (2008) and De Koster, Balk and Van Nus (2009) highlight the implications of misusing the technique. A resent account of the advantages and disadvantages of DEA and SFA is presented in Haralambides, *et al.* (2010).

Although the importance of terminals and ports in the supply chain has become evident (Notteboom and Winkelmans, 2001*a*), few of the studies mentioned before have encompassed the supply chain dimension in the evaluation of container terminal performance. Before looking at these studies more in detail is expedient to briefly discuss the reasons for which framing terminal performance in the supply chain is becoming increasingly urgent.

8.8 Framing container terminal performance in the supply chain

In the previous parts the increasing role of shipping lines in integrated logistics as a consequence of the changes in the demands of shippers and consignees has been discussed. Ports and terminals on the contrary have only been reactive to the change (Notteboom, 2004*b*; Slack, Comtois and Stelmo, 1996). The further involvement of ports in logistics, so that they could virtually become transport solution providers, envisaged for example by UNCTAD (1999) in its discussion on the *fourth generation ports*, does not seem to have materialised yet. Marlow and Paixão Casaca (2003) as well as Mangan, Lalwani and Fynes (2008) have indicated the opportunities that could accrue to ports from a better understanding of their role in logistics.

Robinson (2002) proposed an analytical paradigm where ports are seen as elements in the value-driven supply chain. Although enticing, this new paradigm is far from having become the common perspective. Robinson (2002) argues that shippers and logistics service providers do not compare transport services alone but compare supply chains. As a consequence freight moves in particular logistics pathways served by particular firms because these firms are able to create and sustain competitive advantage (Robinson, 2002). Ports and terminals have naturally a competitive advantage, as they possess a valuable position in the supply chain (Robinson, 2002). In order though to fully benefit of the position, they should proactively seek to sustain competitive advantage through value added creation.

The increasing centrality of supply chain thinking impacts terminals directly and therefore terminal managers and port authorities cannot ignore the change (Slack, *et al.* 1996). This change can be traced in the following trends:

- the development of dedicated terminals;
- the participations of shipping lines and other chain agents in terminal joint ventures;
- the integration among logistics service providers, hinterland transport service providers, ocean liners and feedering service providers;
- the integration of distribution networks;
- the inclusion of performance conditions in terminal lease contracts;
- the increased dependency of terminals and shipping lines on larger customers;
- the increasing role of terminals as buffers;
- the necessity to increase responsiveness in the supply chain.

From the list above it is clear that container terminals and ports are not the drivers of change. By passively reacting to the change, they are unable to entirely benefit from the valuable position that they naturally have on the supply chain (Slack 1993).

The shift towards the supply chain perspective is particularly urgent also because the interfaces between the terminal and the other modes have become the greatest bottlenecks in the system. Most modern terminals are able to move a container out of the terminal within hours from unloading, while terminal yards act as buffer for those containers that have to wait for a full train to be loaded or for the trucks to pick them up. Although internal processes of container terminals are efficient, difficulties arise with the interfaces (hinterland and sea) of transportation. If those inefficiencies are not properly monitored, even the most efficient terminals may be constrained in their ability to deliver value to their customers.

It is widely recognised that performance measurement should be closely related to the goals of an organisation, since effective management requires accurate measurement (Sink and Tuttle, 1989). Nonetheless, it should be noted that this is rarely the case for ports and terminals as far as their position in the supply chain is concerned. Bredrup (1995) explains that the first step in determining a framework for performance measurement is selecting the purpose of the measurement, and this should be done consistently with the organisation's strategy. As metrics drive behaviour, failing to synchronise strategy and performance evaluation, may hinder management or harm the organisation. The measurement of terminal and port performance in a supply chain perspective is therefore central, if ports are to become the agile organisations envisaged by Marlow and Paixão Casaca (2003).

A more general reason for the development of a supply chain perspective in the evaluation of terminals refers to the fact that the assessment of the overall performance of the supply chain is connected with the ability of the system to progress in the future. This aspect is consistent with the delivery, recovery and stewardship model (DRS) and the *Plan, Do, Check, Act* (PDCA) framework previously mentioned (Braithwaite, 2007). Benchmarking delivers better performance and is an essential tool for performance measurement (Rolstadås, 1995*a*; 1995*b*; 1998; Fawcett and Cooper, 1998). Benchmarking techniques have been widely used besides the evaluation of supply chain performence measuring results, and are common practice for terminal managers as well. Gillen (2001) suggests the identification of best performers not only internally and historically, but on each step of the value chain and among companies. As observed by Bichou (2007), port performance focuses largely on competitive benchmarking but rarely against other direct product competitors, and process benchmarking or generic benchmarking are entirely ignored in the port literature.

The reasons for which many ports are not yet able to exploit entirely their valuable position in the supply chain cannot be entirely addressed here. Nonetheless one of the main reasons relates to the difficulty that port managers and terminals have in identifying and measuring their performance in the supply chain. A recent survey (Bichou and Gray, 2004) observes that more than half of the port interviewed, hardly ever uses logistics techniques to assess their performance, if at all, although a large part of the respondents recognised the importance of evaluating logistics performance.

It is surprising that although there is general agreement over the importance of the supply chain position for ports and terminals, very little is proposed in the literature to evaluate the performance of terminals and ports in the supply chain perspective. The identification of performance metrics and frameworks against which terminals can measure themselves, is essential and is not an issue to be easily resolved.

The evaluation of performance in the context of the supply chain does not involve only terminal operators. Supply chains are increasingly becoming cooperative (Thomas and Griffin, 1996; Hoyt and Huq, 2000) and coordination among the various segments of the chain have turned out to be one of the major challenges for sea-ports (Van der Horst and De Langen, 2008). The understanding of the performance of each supply network member can be greatly improved if the performance of the other members is also analysed. In particular it can be envisaged that terminals, carriers, third party logistics operators and port authorities all have a role in the performance of a chain, or in other words, in delivering value to the supply chain users. This defines in the end the value-delivery framework where the terminals operate. The performance of terminals within the supply chain, need to be enriched by transcorporate metrics, since the value delivery of the terminal is constrained by the actions of other network members.

There are to date few major contributions in the literature that aimed at framing the performance of container terminals in the supply chain. Marlow and Paixão Casaca (2003) advocate the inclusion of the following variables as outputs in the evaluation of container terminal effectiveness, where with the term effectiveness they indicate the ability of a port to act as an effective link:

- Timeliness in picking up and delivering shipments;
- Reliability of transit time/ transport availability;
- Responsiveness of transport suppliers in meeting customers' requirements;
- Adaptability of existing processes to customers' requirements;
- Flexibility of operations;
- Accuracy of information regarding status of shipment;
- Accuracy in processing information;
- Compliance with customers' requirements;
- Value for money;
- Notification of any changes in the multimodal process;
- Level of damage to the shipment;
- Overall transport costs;
- Lead-time to service delivery;
- Level of conflict with other processes;
- Employees' interaction with customers.

With respect to the terminal's role in the supply chain, Bichou and Gray (2004) develop a model that attempts at identifying linkages between the port and its various stakeholders within the supply chain. They distinguish between internal and external drivers of change that integrate into a port management system. Core management and operational functions are being centred in a performance management system, which is linked through key performance indicators to the port management system and thus forms an integral part of the model.

The various indicators defined by Bichou and Gray (2004) are used for measuring the performance of container terminals:

- Physical indicators: usually time measures and mainly concerned with the ship (turn around time, waiting time, berth occupancy rate, etc.)
- Factor productivity indicators: labour and capital required to unload a ship.
- Economic and financial indicators: total income related to gross registered tons (GRT), operating surplus per twenty foot equivalent unit (TEU)

The concluding remark of their research highlights the vast potential, especially for ports, that lies in the application of a performance measurement system that integrates well into the supply chain as a whole.

The article of Bichou (2007) expands some of the conceptualizations of Bichou and Gray (2004). This contribution provides a review of container terminal performance measurement and discusses in detail the advantages and limitations of the various approaches to port efficiency. Bichou also proposes a coherent supply chain framework based on channel management concepts, and distinguishes, in the case of ports, among logistics, trade and supply channels. The metrics that can be identified in this perspective are more integrated as they allow direct port operations and value-adding logistics activities. The integrated framework he advances links the logistics and supply chain channels, where benchmarking is actively employed to evaluate and improve performance.

A complementary way of approaching the supply chain perspective could refer to the concept of transcorporate performance measurement advanced by Lee and Billington (1992) among others.

8.9 The supply chain perspective

The measurement of an organisation's performance in the supply chain perspective has to be multifold and may generate measurements that are conflicting (Beamon, 1999). This is particularly true for terminals, where the internal terminal processes may be directed towards objectives that differ from those of the supply chains where the terminal operates. For example, in order to maximise the use of the terminal yard, a terminal may decide to introduce penalties for container exceeding a certain dwell time. But for some logistics operators, maintaining the container at the terminal may respond to a specific logistics strategy. Ideally, the terminal, most likely jointly with the port authority should strive to find a solution, e.g. a transferium or a hinterland container deposit.

Furthermore, terminals may be part of several networks at the same time, so that the role of the terminal in each network may translate differently and conflicting objectives may coexist. So for instance, a shipper dealing with fresh products may be more sensitive to time disruptions in the supply chain than another shipper, who may value the provision of certain information from the terminal more than another shipper. Terminal metrics, if seen as aiming at improving the overall performance of the supply chain, should therefore be associated with the understanding of the role the terminal plays in the various supply chains. This leads to the distinction between intra-terminal, intra-port and *intra*-chain metrics on the one side and *inter*-chain metrics on the other.

Intra-terminal metrics (e.g. crane performance, berth utilisation, resources utilisation, cost-based metrics) reflect the contribution the terminal delivers to the achievement of the internal objectives of the terminal, intra-port metrics (e.g. customer service, value added, connectivity, total costs analysis, employment) reflect the contribution that the terminal delivers to the port objectives and intra-chain (e.g. customer service, value added, flexibility, reliability) the contribution that the terminal delivers to each of the supply chains where it operates. *Inter*-chain metrics will refer to the ability of the terminal to respond to the requirements of the supply chain networks it belongs to, i.e. multiple supply chains.

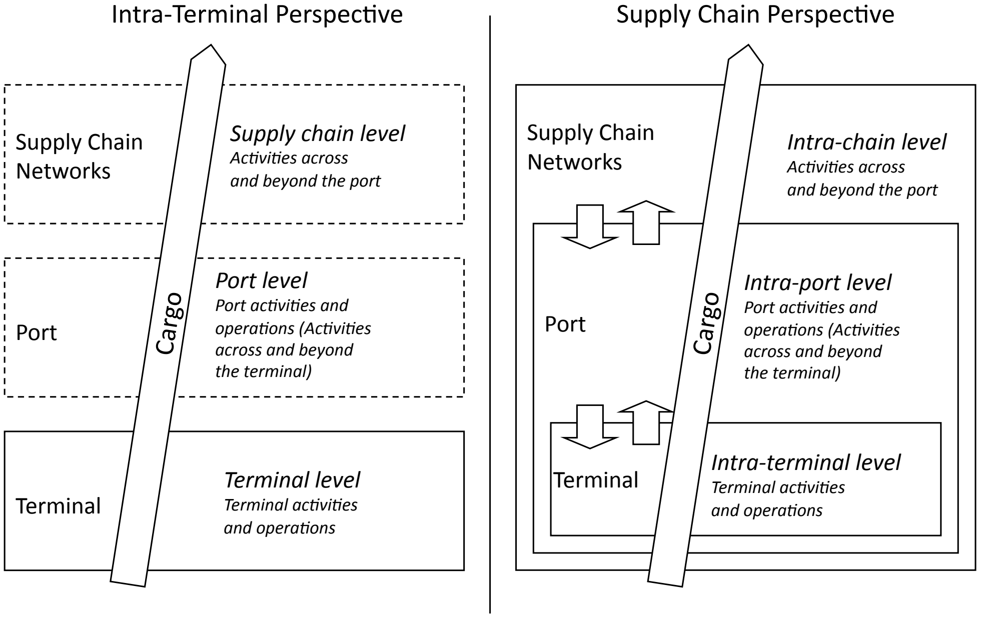


Figure 21: Transcorporate performance measures.

Source: Author.

Neglecting the intra-port, intra-chain and the inter-chain dimensions not only has effects on the supply chain where the terminal operates, but also on the terminal internal processes. The performance metrics predominantly employed in terminals can be classified as cost-related indicators (operating costs, crane utilization, berth productivity, etc.) and a combination of cost and customer responsiveness measures (dwell time, yard utilisation, ship turnaround time, etc.). Those measures are either maximised or minimised depending on overall firm strategy and operational capabilities. Beamon (1999) points out that the two major weaknesses of this approach are related to the inclusiveness[33] and ambiguous representation of costs.

As far as inclusiveness is concerned, considering the complexity and interfirm dependencies within a supply chain, it is misleading to search for one-fits-all-approaches of the kind of what the traditional cost-related measurement systems advocate. Cost-related metrics may lead to optimizing the performance of the terminal sub processes only, losing sight of the inter- and intra-firm linkages. Furthermore, basing the terminal performance solely on cost runs the risk of misrepresentation due to the various potentially distorting accounting practices. The different terminal operating systems may impact the universality attribute, while issues connected with measurability and consistency are self-evident.

A possible solution to this type of problems is offered by Beamon (1999) and Chan (2003) when they suggest basing supply chain performance systems on a broader set of measures and criteria. This approach, that has been presented already in section 8.5, seems applicable also to terminals. The application of the BSC framework developed by Kaplan and Norton (1992; 1996) and also discussed in section 8.5 for ocean carriers, could also successfully be applied to terminals. All these approaches, as clearly discussed by Braithwaite (2007), could be integrated in the supply chain diamond reproduced in figure 20 and discussed above. This framework appears appropriate also for terminals if they are to acquire a more active position within the supply chain.

Another important aspect in the definition of a performance measurement in the supply chain is the account of visibility. As Bartlet, *et al.* (2007) indicate, improving visibility may deliver substantial advantages to the supply chain performance. This relates to the case of container supply chain where the issue of visibility has been indicated in recent years as one of the major challenges for container terminals, defined as 'the black holes' of the container supply chain (Ständer, 2008).

[33] A terminal performance measurement system, like any other performance measurement in general, should be characterized by the following attributes (Beamon 1999):
- inclusiveness (measurement of all pertinent aspects),
- universality (allow for comparison under various operating conditions),
- measurability (data required are measurable),
- and consistency (measures consistent with organization goals).

8.10 Conclusions: the way forward

The chapter argues that ocean carrier performance should also be viewed in the context of the supply chain. Ocean transportation is a subsystem within the supply chain and as such performance should not be limited to the evaluation of its internal processes. As mentioned in the previous paragraphs it is the performance of the entire chain that really matters. If the supply chain performs well, i.e. creates value, then it will be chosen and as consequence also the carrier will be chosen. As the supply chain is as strong as its weakest link, a carrier may be extremely efficient in its operations, but if terminals, or hinterland transport providers do not provide adequate levels of service, or the access roads to the port are congested, this will impact the ability of the chain to create value and in essence also the competitiveness of the carrier.

The focus on the supply chain is requested also by the fact that the performance of each link is influenced by the performance of the other links. As such the performance of a liner company is affected by the performance of a terminal and in turn, the performance of the container terminal is affected for example by inefficient trucking, or inefficient port policy. The cooperative nature of supply chains requires a different approach to performance, where, next to traditional intra company measures, also inter chain metrics should be monitored and analysed.

This of course raises particular challenges for the supply chain operators, as cooperation among the various stakeholders becomes then a fundamental prerequisite for the implementation of efficient supply chain strategies. From the side of the carriers, in particular of those that chose to provide third party logistics services, investment in ICT and in improving supply chain visibility should be on top of their development strategies. But this of course cannot and should not be done independently.

In the chapter we propose next to the use of traditional cost based performance metrics, intra- and inter-chain performance metrics. This approach is consistent with the supply chain diamond and transcorporate performance measurement recommended by Hieber and Schönsleben (2002) for the evaluation of the supply chain system performance. In addition we postulate the applicability of the balance scorecard framework for ocean carriers.

The evaluation of performance in the context of the supply chain does not and cannot involve only ocean carriers. Supply chains are increasingly becoming cooperative (Thomas and Griffin, 1996) and therefore the measurement of the performance of each stakeholder depends to a large extent on the performance of other stakeholders. In particular it can be envisaged that ocean carriers, shippers, terminals, third party logistics operators and port authorities all have a role in the performance of a chain. This defines the value-delivery framework where they operates, and although the performance of carriers within the supply chain is constrained by the actions of other actors, it should still be possible to assess the value-delivery of each chain and of each component of the chain.

We recommend further study of the performance measurement systems actually used by shipping lines. This would contribute to a better understanding of what motivates ocean carriers to invest in logistics and provide useful contribution to improve the performance of supply chain systems. Further study should be carried out on the perspective used in the performance measurement of other chain components, such as terminals and port authorities. Some studies (Bichou and Gray, 2004; Bichou, 2007; Marlow and Paixão Casaca, 2003) recommend the implementation of the supply chain perspective also in the case of port and suggest that the issue discussed in the chapter are relevant and still open.

Terminals performance should be reframed in the context of the supply chain. The terminal is a subsystem within the supply chain and as such performance should not be limited to the evaluation of its internal processes. As mentioned in the previous paragraphs it is the performance of the entire chain that matters. If the supply chain performs well, i.e. creates value for its users, also the terminal will prosper. As the supply chain is as strong as its weakest link, a terminal may be extremely efficient in its operations, but if its hinterland does not provide adequate levels of service, or the access roads to the terminal are congested, this will impact the ability of the chain to create value and in turn the competitiveness of the terminal.

The various frameworks proposed in the literature are legitimate in providing adequate estimations of container terminal performance, as long as the supply chain focus is also included in the analysis. The focus on the supply chain requires a different approach to performance where quality indicators are juxtaposed to costs and resource utilisation metrics. In particular at the intra- and inter-chain level, customer service, value creation, flexibility, reliability and visibility become crucial. At the intra- and inter port level, responsiveness, connectivity, employment and local effects should also be monitored. This approach has as a consequence an increased focus on intangible investment such as ICT, information visibility and ability to monitor the chain, with respect to infrastructure.

The traditional approaches based on costs and efficiency indicators fail to appreciate the complexities of supply chains. More advanced approaches identify performance indicators that are more inclusive and cater for the special characteristics of a supply chain by applying a holistic evaluation methodology. These advanced approaches have positive effects on the terminal internal processes, as studies on the BSC and DRS seem to indicate, since performance measurement is a defining component of good management and metrics drive behaviour.

In general in the case of terminals, three major sets of recommendations can be made. Firstly, it seems imperative to proceed with the setting up of standards for terminal performance and benchmarking in order to harmonise and be able to compare information. In particular more information on the different types of cargo flows at the terminal would help targeting operations to better serve the chain. This, in association with further data transparency and data harmonisation, would contribute improving the quality of terminal performance metrics. Secondly a change in perspective from the side of terminals and port operators is required, in order to fully develop terminal potentials as elements in the supply chain. This requires more focus on time metrics, added value and customer service. Thirdly, further research would be useful in this area. In particular the creation of a task force on the issue and the formulation of clear analytical frameworks would be very useful.

9 Strategic Bundling*

9.1 Introduction

The issue of bundling has been addressed in the industrial organisation literature as a strategic device to better control consumers and gain market control. Although the results of this stream of research are still controversial in the case of oligopoly, we assume the possibility of strategic advantage a reason good enough to investigate the issue further. The approaches used to model this type of strategic interactions are generally based on game theory. This is also the approach decided below, notwithstanding the conceptual difficulties that the use of game theory models imply in the case of applied industry examples.

This chapter presents two game theory models aiming at formalising the strategic interactions that could contribute explaining the carrier motivation to engage in bundling.

9.2 Bundling decisions in oligopoly with linear demand functions

The thesis uses a simple game theory approach, based on Economides (1993), in an attempt to formulate a strategic decision process that could lead to the provision of a bundle. The major differences with the model of Economides (1993) is that the game here is a single stage game, for, in the specific context under analysis, the *a priori* decision of a carrier not to provide bundles is unrealistic and, in any case, the focus of the present model is limited to those carriers that do provide bundles (*exclusive liner companies* are kept out from the analysis). In addition, we introduce a parametric representation, in order to distinguish among the different abilities of

* This chapter is based on Acciaro and Haralambides (2007) and Haralambides and Acciaro (2010).

carriers and shippers in providing the bundle. These parameters, which we will refer to as transaction costs, in reality summarise the differences among carriers in performing integrator tasks. The latter are seen as a function of the carrier's marketing ability; the resources dedicated to logistics; production efficiency; or the carrier's bargaining power. The disadvantage of those extensions is that calculations become tedious and formulas less elegant[34].

We can simplify the analysis by assuming that each transaction is the result of a game between two carriers, *C1* and *C2*. The supply chain is assumed to consist of two components, ocean transportation (*O*) and a logistics service (*S*). The services are provided by the two carriers either on their own or as a bundle.

The bundle can be provided by *C1* either by assembling its own services, or combining one of his own services with the services provided by his competitor. Naturally every service implies a cost, but in the analysis here the technical costs of producing the two services have been kept out, as they would make it impossible to obtain (analytically) equilibrium.[35]

In addition, if the shipper does not buy the bundle from either carrier but buys only the separate components instead (eventually by the same carrier), she is penalized by an additional cost component (t_S) deriving from the transaction costs of assembling the bundle herself. Analogously, the carriers have to bear their own transaction costs when providing the bundle (t_1 and t_2 respectively).

Implicitly we are assuming that if the carriers diverge in their ability to provide the bundle, the difference in the bundle prices will also increase, while the difference in the price of the individual components will be proportionally reduced. In other words, the ability of each carrier in providing the bundle is reflected in the price charged to the consumer.

The game can be thought of as a single stage game, where the players (the carriers) decide a set of prices for the bundle and the unbundled services. Following are the possible situations in the game:

1. The shipper buys the bundle either from *C1* or *C2*;
2. The shipper buys the services separately;
3. The shipper buys ocean transportation from *C1* and the logistics service from *C2*;
4. The shipper buys ocean transportation from *C2* and the logistics service from *C1*;
5. The shipper buys both ocean transportation and logistics from *C1*, but does not buy the bundle;
6. The shipper buys both ocean transportation and logistics from *C2*, but does not buy the bundle;

[34] In what follows, we acknowledge use of Wolfram's *Mathematica*.
[35] The impact of introducing costs on the competitive outcome is reserved for a forthcoming paper.

Let's now define the set of strategies available to *C1* and *C2*, given the set of coefficients, t_S, t_1, t_2. The strategy for the carriers is defined as the set of prices $P_i = \{r_i; o_i; s_i\}$, $i=1,2$.

Given a set of prices, $P_i = \{r_i; o_i; s_i\}$, a demand system is next required on order to determine the payoffs of the players. Assuming a linear demand in $(r_i; o_i; s_i)$, we can express the demand system as:

$$D(B_1) = a - br_1 + c(o_1 + s_1) + d(o_1 + s_2) + e(o_2 + s_1) + f(o_2 + s_2) + g(r_2)$$
$$D(B_2) = a - br_2 + c(o_1 + s_1) + d(o_1 + s_2) + e(o_2 + s_1) + f(o_2 + s_2) + g(r_1)$$
$$D(N_{1,1}) = a - b(o_1 + s_1) + c(o_1 + s_2) + d(o_2 + s_1) + e(o_2 + s_2) + f(r_1) + g(r_2)$$
$$D(N_{1,2}) = a - b(o_1 + s_2) + c(o_1 + s_1) + d(o_2 + s_1) + e(o_2 + s_2) + f(r_1) + g(r_2)$$
$$D(N_{2,1}) = a - b(o_2 + s_1) + c(o_1 + s_1) + d(o_1 + s_2) + e(o_2 + s_2) + f(r_1) + g(r_2)$$
$$D(N_{2,2}) = a - b(o_1 + s_2) + c(o_1 + s_1) + d(o_1 + s_2) + e(o_2 + s_1) + f(r_1) + g(r_2)$$

The demand system is similar to the one used by Economides (1993)[36], with the difference that in this case it has been adapted to a single stage game, where the prices of the bundle and the separate components are set simultaneously.

In general we will have $b > c + d + e + f + g$, so that an increase in the prices of all six systems will decrease the demand for each system. Without loss of generality we can assume $c = d = e = f = g$. If we also consider the shippers transaction costs t_S, the demand system becomes:

$$D_{B1} = a - br_1 + c(2o_1 + 2s_1 + 2o_2 + 2s_2 + r_2)$$
$$D_{B2} = a - br_2 + c(2o_1 + 2s_1 + 2o_2 + 2s_2 + r_1)$$
$$D_{N11} = a - b(o_1 + s_1) + c(o_1 + s_1 + 2o_2 + 2s_2 + r_1 + r_2) - t_S$$
$$D_{N12} = a - b(o_1 + s_2) + c(o_1 + 2s_1 + 2o_2 + s_2 + r_1 + r_2) - t_S$$
$$D_{N21} = a - b(o_2 + s_1) + c(2o_1 + s_1 + o_2 + 2s_2 + r_1 + r_2) - t_S$$
$$D_{N22} = a - b(o_2 + s_2) + c(2o_1 + 2s_1 + o_2 + s_2 + r_1 + r_2) - t_S$$

For the carrier i $(i = 1,2)$, the payoff will be defined as the difference between the price obtainable from selling the individual services at price (o_i, s_i) or the bundle (r_i), and the cost of assembling the bundle (t_i).

[36] As rightly pointed out for example in Liao and Taumann (2002), liner demand systems have some undesirable characteristics. A refinement of the analysis will be presented in a forthcoming paper.

The payoff (profit) functions for *C1* and *C2* are given by:

$$\pi_1 = (r_1 - t_1)\, D_{B1} + (o_1 + s_1)\, D_{N11} + o_1\, D_{N12} + s_1\, D_{N21}$$
$$\pi_2 = (r_2 - t_2)\, D_{B2} + s_2\, D_{N12} + o_2\, D_{N21} + (o_2 + s_2)\, D_{N22}$$

The non-cooperative equilibrium is characterized by the following conditions:

$$\partial\pi_1 / \partial r_1 = D_{B1} + (r_1 - t_1)\, D'_{B1} + (o_1 + s_1)\, D'_{N11} + o_1\, D'_{N12} + s_1\, D'_{N21} = 0$$
$$\partial\pi_1 / \partial o_1 = (r_1 - t_1)\, D'_{B1} + D_{N11} + (o_1 + s_1)\, D'_{N11} + D_{N12} + o_1\, D'_{N12} + s_1\, D'_{N21} = 0$$
$$\partial\pi_1 / \partial s_1 = (r_1 - t_1)\, D'_{B1} + D_{N11} + (o_1 + s_1)\, D'_{N11} + o_1\, D'_{N12} + D_{N21} + s_1\, D'_{N21} = 0$$

$$\partial\pi_2 / \partial r_2 = D_{B2} + (r_2 - t_2)\, D'_{B2} + (o_2 + s_2)\, D'_{N22} + o_2\, D'_{N21} + s_2\, D'_{N12} = 0$$
$$\partial\pi_2 / \partial o_1 = (r_2 - t_2)\, D'_{B2} + D_{N22} + (o_2 + s_2)\, D'_{N22} + D_{N21} + o_2\, D'_{N21} + s_2\, D'_{N12} = 0$$
$$\partial\pi_2 / \partial s_2 = (r_2 - t_2)\, D'_{B2} + D_{N22} + (o_2 + s_2)\, D'_{N22} + o_2\, D'_{N21} + D_{N12} + s_2\, D'_{N12} = 0$$

This, simplified, leads to the following system of equations:

1) $\partial\pi_1 / \partial r_1 = 4c\, o_1 + 2c\, o_2 - 2b\, r_1 + c\, r_2 + 4c\, s_1 + 2c\, s_2 + a + b\, t_1 = 0$
2) $\partial\pi_1 / \partial o_1 = 4(c - b)\, o_1 + 4c\, o_2 + 4c\, r_1 + 2c r_2 + 2(3c - b)\, s_1 + (3c - b)\, s_2 + 2(a - t_S - c\, t_1) = 0$
3) $\partial\pi_1 / \partial s_1 = 2(3c - b)\, o_1 + (3c - b)\, o_2 + 4c r_1 + 2c\, r_2 + 4(c - b)\, s_1 + 4c\, s_2 + 2(a - t_S - c\, t_1) = 0$

1’) $\partial\pi_2 / \partial r_2 = 2c\, o_1 + 4c\, o_2 + c\, r_1 - 2\, b\, r_2 + 2c s_1 + 4\, c\, s_2 + a + b\, t_2 = 0$
2’) $\partial\pi_2 / \partial o_2 = 4c\, o_1 + 4(c - b) o_2 + 2c r_1 + 4c r_2 + (3c - b) s_1 + 2(3c - b) s_2 + 2a - 2\, c\, t_2 - 2t_S = 0$
3’) $\partial\pi_2 / \partial s_2 = (3c - b) o_1 + 2(3c - b) o_2 + 2c\, r_1 + 4c\, r_2 + 4c\, s_1 + 4(c - b)\, s_2 + 2a - 2c\, t_2 - 2t_S = 0$

From the comparison of equations 2, 3, 2’ and 3’ we know that one equilibrium is given by $o_1 = s_1$ and $o_2 = s_2$.

Solutions are r_1, r_2, o_1,o_2, s_1, s_2:

$$r_1 = \frac{7a}{(14b - 55c)} + \frac{\left[c(35b - 88c)\, t_2 - (352bc - 352c^2 - 70b^2)t_1\right]}{(14b - 55c)(10b - 11c)} - \frac{24c}{(14b - 55c)(b + c)} t_S$$

$$r_2 = \frac{7a}{(14b - 55c)} + \frac{\left[c(35b - 88c)t_1 - (352bc - 352c^2 - 70b^2)t_2\right]}{(14b - 55c)(10b - 11c)} - \frac{24c}{(14b - 55c)(b + c)} t_S$$

$$o_1 = s_1 = \frac{4a}{(14b - 55c)} + \frac{2c\left[3(4b - 11c)t_2 - 2(b - 11c)\, t_1\right]}{(14b - 55c)(10b - 11c)} - \frac{2(2b - c)}{(14b - 55c)(b + c)} t_S$$

$$o_2 = s_2 = \frac{4a}{(14b - 55c)} + \frac{2c\left[3(4b - 11c)\, t_1 - 2(b - 11c)t_2\right]}{(14b - 55c)(10b - 11c)} - \frac{2(2b - c)}{(14b - 55c)(b + c)} t_S$$

From this we can work out the prices of the unbundled services observed by the shippers:

$$o_1 + s_1 = 2o_1 = 2s_1 = \frac{8a}{(14b - 55c)} + \frac{4c\,(3(4b - 11c)\, t_1 - 2(b - 11c)\, t_2)}{(14b - 55c)(10b - 11c)} - \frac{(2b - c)}{(14b - 55c)(b + c)} t_S$$

$$o_2 + s_2 = 2o_2 = 2s_2 = \frac{8a}{(14b - 55c)} + \frac{4c(3(4b - 11c)t_2 - 2(b - 11c)t_1)}{(14b - 55c)(10b - 11c)} - \frac{(2b - c)}{(14b - 55c)(b + c)} t_S$$

$$o_1 + s_2 = o_2 + s_1 = \frac{8a}{(14b - 55c)} + \frac{2c\,(t_1 + t_2)}{(14b - 55c)} - \frac{4(2b - c)}{(14b - 55c)(b + c)} t_S$$

The difference $(r_1 - r_2)$ is linear in t_1-t_2 and is given by:

$$r_1 - r_2 = \frac{5b - 8c}{10b - 11c}(t_1 - t_2)$$

While the difference $(o_1 - o_2 = s_1 - s_2)$ is given by:

$$o_1 - o_2 = s_1 - s_2 = \frac{-2c}{10b - 11c}(t_1 - t_2)$$

These differences comply with the assumption of the model that if the companies diverge in their ability to provide the bundle, the difference in the bundle prices will also increase, while the difference in the price of the individual components will be proportionally reduced.

The relations between r_1, r_2, o_1+o_1, o_1+s_2, o_2+s_1 are given in the following formula, where the term G is provided in Table 27.

$$D = \frac{-a}{(14\,b - 55\,c)} + \frac{G}{(14\,b - 55\,c)\,(10\,b - 11\,c)} + \frac{4\,(2\,b - 7\,c)\,t_S}{(14\,b - 55\,c)\,(b + c)}$$

Table 28: G term.

$r_1 - o_1+s_1$		$70\,b^2\,t_1 + 44\,c^2\,(11\,t_1 - 4\,t_2) + bc\,(-400\,t_1 + 43\,t_2)$
$r_1 - o_1+s_2 = r_1 - o_2+s_1$		$70\,b^2\,t_1 + 3\,bc\,(-124\,t_1 + 5\,t_2) + 22\,c^2\,(17\,t_1 - 3\,t_2)$
$r_1 - o_2+s_2$	$\Rightarrow G =$	$70\,b^2\,t_1 + 44\,c^2\,(6\,t_1 + t_2) - bc\,(344\,t_1 + 13\,t_2)$
$r_2 - o_1+s_1$		$bc\,(43\,t_1 - 400\,t_2) + 70\,b^2\,t_2 + 44\,c^2\,(-4\,t_1 + 11\,t_2)$
$r_2 - o_1+s_2 = r_2 - o_2+s_1$		$3\,bc\,(5\,t_1 - 124\,t_2) + 70\,b^2\,t_2 + 22\,c^2(-3\,t_1 + 17\,t_2)$
$r_2 - o_2+s_2$		$bc\,(13\,t_1 + 344\,t_2) + 70\,b^2\,t_2 + 44\,c^2\,(t_1 + 6\,t_2)$

Source: Author.

The differences between o_1+o_1, o_1+s_2, o_2+s_1 are given in Table 28.

Table 29: Differences between pairs of combined prices.

o_1+s_1		o_1+s_1		0
		$o_1+s_2 = o_2+s_1$		$2\,c\,(t_2 - t_1)/\,10\,b - 11c$
		o_2+s_2		$4\,c\,(t_1 - t_2)/\,10\,b - 11c$
o_1+s_2 o_2+s_1	–	o_1+s_1	=	$2\,c\,(t_1 - t_2)/\,10\,b - 11c$
		$o_1+s_2 = o_2+s_1$		0
		o_2+s_2		$2\,c\,(t_2 - t_1)/\,10\,b - 11c$
o_2+s_2		o_1+s_1		$4\,c\,(t_2 - t_1)/\,10\,b - 11c$
		$o_1+s_2 = o_2+s_1$		$2\,c\,(t_1 - t_2)/\,10\,b - 11c$
		o_2+s_2		0

Source: Author.

The model allows for the specification of t, and we can see that the bundle price is affected by the difference in the transaction costs of the two carriers in assembling the bundle, allowing only the company with the lowest assembling cost to bundle.

Let's start with the simplest case where $t_1 = t_2 = t_S = 0$. In this case clearly $r_1 = r_2 = r$ and $o+s=o_1+s_1=o_1+s_2=o_2+s_1=o_2+s_2$. The non-cooperative equilibrium prices are given by:

$$r = \frac{7a}{14b - 55c}$$

$$o + s = \frac{8a}{14b - 55c}.$$

It is clear that the price of the bundle will be always lower than the price of the unbundled alternatives ($o+s$). This conclusion is also in line with economic theory, for, in a duopoly, the bundle will be the Nash equilibrium of the game if no transaction costs are taken into account.

Let's consider now the case where $t_1=t_2=t$ with $t > 0$, while t_S is still equal to 0. We know that clearly $r_1=r_2$, and $o_1+s_1=o_1+s_2=o_2+s_1=o_2+s_2=o+s$, so the consumer is indifferent between carrier 1 and carrier 2. In this case though, the price of the bundle is not necessarily the lowest. The introduction of transaction costs t affects the outcome of the game.

$$r = \frac{7a + (7b - 24c)t}{14b - 55c}$$

$$o + s = \frac{8a + 4ct}{14b - 55c}$$

As long as t is relatively small, the bundle will remain attractive. If t is greater than $\frac{a}{7(b - 4c)}$, then the price of the bundle will be higher than the price of the separate components and the equilibrium in the game will shift to the provision of separate components. It will here be more profitable for the shipper to buy the non bundled alternatives[37].

[37] Note that we are assuming that $b \geq 5c$, then the quantity $a/7(b-4c)$ is always positive.

In general, as long as t_S is small relatively to t, the price of the bundle will remain above that of the sum of the individual components. In case t is also positive, the equilibrium prices are given by:

$$r = \frac{(b+c)(7a+(7b-24c)t)-24ct_S}{(14b-55c)(b+c)}$$

$$o+s = \frac{4(b+c)(2a+ct)+4(c-2b)t_S}{(14b-55c)(b+c)}$$

Specifically, as long *as* $t > \theta t_S$, where θ is the following quantity,

$$q = \frac{a}{7(b-4c)} + \frac{4(7c-2b)}{7(14b-55c)(b-4c)}$$

then the price of the bundle is greater than the sum of the prices of the individual components. Clearly if t_S is significantly greater than t, then the bundle will be always preferred.

We can extend this analysis to the case where the carriers incur different costs in assembling the bundle, so that $t_1 \neq t_2$, i.e. one of the two carriers is better at providing the bundle. We can assume that $t_1 < t_2$.

Let us start with the case where $t_1 < \theta t_S$. In this case, the bundle to be sold will be the one provided by carrier 1, at price

$$r_1 = \frac{(b+c)(7a+(7b-24c)t_1) -24\ c\ t_S}{(14\ b-55\ c)(b+c)}$$

which is lower than r_2 (the opposite will of course be the case when $t_2 < t_1$ and $t_2 < \theta t_S$).

If t_1 is greater than θt_S, i.e. $\theta t_S < t_1 < t_2$, then the bundle will not be sold and $min\{o_1+s_1, o_1+s_2, o_2+s_2\} = o_1+s_1 = 2o_1 = 2s_1$. If on the contrary $t_1 > t_2$ and $t > \theta t_S$ then the equilibrium price will be $min\{o_1+s_1, o_1+s_2, o_2+s_2\} = o_2+s_2 = 2o_2 = 2s_2$. Finally the for the carriers to sell a component each in the unbundled alternative, it will have to be $min\{o_1+s_1, o_1+s_2, o_2+s_2\} = o_2+s_1 = o_1+s_2$, this implies that at the same time,

$$t_1 < \frac{2(12-5a)b+11(a-6)}{2(2+5a)b-11(4+a)c} t_2$$

$$t_1 < -\frac{2(2+5a)b-11(4+a)c}{2(12-5a)b+11(a-6)} t_2$$

These conditions cannot hold, given that both t_1 and t_2 are both non-negative. This implies that if $t_1 \neq t_2$ then equilibrium exists only if the shipper consumes service 1 and service 2 of the same carrier or one of the bundles is provided.

Table 30 summarizes the cases just discussed.

Table 30: Transaction costs and equilibrium outcomes.

Situation	**Conditions**	**Selection of the shipper**	**Lowest price**
$A1$	$\theta t_S < t_1$ $t_1 < t_2$	Separate components	$o_1 + s_1$
$A2$	$\theta t_S < t_2$ $t_2 < t_1$	Separate components	$o_2 + s_2$
$B1$	$t_1 < \theta t_S$ $t_1 < t_2$	Bundle provided by carrier 1	r_1
$B2$	$t_2 < \theta t_S$ $t_2 < t_1$	Bundle provided by carrier 2	r_2
C	$t = t_1 = t_2$ $t > \theta t_S$	Separate components	$o + s$
D	$t = t_1 = t_2$ $t < \theta t_S$	Bundle	$r = r_1 = r_2$

Source: Author.

The model shows that the carriers in reality are competing on the bundle not only among themselves but also with their customer.

9.3 Results of the model

The theoretical model described above is an attempt to discuss the implications of bundling of separate activities that involve a certain cost of producing the bundle. Intuitively we would expect the transaction costs of the carrier to be lower than those of the shipper (t_S). In reality the model may apply to a situation where those demanding the separate services are the freight forwarders. For some of them t_S may actually be lower than the transaction costs of the carriers.

In real markets, then, the carrier who has the possibility to offer bundles is exposed to competition from two sides. On the one hand, he is forced to reduce his bundle price, for he is competing directly with other carriers. This pressure stems from the competitiveness of each carrier in assembling the bundle. On the other hand, the carrier faces competitive pressure generated from the demand side.

In previous papers it has been shown that mixed bundling is a dominant strategy in duopoly for both firms, even if its outcome is not the best possible (Prisoner Dilemma). In the situation outlined in our model we show that, in reality, differences in the ability to provide the bundle -wrt the ability of providing the bundle from the demand side, may justify the decision of a company not to provide bundles. If a carrier knows that compared to his competitors, or alternatively to his customers, the costs of providing bundles are too high (implying that the competitor will provide a cheaper bundle or the customer will be able to assemble the bundle cheaply herself) then the best strategy available will be not to provide bundles and focus only on the separate components.

In the specific case of the model used here, mixed bundling is a dominant strategy for carriers depending on the distribution of transaction costs. The analysis shows though that the equilibrium elasticity to a change in transaction costs of the carriers is much higher than that of a change in the transaction costs of the shipper.

9.4 Welfare effects

Welfare calculations are omitted in the paper, as the results are analogous to those obtained in the existing literature on bundling in oligopoly, albeit much more tedious. The addition of transaction costs does not add anything to the results obtained for example in the aforementioned article of Economides (1993) or Liao and Taumann (2002). For the purpose of our discussion it should be noticed that mixed bundling is socially beneficial as it lowers consumer prices and increases choice for consumers.

9.5 Pricing decisions in oligopoly with transaction costs

A simple game theoretic approach is employed below to formulate the strategic decision process that leads to a bundle price. Without loss of generality it can be assumed that each transaction is the result of a game between two carriers and one shipper. It is assumed that the supply chain consists of two components, ocean transportation (t) and a logistics service (l). The two services are complementary and they are provided by one carrier as substitutes for the respective two services provided by the other. The shipper purchases a combination of t and l. $N_j = \{t_j, l_j\}$ is the set of services provided by carrier j. Let $T = \{t_1, t_2\}$ and $L = \{l_1, l_2\}$ be the sets of ocean transportation and logistics services respectively. $N = T \cup L$ is the set of all services. A *system* S consists of two products t and l, where $t \in T$ and $l \in L$. Let $C = \{\{t, l\} \mid t \in T \text{ and } l \in L\}$ be the set of all possible systems, so that $S \in C$. The system $\{t_j, l_i\}$ is a mixed system if $j \neq i$ and a pure system if $j = i$. This formulation is similar to the one proposed by Liao and Tauman (2002). The services are provided by the two carriers either separately or as a bundle (mixed bundling).

To simplify the analysis, and without loss of generality, we assume that the costs involved in the provision of each service are null. This implies that carriers possess the same technology and are characterised by the same level of efficiency in providing ocean transportation and logistics services. Although restrictive, this assumption does not affect the essence of the bundle pricing decision.

In our case of two carriers and one shipper, we have $C = \{S_{11}; S_{22}; S_{12}; S_{21}\}$, where the specification of all four systems is as follows:

- $S_{11} = \{t_1, l_1\}$ The shipper buys the bundle from carrier *1*;
- $S_{22} = \{t_2, l_2\}$ The shipper buys the bundle from carrier *2*;
- $S_{12} = \{t_1, l_2\}$ The shipper buys ocean transportation from carrier *1* and the logistics service from the other carrier;
- $S_{21} = \{t_2, l_1\}$ The shipper buys ocean transportation from carrier *2* and the logistics service from the other carrier.

Shippers have identical tastes (symmetric) and are indifferent between purchasing a bundle or buying the two services separately from the two carriers. For simplicity we assume that their willingness to pay is equal to a large enough arbitrary value, V. Shippers are penalized by bearing an additional cost k deriving from the transaction costs involved in assembling the bundle themselves. If they decide to buy the bundle from either carrier, $k = 0$, otherwise $k > 0$. The carriers have to bear their own transaction costs when providing the bundle (k^1 and k^2 respectively).

Let us now define the set of strategies available to the carriers and the shipper. A strategy for carrier j is defined as the triplet of prices $p^j = \left\{p_r^j, p_t^j, p_l^j\right\}$, where p_t^j and p_l^j are the (non-negative) prices of each service sold separately, and p_r^j is the (non-negative) price of the bundle. A strategy for the shipper is a decision rule $\tilde{S}$, which determines the subset of services he will buy at a price system $p = \left(p^i, p^j\right)$.

Let us now define a game G as follows. In the first stage of the game, each carrier decides its strategy p^j. Carriers compete in a Bertrand fashion and select their prices simultaneously. In the second stage, the shipper observes the price vector p and selects his consumption set. We assume shipper and carriers are rational and information is perfect.

Payoffs are defined as the net profit of the carriers, and the sum of the cost of purchasing the services, plus the (eventual) cost of assembling the bundle k for the shipper. Namely:

(1) $$\pi^j\left(p,\tilde{S}\left(p\right)\right)=\sum_{j\in\tilde{S}\left(p\right)\cap N_j} p^j - k^j$$

(2) $$CS\left(p,\tilde{S}\right)=V-\sum_{j\in\tilde{S}\left(p\right)} p^j - k$$

Let NE be the set of all pure strategy Nash equilibria which are subgame perfect. We will refer to a point in NE as an equilibrium point. The first step in the solution of the game consists of determining the behaviour of the shipper given all possible carrier strategies. The shipper observes p and will purchase the product that gives him the highest CS.

In order to find solutions to the game, we proceed by listing the payoffs for the shipper and both carriers for every possible pricing strategy. We will start our discussion by considering $p_r^i < p_r^j$ and $p_t^i + p_l^j < p_t^j + p_l^i$. The following alternatives exist:

1. If $p_t^i + p_l^j + k < p_r^i$, the shipper will purchase the separate components, namely ocean transportation from carrier i and the complementary logistics service from carrier j.

2. If $p_t^i + p_l^j + k = p_r^i$, the shipper is indifferent between buying the bundle of carrier i and the separate services bought from the two carriers.

3. If $p_t^i + p_l^j + k > p_r^i$, the shipper buys the bundle from carrier i

The shipper and the carriers' payoffs are given in table 31 below.

We can therefore distinguish three cases:

- Case 1: when $p_r^i < p_r^j$ and $p_t^i + p_l^j < p_t^j + p_l^i$;
- Case 2: when $p_r^i < p_r^j$ and $p_t^i + p_l^j = p_t^j + p_l^i$;
- Case 3: when $p_r^i = p_r^j = p_r$.

Table 31: Shipper and carriers' payoffs in case 1.

	Shipper	Carrier i	Carrier j
$p_t^i + p_l^j + k < p_r^i$	$V - p_t^i - p_l^j - k$	p_t^i	p_l^j
$p_t^i + p_l^j + k = p_r^i$	$V - \frac{p_r^i + p_t^i + p_l^j + k}{2}$	$\frac{p_r^i - k^i + p_t^i}{2}$	$\frac{p_l^j}{2}$
$p_t^i + p_l^j + k > p_r^i$	$V - p_r^i$	$p_r^i - k^i$	0

The case $p_t^i + p_l^j > p_t^j + p_l^i$ can be worked out similarly. We discuss below the case $p_t^i + p_l^j = p_t^j + p_l^i$. The payoffs are given in the following table.

Table 32: Shipper and carriers' payoffs in case 2.

	Shipper
$p_t^i + p_l^j + k < p_r^i$	$V - \frac{p_t^i + p_l^j + p_t^j - p_l^i}{2} - k$
$p_t^i + p_l^j + k = p_r^i$	$V - \frac{2p_r^i + p_t^i + p_l^j + p_t^j + p_l^i + 2k}{4}$
$p_t^i + p_l^j + k > p_r^i$	$V - p_r^i$

	Carrier i	Carrier j
$p_t^i + p_l^j + k < p_r^i$	$\frac{p_t^i + p_l^i}{2}$	$\frac{p_t^j + p_l^j}{2}$
$p_t^i + p_l^j + k = p_r^i$	$\frac{2\left(p_r^i - k^i\right) + p_t^i + p_l^i}{4}$	$\frac{p_t^j + p_l^j}{4}$
$p_t^i + p_l^j + k > p_r^i$	$p_r^i - k^i$	0

The case in which $p_r^i > p_r^j$ leads to payoffs analogous to the ones presented above. We next discuss the payoff system in the case of $p_r^i = p_r^j = p_r$. The shipper payoffs remain unchanged while the carriers' payoffs are given in the table below.

Table 33: Shipper and carriers' payoffs in case 3.

	Carrier i	**Carrier j**
When $p_t^i + p_l^j < p_t^j + p_l^i$		
$p_t^i + p_l^j + k < p_r$	p_t^i	p_l^j
$p_t^i + p_l^j + k = p_r$	$\dfrac{p_r - k^i + 2p_t^i}{4}$	$\dfrac{p_r - k^j + 2p_l^j}{4}$
$p_t^i + p_l^j + k > p_r$	$\dfrac{p_r - k^i}{2}$	$\dfrac{p_r - k^j}{2}$
When $p_t^i + p_l^j = p_t^j + p_l^i$		
$p_t^i + p_l^j + k < p_r$	$\dfrac{p_t^i + p_l^i}{2}$	$\dfrac{p_t^j + p_l^j}{2}$
$p_t^i + p_l^j + k = p_r$	$\dfrac{p_r - k^i + p_t^i + p_l^i}{4}$	$\dfrac{p_r - k^j + p_t^j + p_l^j}{4}$
$p_t^i + p_l^j + k > p_r$	$\dfrac{p_r - k^i}{2}$	$\dfrac{p_r - k^j}{2}$

The other payoffs can be easily calculated on the basis of what was presented in the above tables.

Now that the payoffs have been listed, let us discuss the solutions to the game in relation to the transaction costs parameters k^i, k^j and k. It should be noted that we are assuming that these are the only costs incurred in the provision of the services, i.e. production costs are 0. In the simple case of $k^i = k^j = k = 0$, the equilibrium for the game is, as to be expected, $p_r^{i*} = p_t^{i*} = p_l^{i*} = 0, \forall i$. Shippers are indifferent between purchasing the bundle or the separate components; profits for both carriers are 0 and shipper payoff is *V*. This example corresponds to the Bertrand oligopoly pricing model, as the four systems in *C* are perfect substitutes.

The other equilibria depend apparently on the relations among the transaction costs parameters k^i, k^j and k. We will assume in the rest of the discussion that $k^i \neq k^j$ since the case $k^i = k^j$ is trivial.

Let us assume without loss of generality that $k^i < k^j$ with $k < k^j$. The results of the analysis are the same irrespective of whether k is greater than k^i. In this case, if the shipper purchases the bundle, he will do so only from carrier *i*. Carrier *i* has the possibility of setting $p_r^i > k^i$. As long as $p_r^i \leq k^j$, carrier *i* does not fear competition from carrier *j*, who is unable to set prices at the same level. Carrier *i* could then set $p_r^i = k^j - \varepsilon$, for ε arbitrarily small. Carrier *j* does not have the possibility of setting p_r^j below k^j. Remember that carrier *i* and carrier *j* can have the same costs for service *t* and *l*, therefore they differ only on their ability to assemble the bundle, i.e. k^i and k^j. Carrier *j* cannot therefore compete on the bundle and his best strategy is to try to lead consumers to buy the unbundled components. To do so he sets p_l^j and p_t^j as low as profitably possible, so that the shipper has a disincentive to purchase the bundle.

This implies that p_l^j and p_t^j need to be set so that $p_t^i + p_l^j + k = p_t^j + p_l^i + k \le p_r^i$. If we replace p_r^i with $k^j - \varepsilon$, the following relations hold: $p_l^j \le k^j - \varepsilon - p_t^i - k$ and $p_t^j \le k^j - \varepsilon - p_l^i - k$. Carrier *j*'s best strategy is setting:

(3) $$p_l^j = k^j - \varepsilon - p_t^i - k \text{ and } p_t^j = k^j - \varepsilon - p_l^i - k$$

We still however need to define how carrier *i* sets p_l^i and p_t^i. If he sets p_t^i and p_l^i so that $p_t^i + p_l^j + k > p_r^i$ and $p_t^j + p_l^i + k > p_r^i$, the shipper will buy the bundle carrier *i*'s payoff will be $k^j - \varepsilon - k^i$.

If prices are set so that $p_t^i + p_l^j + k \le p_r^i$ or $p_t^j + p_l^i + k \le p_r^i$, the shipper buys the unbundled alternative, and carrier *i*'s profit will be p_t^i or p_l^i if the shipper buys only the unbundled alternative, and $\frac{p_r^i + p_t^i}{2}$ or $\frac{p_r^i + p_l^i}{2}$ if the shipper also buys the bundle, i.e. if $p_t^i + p_l^j + k = p_r^i$ or $p_t^j + p_l^i + k = p_r^i$. Apparently, *i*'s strategy would then be setting p_t^i or p_l^i as high as possible, as long as the shipper continues to purchase the unbundled alternative. The latter will do so if and only if $p_t^i \le k^j - \varepsilon - p_l^j - k$ and $p_l^i \le k^j - \varepsilon - p_t^j - k$. The best strategy for carrier *i* is then to set:

(4) $$p_t^i = k^j - \varepsilon - p_l^j - k \text{ and } p_l^i = k^j - \varepsilon - p_t^j - k$$

From equations (3) and (4) we have that $p_t^i + p_l^j = p_t^j + p_l^i$. Symmetrically, we also have $p_t^i = p_l^i$ and that $p_t^j = p_l^j$ and therefore $p_t^i = p_t^j = p_l^i = p_l^j$. Rearranging terms in (3) and (4) we get:

(5) $$p_t^i = k^j - \varepsilon - p_t^i - k \Rightarrow p_t^i = \frac{k^j - \varepsilon - k}{2} = p_t^j = p_l^i = p_l^j$$

The following set of prices is therefore an equilibrium:

(6) $$p_r^{i*} = k^j - \varepsilon, \; p_r^{j*} = k^j, \; p_t^{i*} = p_t^{j*} = p_l^{i*} = p_l^{j*} = \frac{k^j - \varepsilon - k}{2}$$

this implies that $p_t^{i*} + p_l^{j*} + k = p_t^{j*} + p_l^{i*} + k = p_r^{i*}$. The payoffs for the carriers and the shipper are given by:

(7) $$\pi^i = \frac{3k^j - 3\varepsilon - 2k^i - k}{4}$$
$$\pi^j = \frac{k^j - \varepsilon - k}{4}$$
$$CS = V - \left(k^j - \varepsilon\right)$$

Note that although the equilibrium affords the best possible result to the shipper, carrier *i* is better off if and only if $\frac{3k^j - 3\varepsilon - 2k^i - k}{4}$ is below the profit the carrier makes by selling the bundle only, i.e:

$$\frac{3k^j - 3\varepsilon - 2k^i - k}{4} < k^j - \varepsilon - k^i \text{; or } k^i < \frac{k^j - \varepsilon + k}{2}.$$

When $k^i > \frac{k^j - \varepsilon + k}{2}$, the carrier would have been better off if the bundle only had been sold.

It can be easily shown that if $k^i = \frac{k^j - \varepsilon + k}{2}$, carrier *i* is indifferent between the shipper buying the bundle or the unbundled components. For carrier *j* we observe that payoffs are always below those obtained by selling only the separate components, but above those obtained if only the bundle was sold. These considerations are summarised in Table 34.

Table 34: Maximum payoffs.

Condition	**Highest payoff**		
	Carrier i	**Carrier j**	**Shipper**
$k^i > \frac{k^j - \varepsilon + k}{2}$	$\frac{k^j - \varepsilon - k}{2}$	$\frac{k^j - \varepsilon - k}{2}$	
$k^i = \frac{k^j - \varepsilon + k}{2}$	$\frac{3k^j - 3\varepsilon - 2k^i - k}{4}$	$\frac{k^j - \varepsilon - k}{4}$	$V - \left(k^j - \varepsilon\right)$
$k^i < \frac{k^j - \varepsilon + k}{2}$	$k^j - \varepsilon - k^i$	0	

Another way of looking at it: As the shipper is the one that determines the outcome of the game, and he is indifferent between the bundle and the unbundled components, the payoffs are given by the second row of Table 34.

This implies that in some circumstances, i.e. every time $k^i \neq \frac{k^j - \varepsilon + k}{2}$, the carrier will obtain a profit that is lower than what he could have achieved simply because of the nature of competition.

Let us now discuss the case in which $k^j \leq k$. In this case carrier i has the possibility of setting the price of the bundle even above k^i and be sure that the shipper will continue buying the bundle. Let us assume that carrier i sets $p_r^i = k^j - \varepsilon$ as before. Even with p_t^j and p_l^j equal to 0, if carrier i sets $p_t^i = p_l^i = 0$, the shipper will always purchase the bundle; his payoff (cost) by doing so will always be less than what he would obtain from purchasing the separate components, i.e. $V - k \leq V - \left(k^j - \varepsilon\right)$.

The equilibrium in this case is given by:

$$(8) \qquad p_r^{i*} = k^j - \varepsilon\,,\ p_r^{j*} = k^j\,,\ p_t^{i*} = p_t^{j*} = p_l^{i*} = p_l^{j*} = 0$$

This implies that $p_t^{i*} + p_l^{j*} + k = p_t^{j*} + p_l^{i*} + k = p_r^{i*}$. The payoffs for the carriers and the shipper are given by:

$$
(9) \qquad \begin{aligned} &\pi^i = k^j - \varepsilon - k^i \\ &\pi^j = 0 \\ &CS = V - \left(k^j - \varepsilon\right) \end{aligned}
$$

Note that this case is very different from the case where $k < k^j$ discussed above. In fact, no matter what the price of the bundle now is, and at what level carrier j sets p_t^j and p_l^j, carrier i will always set p_t^i and p_l^i high enough to ensure that the shipper buys the bundle. The results of the game are given in Table 35.

Table 35: Equilibrium prices and payoffs.

Parameters	**Equilibrium prices**	**Payoffs**
$k^i = k^j = k^c$ $k < k^c$	$p_r^{i*} = k^c$; $p_r^{j*} = k^c$ $p_t^{i*} = p_t^{j*} = p_l^{i*} = p_l^{j*} = \frac{k^c - k}{2}$	$\pi^i = \frac{k^c - k}{4}$; $\pi^j = \frac{k^c - k}{4}$ $CS = V - k^c$
$k \le k^j$ $k^i \le k^j$	$p_r^{i*} = k^j - \varepsilon$; $p_r^{j*} = k^j$ $p_t^{i*} = p_t^{j*} = p_l^{i*} = p_l^{j*} = \frac{k^j - \varepsilon - k}{2}$	$\pi^i = \frac{3k^j - 3\varepsilon - 2k^i - k}{4}$; $\pi^j = \frac{k^j - \varepsilon - k}{4}$ $CS = V - \left(k^j - \varepsilon\right)$
$k^i < k^j \le k$	$p_r^{i*} = k^j - \varepsilon$; $p_r^{j*} = k^j$, $p_t^{i*} = p_t^{j*} = p_l^{i*} = p_l^{j*} = 0$	$\pi^i = k^j - \varepsilon - k^i$; $\pi^j = 0$ $CS = V - \left(k^j - \varepsilon\right)$
$k^i = k^j = k^c$ $k \ge k^c$	$p_r^{i*} = k^c$; $p_r^{j*} = k^c$ $p_t^{i*} = p_t^{j*} = p_l^{i*} = p_l^{j*} = 0$	$\pi^i = 0$; $\pi^j = 0$ $CS = V - k^c$

If the bundles were not available, the shipper would always obtain $CS = V - k$ and carriers $\pi^i = \pi^j = 0$. The option of having the bundle may increase shipper payoff as long as k^j is lower than k, in other words, as long as the less efficient carrier in assembling the bundle in the industry has the ability to assemble bundles better that its customers (i.e. at a lower transaction cost).

9.6 Results of the model

The theoretical model described above discusses the implications of bundling separate logistics services at a cost. We have referred to this cost as *transaction costs*. Intuitively we would expect carriers to be able to assemble bundles with greater efficiency than shippers, *i.e.* the transaction costs of the carrier (k^i and k^j) to be lower than those of the shipper (k). It should be noted that this is not necessarily the case, since some shippers, *e.g.* freight forwarders, may be more efficient in assembling bundles. Each carrier faces competition in the bundle market from two sides: directly from other carriers on the supply side, and from their clients on the demand side. This assumption is embedded in the model.

The results of the model indicate that engaging in bundle provision is more profitable for a carrier who is significantly more efficient in providing bundles than its competitor or its client. If transaction costs are not simultaneously significantly below those of its client or its competitor, bundling does not seem to be a particularly profitable strategy. On the contrary, when a carrier reaches sufficient levels of efficiency in the provision of the bundle, this grants him the ability of obtaining positive results.

Having lower costs in assembling bundles, *vis-à-vis* competitors, might not afford a carrier substantially higher profits. This is because, in the model, the profitability of the bundling strategy depends on the ability of the shipper to assemble the bundle himself. Similarly, the ability of offering bundles at a low price does not necessarily ensure that the shipper will purchase the bundle.

It should be noted that bundling is nonetheless never a worse strategy than selling only separate components, as long as the difference in the costs of assembling the bundles between carriers are small. Therefore, if the costs of setting up a logistics branch within the company are small enough, the decision of engaging in bundle provision is at least as good as the decision of not engaging in this practice.

In previous research (see Tauman *et al.*1997) it has been shown that mixed bundling is a dominant strategy in duopoly for both firms, even if its outcome is not necessarily the best possible for the firms (Prisoner Dilemma). In the situation outlined in our model we show that differences in the ability to provide the bundle, with respect to the ability of providing the bundle by the demand side, may justify the decision of a company not to provide bundles. If a carrier knows that compared to his competitors, or alternatively to his customers, the costs of providing bundles are substantially higher (implying that the competitor will provide a cheaper bundle or the customer will be able to assemble the bundle cheaply herself) then the best strategy available will be not to provide bundles and focus only on the separate components.

9.7 Welfare effects

The results of our model do not differ substantially from the findings of previous research (Economides, 1993 or Liao and Taumann, 2000). The effects of bundling on consumer surplus and social welfare are ambivalent. When shippers are substantially more efficient in assembling the bundle, it seems that competitive interaction in the oligopoly is not enough to ensure that welfare is maximised, and society might be penalised. In this case, disallowing bundling might be a better option.

When one of the carriers reaches substantial levels of efficiency in assembling bundles, the effects on consumer surplus are mixed, depending on whether the carrier's transaction costs are lower than the transaction costs of the shipper. The effects on social welfare are also dependent on the difference between carrier- and shipper transaction costs. When carriers are able to assemble bundles at a lower cost than shippers, bundling affords society and consumer better welfare results.

Table 36: Consumer surplus and social welfare.

	Parameters	Consumer Surplus	Social Welfare
Mixed bundling	$k^i = k^j = k^c$ $k < k^c$	$CS = V - k^c$	$V - \frac{k^c + k}{2}$
	$k \leq k^j$ $k^i \leq k^j$	$CS = V - \left(k^j - \varepsilon\right)$	$V - \frac{k^i + k}{2}$
	$k^i < k^j \leq k$	$CS = V - \left(k^j - \varepsilon\right)$	$CS = V - k^i$
	$k^i = k^j = k^c$ $k \geq k^c$	$CS = V - k^c$	$CS = V - k^c$
No bundling		$CS = V - k$	$CS = V - k$

The interesting feature of bundling, as opposed to the case in which bundling is not permitted, concerns the possibility of carriers passing efficiency gains on to shippers and society. We observe that when a carrier is more efficient than a shipper in assembling the bundle, social welfare is higher. The effects on consumer surplus depend on the difference between the transaction costs of the less efficient carrier and the shipper. If the transaction costs of the shipper are lower than those of the less efficient carrier, bundling lowers consumer surplus; if they are greater, then bundling increases consumer's surplus.

9.8 Conclusions

The model adds to the discussion on the strategic dimensions of bundling decisions. This is done by evaluating the outcomes of competition in a duopoly where carriers compete on prices; can sell individual components or bundles; and both carriers and the shipper incur a cost in assembling the bundle. The most interesting finding of the models is that bundling allows for efficiency gains to be passed on to shippers and society, an eventuality that cannot take place when bundling is forbidden.

This desirable feature of bundling though comes at a risk since carriers may not necessarily have the highest levels of efficiency in providing the bundle. When this is the case, bundling tends to reduce consumer surplus and can even reduce social welfare. An important issue that remains open for further research is whether carriers are intrinsically better than other parties in the supply chain in providing bundles. If this is the case, competitive forces, even in the restrictive case of duopoly, ensure that this efficiency is passed on to consumers and society.

It should be noted in addition that one of the benefits of mixed bundling is that it increases choice for consumers. Considerations on social welfare should then additionally be weighted against the value of increased choice and variety. Especially in the case of certain supply chains, these benefits can be substantial.

10 Bundling and Competition[*]

10.1 Introduction

Even if the practice of product bundling is common in many consumer markets, in the case of ocean transportation and other logistics services it is still rare, and, in some circumstances, even forbidden by law. As indicate by Kühn *et al.* (2005), the legal implications of bundling have become clearer and the approach of legal authorities towards this practice more consistent and in line with the findings of economic theory. A recent set of preliminary interviews done by Erasmus University Rotterdam and Singapore Management University (EUR-SMU, 2006), within a research framework promoted under the auspices of the NOL Foundation of Singapore, indicated a large interest of the industry on the possibilities offered by product bundling and solicit the question whether the attitude towards price bundling in the container industry is about to change.

Notwithstanding the general acceptance in the industry of the advantages delivered by logistics service integration, the reluctance of shippers to accept product bundling is still substantial (Acciaro and Haralambides, 2007; EUR-SMU, 2006; SMU-EUR, 2008*a*). Besides, the legal restrictions on product bundling, the specific regulatory regime that governed the liner sector until the last decades of the twentieth century and of the debate that has animated the reform of this regulatory regime, have contributed to increase the diffidence towards this practice in the container sector.

The large existing *corpus* of economic theory and legal cases is often cited in the industry as a reason for dismissing product bundling as an anticompetitive practice and terminating any discussions on its possible implementation in the container industry. In addition, product bundling has been regarded by container car-

---

[*] We acknowledge reference to Parameritis (2009) on which part of the chapter is based.

riers as difficult to sell and its potential as a marketing and strategic tool has never been structurally assessed in the context of container transportation.

From the academic side, the analysis of the market structure effects of product bundling has animated the debate since the seventies, and, although scientific studies have tried to apply the findings of the theoretical literature to a large number of industries—the hotel and holiday industry, the software industry, to the health-care and the automobile industry are well-known examples of successful applications of product bundling—a very limited amount of research has been devoted to the topic in the context of container transportation, where product bundling is so important to constitute in essence the backbone of what we refer nowadays as (maritime) logistics.

With the exception of some exploratory works (Acciaro and Haralambides, 2007; EUR-SMU, 2006) and seminal papers (Haralambides, *et al.* 2002), and of the very specific literature resulting from the debate on the so-called *inland transportation clause* of the European Commission review process of the regulation 823/2000 and the TACA[38] case, the discussion on product bundling has never been addressed systematically in the container industry.

Transport policy has changed significantly in the last decades in order to cope with the developments of the liner industry and the various reforms in the regulatory regimes of countries involved in the shipping sector. Globalization and liberalization have been widely seen in the sector making it imperative for policy makers to reflect these changes in the legislation regarding the liner sector. In addition, containerization and its impact on the size and number of vessels have contributed to the increasing popularity of alliances and consortia in order to share investment costs and maintain a competitive liner shipping service (Consultation paper on the review of 4056/86). Also, people from the industry quite often advocate it contains unique competition features, which require global attention due to the international character of shipping. There are still contradictory national regulations, fortunately to a lower extent than two decades ago. It should be mentioned that even within the organization of economic cooperation and development (OECD) there have been serious controversial thoughts about how to form the appropriate competition rules for the shipping sector. Conferences and alliance activities are conducive to complicating further the regulation packages that used to be modified at a constant basis due to the dynamic environment of the liner industry.

The aim of the competition policy is the improvement of competition through economic regulation of the market (Sjostrom, 2002). Its origin is traced in

[38] In 1998 the European Commission found that parties adhering to the TACA (Trans-Atlantic Conference Agreement) had abused their joint dominant position by inducing potential competitors to join TACA, thereby altering the competitive structure of the market. The decision made also specific reference to hinterland transportation.

the United States where is referred as antitrust policy. The term "antitrust" was used to describe policies aiming at the prevention of anti competitive business practices which were seen in the United States at the end of the 19th century. Business practices that restricted competition were prevented by the anti trust laws which were based on the concept that a competitive market is desirable due to the fact that it promotes the most efficient use of a society's scarce resources (Sjostrom, 2002).

10.2 Foundations of antitrust policy[39]

Antitrust in the USA

US antitrust policy is rooted in the Sherman Act (1890), the Clayton Act (1914) and the Federal Trade Commission Act (1914). Section 1 and 2 of the Sherman Act constitute the major provision of American antitrust law. In particular section 1 prohibits concerted action that leads to, or is intended to lead to, restraints of trade. Section 2 deals with unilateral behaviour. The Clayton Act contains specific provision dealing with price discrimination, tying and exclusive dealing and mergers (Sections 2, 3 and 7).

Given the generality of the Sherman Act provisions, a great deal of US antitrust law is based on court decisions. In particular the following business practices are illegal under Section 1 (Church and Ware, 2000).

- Horizontal price-fixing;
- Vertical price-fixing;
- Horizontal market division;
- Vertical market division or non-price vertical restraints;
- Tying;
- Exclusive dealing;
- Group boycotts.

The following business practices are illegal under Section 2 of the Sherman Act:

- Actual monopolisation;
- Attempted monopolisation;
- Joint monopolisation;
- Incipient Conspiracy to monopolise.

Enforcement of antitrust law in the USA is the responsibility of the Antitrust Division of the Department of Justice (DOJ) and the Federal Trade Commission (FTC). Private enforcement is also allowed. The Antitrust Division has the option

---

39 This section is loosely based on Church and Ware (2000), Anderson and Rogers (1992), Goyder, (1995) and Brooks (2000). Literature on conference regulation in other regions is nonexistent, with the exception of Brooks (2000; 2002*b*) for Canada; and to some extent Bennathan and Walters (1972) for Asia.

of bringing a civil or a criminal case, but many cases are settled by consent decree (Anderson and Rogers, 1992).

Competition policy in Europe

The foundations of the European competition law are Articles 81 (amended article 85) and 82 (ex article 86) of the European Economic Treaty, or Treaty of Rome, signed in 1957. Article 81 deals with concerted action and agreements among firms, while article 86 prohibits abuse of dominant position. The European Commission has jurisdictional pre-eminence over member states for investigations concerning articles 81 and 82, exclusive authority to issue exemptions; the ability to impose fines up to 10% of annual worldwide turnover; extensive powers of investigation and a high degree of autonomy.

10.3 Policies with regard to horizontal forms of cooperation and M&A

US Policies

In the US, competition rules related to the liner industry are covered by the "Ocean Shipping Reform Act of 1998". Cooperation, nevertheless, in the business relationships of the industry occurred earlier than the jurisdiction of the "Shipping Act of 1984". A consortium of two or more carriers can be classified either as a "joint venture" or "cooperative working agreements". An alliance should have its own name during the operation and provision of liner services, publish its own tariff otherwise it will be considered as a working agreement and not a single carrier, thus joint venture. The sample conditions in an alliance agreement were (Brooks, 2000):

- Coordination of sailings, including: members of vessels and total capacity, sailing schedules, service frequency, ports served and rotation, feeder arrangements, and notice of changes in vessel allocation.
- Reciprocal space chartering, including terms of its provision, and advertisement of its availability
- Contracting with and co-ordination with suppliers of equipment, terminals and ancillary services
- Maintenance of individual marketing and sales offices
- Joint development of documentation and data systems
- Conditions of withdrawal from agreement
- Duration of agreement
- Conditions determining breach of agreement

Alliances usually are related to better asset organization and sharing of resources in order to provide better services. Cargo or profits sharing are not part of the alliances.

EU Policies

Initially EU policies regarding consortia in the shipping industry were related to conferences (Brooks, 2000). After the issue of the Commission Regulation 870/95, there was a clear separation between these two types of agreements. In order to evaluate a merger, the EU examines various business agreements by using a framework for the particular business structure being examined. According to Article 3 of Council Regulation 4064/89 a merger has occurred when a company acquires the securities or assets of another company by contract or other form of agreement which leads in taking the control directly or indirectly of this company. In order for the merger to be covered under the Council Regulation 4064/89 it must have a "community dimension" meaning that the world turnover of the parties should equal or exceed ECU 5 billion or at least one of them to have a turnover of ECU 250 million or more.

The consortium according to EU regulation, not often can be resembled a merger due to the fact that lacks the permanent character of the merger as it contains clauses regarding its termination. Nevertheless, a consortium can be considered as a joint venture which under EU law it can have a "concentrative" nature or have the form of "coordination" leading to efficiency advantages (Brooks, 2000). The merger control regulation excludes the consortium which aim is to coordinate the competitive activities of independent undertakings. In that case the Council Regulation 17/62 of 21 February 1962. As far as concentrations are concerned the EU prohibits only those that can lead to accumulative significant market power. The phrase "performing on a lasting basis" in the Article 3(2) of Council Regulation 4064/89 is what differentiate cooperative and concentrative joint ventures resulting in the conclusion that liner shipping consortia are not concentrations.

10.4 Liner shipping and antitrust law

It should be clear from the review of pricing practices presented in the previous paragraph, that the liner shipping industry has been characterised by a rather unique regulatory regime. Before proceeding with the discussion on the applicability and legality of bundling of ocean transportation and other logistics services, it is useful to review the regulation in the USA and Europe in particular with reference to service contracts (SC). This regulation has deeply affected industry practices and perceptions of bundling strategies, and in particular in Europe bundling has been discussed at the deliberations in some landmark antitrust cases against conferences. The three most important cases are discussed in the next section, while in the remainder the foundations of antitrust policy in Europe and USA are presented.

The *Shipping Act of 1984* is the piece of regulation that sets the standards for pricing in ocean transportation to and from the USA and sanctions the existence and operation of conferences. Conferences existed in the USA before, but the specific aim of the Shipping Act was to limit their market power by introducing the two concepts of independent action (IA) and service contracts (Brooks, 2000). IA is the possibility granted to conference members to negotiate rates below the publicly filed conference rates. Although the shipping act endorsed IA, it also specifically allowed conferences to veto IA on specific commodities. This controversial provision was revoked with the Ocean Shipping Reform Act of 1998.

The Shipping act of 1984 also contained important provisions on the applicability of SC in Section 8 and Section 3(21), although they are reported to have been in use before (Marlow and Nair, 2008). SC are agreements between shippers and carriers or conference members to transport cargo over a period of time. SC are defined in the Shipping Act of 1984 as:

> *'[…] a contract between a shipper and an ocean common carrier or conference in which the shipper makes a commitment to provide certain minimum quantity of cargo over a fixed time period and the ocean common carrier or conference commits to a certain rate or rate schedule as well as a defined service level such as, assured space, transit time, port rotation, or similar service features; the contract may also specify provisions in the event of non-performance on the part of either party.'* (Shipping Act of 1984, Section 3(21))

Since the OSRA, SC are to be filed with the Federal Maritime Commission (FMC) on a confidential basis, while according to the provisions of the Shipping Act of 1984, they had to be filed in tariff format and made available to other shippers. These provisions aimed at ensuring and maintaining the common carrier principle, under which in essence the terms of the contracts should be made available to all shippers located in the same region and for similar services. In particular, the provisions of the Shipping Act of 1984 under *Section 8(c)* required that in case a lower rate for a particular commodity was offered to a new shipper entering in a SC, the same rate had to be offered to existing shippers (known as the 'me too' principle). Although this clause was aiming at preserving competition, it had the potential to weaken carrier rate exposure, especially in market downturns (Marlow and Nair, 2008).

The provisions on SC in the Shipping Act of 1984 were substantially reviewed with the adoption of OSRA in 1998. In 1989 the Shipping Act had already been reviewed by the FMC, however, the essence of the regulation on conferences was not altered despite the fact that shippers complained that liners tried to prevent fruitful negotiations (Brooks, 2000). It was only in 1992 that the regulation attracted the attention of the legislator, when the newly developed conference TAA (Trans-Atlantic Agreement) announced capacity reductions in specific routes in order to increase prices due to accumulated losses of millions, bad utilization levels and low freight rates (Brooks, 2000).

The TAA announcement, which also attracted the attention of the European Commission (see below), specifically discriminated between conference and non-conference members; defined the limits and contents of SCs individual members were able to enter into with their shippers, including provision on inland rates; and, limited to the westbound routes only, it also endorsed a capacity management program. Shippers loudly complained against these provisions and engaged in fierce lobbying action with the regulator. In 1994, seventeen powerful shippers and the National Industrial Transportation League (NIT League) filed a complaint about the TAA with the FMC. The *casus belli* was that the TAA refused negotiation on rates, conditions and rules for carriage of cargo (Clarke, 1997). The NIT League proposed to the FMC the following changes in the Shipping Act (Sjostrom, 2002):

- Removing carriers' antitrust immunity altogether;
- Terminating the requirements for public filing of tariffs and service contracts with the FMC;
- Abolition of the FMC and transfer monitoring consortia to the Department of Justice (DOJ).

The FMC initiated a new investigation on conferences resulting in a modification of the stipulations of the TAA, which, in the meanwhile also under fire on the other side of the Atlantic, was renamed TACA (Brooks, 2000). The TACA was different from the TAA in the sense that it did not discriminate between conference and non-conference members; it relaxed the restrictions on the capacity management programme; increased volume limits on SCs; and loosened control on IA. The FMC required further changes to the TACA before approval could be granted. Specifically, the FMC stipulated the elimination of any form of capacity management, the removal of limits on SC volumes and further flexibility on IA.

In September 1995, the US House of Representatives proposed a modification of the Shipping Act of 1984 by passing the *Ocean Shipping Reform Act of 1995*, in the attempt to remove the obligation of carriers to file tariffs and SC provisions with the FMC (Fusillo, 2006). The relatively more favourable conditions deriving from confidential contracts for larger shippers with respect to smaller ones resulted in the stalling of the Act in the Senate. The *impasse* was resolved in March 1997 and finally on the 1st October of 1998 the *Ocean Shipping Reform Act of 1998* was passed by the Senate with effect as of 1st of May of 1999.

OSRA modified significantly the Shipping Act of 1984 since carriers were no longer obliged to file their tariffs with the FMC. However, they were requested to publish their tariffs electronically and make them available to the public through a system accessible from remote locations. The provisions related to SCs were also significantly altered. SCs could include provisions among common carriers and shippers, that deviated from those of the conference, but most importantly, the following terms of the contract did not have to be filed with the FMC and remained therefore confidential (Gardner, Marlow and Nair, 2002):

- The origin and destination of cargo in the case of intermodal movements;
- The maritime haul freight rate;
- The specifications of the service commitments;
- The eventual amount of damage payment for non-performance.

Most notably, the clause that required existing shippers to be treated in the same way as new shippers entering into service contracts was removed. Furthermore, the OSRA set further limitations on conferences and other ocean common carrier agreements (Gardner, *at al.* 2002). In particular, these agreements may not prohibit a member or members of the agreements to enter into SC negotiations with one or more shippers; a member of the agreement is not obliged to disclose negotiations or the terms of a SC, with the exception of the terms that are published under Section 8(c); mandatory rules regarding the right of a member to negotiate or enter into a SC were prohibited.

The OSRA appeared to be a very pro-competitive Act, since it grants the ability of conference carriers to enter into IA or service contracts without fear of a conference veto or retaliation (Brooks, 2000). It was also consistent with the nature of the logistics requirements of shippers in today's business environment where supply chain management has become an integral part of shippers' negotiations and confidentiality is a necessary requirement for successful collaboration with the LSP (Jané and de Ochoa, 2007).

The US approach diverges from the one adopted in the EU mainly as a result of the intrinsic difference in perspective and objectives between US and European antitrust regulation (Haralambides, 2007). The European focus is on the abuse of dominant market position while the objective of US antitrust regulation is the elimination of unjustifiably high prices and price discrimination practices detrimental to consumers. Although the outcome of the regulation may be in the end similar, the assessment methods and approaches towards potentially anticompetitive practices are different. This is also evident in the case of the liner shipping industry.

Furthermore, regulation in Europe is the concerted result of negotiations among countries that may have different national interests and policy perceptions resulting therefore in longer time for an effective policy to be found and implemented (Brooks, 2000). Antitrust regulation within the EU is based on the European Community Treaty or *Treaty of Rome* Articles 81 and 82 and is monitored closely by the European Commission (EC). In line with the European policy principle of *subsidiarity* and although transport policy was at the origin of the establishment of the EU, every Member State had the freedom to implement the provisions of the European Treaty in the way they deem most appropriate. In addition, the Treaties came on top of the existing multilateral and bilateral agreements among

Member States and among Member States and parties outside the Community. This resulted in the existence of transport regulatory frameworks that differed substantially among Member States in terms of degree of government intervention, ratified multilateral and bilateral agreements and in general the degree of market liberalisation (Brooks, 2000).

The divergence of policy framework among various Member States is evident for example in the discussions related to the adoption of the UNCTAD *Code of Conduct for Liner Conferences*. Some of the provisions of Code of Conduct were at variance with those of the Treaty of Rome (Brooks, 2000). European Council Regulation 954/79 granted permission to Member States to ratify the UNCTAD Code, under the pressure of some of the Member States that had already made provisions in order to allow for self-regulation in the liner shipping industry and essentially since the EEC shipping industry was loosing competitiveness against East European countries and the USSR. The Code did not apply among the EEC countries and EEC countries and OECD counties.

The European Council recognised the advantages deriving from the UNCTAD Code for the Common Market, and allowed its ratification in 1983. At the time it was recognised, in the *Cockfield Report* for example, that a more concerted approach to liner shipping regulation would have been more beneficial to the EEC (Brooks, 2000). This resulted in the elaboration of a set of rules—the so-called *First Package*—aiming at harmonising the Single European Market maritime policy.

The 'First Package' was accepted by the Council of Ministers in December 1986, in effect from July 1987. The package contained one of the most crucial pieces of regulation on the liner shipping industry, the European Council Regulation 4056/86 that remained in effect until October 2008. The package though consisted of four regulations (Brooks, 2000):

- Council Regulation (EEC) 4055/86 of 22 December 1986: applied the principle of freedom in providing services to maritime transport between member states and between member stated and third countries;
- Council Regulation (EEC) 4056/86 of 22 December 1986 (repealed): brought detailed rules regarding the application of Articles 85 and 86 (related to competition policy) of the Treaty of Rome to the maritime sector;
- Council Regulation (EEC) 4057/86 of 22 December 1986: monitored unfair pricing practices in maritime transport;
- Council Regulation (EEC) 4058/86 of 22 December 1986: this regulation was about coordinated action in order to ensure free access to cargoes in ocean trades.

These measures aimed at enhancing the competitiveness of the European shipping industry and improving its strength over unfair practices from third countries (Brooks, 2000). One feature of the Council Regulation 4056/86 was that it excluded liner conferences from antitrust regulation granting a block exemption from the cartel rule of Article 81(1) (at that time 85(1)) of the EC Treaty. In addition to granting carriers the possibility of coordinating tariffs the exemption also allowed for:

- coordination of shipping timetables, sailings dates or dates of calls;
- determination of the frequency of sailings or calls;
- coordination or allocation of sailings or calls among members of the conference;
- management of the carrying capacity offered by each member;
- allocation of cargo or revenue among members.

The regulation also included provisions aiming at avoiding the abuse of the exemption. In particular, benefits should also accrue to consumers; the block exemption is 'indispensable' in the sense that its benefits cannot be obtained in other ways; the onus of proof of these benefits is on carriers; carriers were not to use discriminatory policy among ports and shippers, and were expected to discuss with shippers matters of mutual relevance (Brooks, 2000). The regulation also introduced the possibility in Article 6 of 'loyalty agreements', an instrument to allow conference carriers to give immediate, but not deferred, rebates, in line with Article 7 of the UNCTAD Code, and required carriers to file tariffs with the EC.

As already mentioned, Council Regulation 4056/86 came under attack in 1992, when the TAA was notified to the Commission in August. The Commission argued that the TAA did not constitute a conference due to the fact that pricing was not fixed among all members, but the capacity management programme was illegal under Council Regulation 4056/86. In addition the TAA provided for the creation of an inland pricing authority, and this, in the view of the Commission, was beyond the scope of the antitrust block exemption and in breach of the Council Regulation 1017/68 that ensured at the time competition on inland transportation.

In October 1994, the Commission ruled against the TAA and in December of the same year, it banned the Far Eastern Freight Conference from setting multimodal tariffs. Although the Court of First Instance in March 1995 granted a stay of the decision in the fear of market instability, the members of the renamed TACA could set multimodal tariffs until April 1995, when the Commission passed Regulation 870/95 on consortia. The consortia regulation allowed antitrust immunity to a long list of activities, typical of joint ventures, but not to price-fixing. In this sense the Commission Regulation 870/95 differs substantially from Council Regulation 4056/86. Another characteristic of Commission Regulation 870/95 worth noting is its similarity to OSRA: it aims at encouraging IA and SC, but does not allow extensive cooperation on inland transportation and capacity management.

On the 21 of June 1995, the Commission lifted TACA's block exemption on the basis of collective inland rate-fixing and penalties were imposed on its members. The TACA members appealed against this decision but the Court of First Instance, on the 30th of December 2003, upheld the Commission's decision. Nevertheless, the TACA had already been revised to conform to the requirements of the Commission and had been granted exemption in November 2002. The 1995 was an important year not only for Commission Regulation 870/95 but also because of the publication of the *Van Miert Report*, that specifically addressed the issue of multimodal pricing.

The Van Miert Report advised the Commission that conferences should not be allowed to set jointly tariffs for inland transportation, although it argued that a possible exemption could be granted for those services where separate provision would cost more than joint provision, referred to as *fused services* (Brooks, 2000). The 'Van Miert Report' did not recognise the TACA agreements on inland transportation as joint services, although it agreed to the fact that the TACA's proposed *hub and spoke* system improved substantially the efficiency of the system and therefore could eventually qualify for the exemption of intermodal rate from antitrust regulation.

The consultations since 2003 resulted in 2005 in the proposal to the European Council of repealing Regulation 4056/86, mainly on the grounds that the cost structure of the liner shipping industry is not unique and therefore protection from competition is no longer essential. In addition the Commission argued that the industry did not satisfy the three requirements for a block exemption as laid down in Article 81(3) of the Treaty of Rome (Benacchio, *et al.* 2007). The conditions are that the benefits of the exemption must be higher than its costs, that they should be passed on to consumers and that no other measures may be adopted to achieve comparable results (indispensability requirement). In the eyes of the Commission, none of these conditions were met by conferences, and in particular argued that the exemption granted to consortia was sufficient to account for the cooperation needs of the industry. On the 25th of September 2006, Council Regulation 4056/86 was repealed terminating the block exemption of conferences to/from Europe. The liner industry had to meet the new legislation by the 18th October 2008.

The repeal clearly put an end to the discussion on inland joint rate agreements, and it should be noted that as of today joint inland negotiations are not permitted as part of consortium regulation. They are though allowed as part of service contracts negotiated confidentially among individual carriers and shippers—note that consortia are not allowed to prevent their members from entering into SC. Carriers are allowed to offer intermodal rates to shippers competitively although they are required to respect the 'not below cost' rule. The rule entails that the inland component of a multimodal tariff cannot be priced below the actual cost of the inland service (Marlow and Nair, 2008). The aim of this rule is to prevent ocean carriers to cross subsidise inland operations with ocean transport.

Another substantial difference with respect to regulation in the liner shipping industry worth mentioning refers to the use of *discussion agreements*. Discussion agreements grant carriers, under US regulation, the possibility of exchanging information between conference members and independents in relation to operational variables such as capacity or operating costs on a particular route as well as information on freight rate levels. These information exchanges are not allowed in trades to and from the EU but are allowed in trades to and from the US.

10.5 Bundling and regulatory constraints during the conference era

This paragraph reviews three landmark cases involving integrated pricing that determined the development of bundling practices in Europe in the past. The cases focused on concerted price fixing practices on inland rates as an extension of the provisions of Council Regulation 4056/86. All cases rejected the applicability of inland price fixing on the grounds that this was neither a necessary nor a sufficient condition to achieve technical and operational advantages that could benefit shippers and society by and large.

The Far East Freight Conference (FEFC) case

The German Shippers' Council complained to the European Commission about FEFC practices on the 28th of April 1989. The complaint was about the collectively fixed price setting for inland transport by members of the FEFC and, according to the shippers, the fact that this price fixing was not part of the block exemption included in Article 3 of Regulation 4056/86.

At the time, FEFC offered the following services in the Europe - Far East route: maritime transport services, port handling services and inland transport services. This was the consequence of the involvement of carriers in logistics activities and of competition against freight forwarders and other transport intermediaries (Nair, Gardner and Banomyong, 2001). Shippers, in fact in most cases, did not pay to transport intermediaries the rate negotiated by the carrier and the inland transport provider but a door-to-door price.

In the proposal of the FEFC the tariff was collectively set by the Conference and was integrated in the total price of the multimodal service. The multimodal service was offered together with the maritime service and shippers were charged with a multimodal tariff. This was openly in contrast with the provisions of Regulation 4056/86, that in Article 5(3) obliged conferences to allow shippers to choose the merchant haulage of their choice for the inland transport leg. It should be noted that in reality no objection was ever brought against multimodal pricing in itself, as long as it did not involve collective pricing, as in the case of ocean tariffs. The reasons of Article 5(3) were (Nair, *et al.* 2001):

- prevent conference carriers to dominate the inland transport market by providing services in combination with the maritime leg of the transportation;
- mitigate foreign exchange risk, as inland services could be bought in local currency;
- enable FOB buyers who had their own ships to be charged with separate inland tariffs.

FEFC, in order to support collective pricing on the hinterland leg, argued that collective pricing in the trade was essential in order for shipping companies to provide scheduled services. This ensured rate stability but as markets were moving towards multimodal transport services, collective pricing had to be extended to this segment of the transport chain as well. The conference argued therefore that Regulation 4056/86 was applicable also in the case of the integrated multimodal services offered by conference members.

The European Commission argued that the appropriate regulation for the inland part of the trade was the Regulation 1017/68, as it provided rules for price fixing agreements in the field of transport by rail, road or inland waterways. The European Commission did not accept the argument that a sector complementary to one that was granted a block exemption should be exempted as well. The Commission rejected therefore the arguments of the FEFC on the ground that (Nair, *et al.* 2001):

- the agreements regarding inland prices were commercial agreements and did not involve technical improvements or cooperation;
- the FEFC subcontracted inland transport services from other providers and did not provide them itself;
- other transport intermediaries such as railway companies and forwarders were not granted antitrust exemption;
- it was possible to provide similar services without the aid of the antitrust exemption, since there were carriers that were providing such services without being part of a conference.

The Commission provided further clarification on the applicability of the regulation stating that exemptions to antitrust regulation were allowed in case of "successive, complementary, substitute or combined transport operation" between inland modes and not between sea and inland modes, making the exception applicable only when transportation was carried wholly inland (Nair, *et al.* 2001).

The Trans Atlantic Agreement (TAA) case

The TAA applied for an exemption under Article 81(1) and of Regulation 4056/86 on the 28 of August 1992. The most important provisions of the TAA Agreement were:

- Price agreements on the maritime transport;
- Capacity management programmes for the maritime transport;
- A two tier pricing agreement with two classes of membership;
- Collective inland price fixing as part of the multimodal transport service.

The two tier pricing agreement allowed the members of TAA that were also members of an existing conference to charge a different price from the members of the agreement that had not previously been part of a conference (so called *independent carriers*). The Commission did not consider tariffs set up through this mechanism as *common tariffs*, although *agreed in common*, and therefore TAA did not satisfy the legal definition of *conference*. This two tier pricing mechanism was later abandoned by TACA.

The provision concerning inland transportation was rejected by the Commission on the 28th of September 1992 on the ground that such agreements should be examined under Regulation 1012/68. The TAA advocated that the agreement was established in order to achieve stability on the North Atlantic route and insisted that the agreement should be examined under Regulation 4056/86 of shipping conferences.

The TAA sought an exemption for the inland transportation segment arguing that it was connected to the maritime leg. As discussed in the previous paragraph, this justification was not sufficient for an exemption under Regulation 4056/86, as it did not meet the criteria of a traditional conference. But since the TAA was not a regular conference agreement, the Commission had to examine the case of inland pricing separately. The agreement regarding inland pricing restricted competition in rail, road and waterway transport and could only be allowed under Regulation 1017/68 (now partially repealed by Council Regulation 1/2003 of 16 December 2002). Hence, the case was reviewed by the Commission under Regulation 1017/68 and its provision for rate fixing. At the time cooperation among transport operators could be justified under Regulation 1017/68 only in case of substantial efficiency gains deriving from technical agreements mostly aiming at the joint implementation of new technologies and standards.

The European Commission decided that (Nair, *et al.* 2001):

- The price agreement was not a technical agreement and it did not aim at achieving technical improvement or cooperation;
- The services were not provided by the conference but by other inland hauliers;

- There were no benefits for the consumers, as shippers complained about inland price fixing.

The Commission also referred to the FEFC case and stated that the arguments that had been made there were also applicable in this case. It highlighted that multimodal service providers operated successfully outside the TAA, without having an exemption, proving that efficient multimodal service provision was not dependent on price fixing.

On 19 October 1994,the European Commission reached the following decision (Nair, *et al.* 2001): the provisions concerning price fixing and capacity management infringed Article 81(1) of the Treaty and, therefore, the application of Article 81(3) of the Treaty and Article 5 of Regulation 1017/68 is rejected. The TAA challenged the decision in the Court of First Instance but the appeal was dismissed by order of the President of the European Court of Justice on the 19th of July 1995.

TACA Ruling Against Integrated Pricing

The TAA was renamed TACA and on the 5th of July 1994 it submitted a modified application for exemption under Article 81(3). The agreement was permitted under the US law, allowing the conference to operate in the US, but TACA carriers did not want to face the same problem they faced as TAA with the European Commission. The new agreement had been amended quite extensively (Nair, *et al.* 2001). This clearly showed the intentions of the carriers to abandon the old TAA provisions which were questioned by the Commission. Taking into consideration the previous decision of the European Commission on the TAA, the new TACA had abandoned the capacity management programme and the two tier pricing agreement with the two classes of membership. The Commission intended to examine the new agreement under Regulations 17/62 and 1017/68, as Regulation 4056/86 was in their view again not applicable to inland transportation.

The European Commission considered TACA as a landmark case due to the fact that there were other issues in addition to multimodal pricing which attracted the Commission's attention. The members of the TACA were considered to have a dominant position in the relevant market and, as already mentioned, the TACA imposed strict limitations on service contracts.

With reference to pricing of inland services, more specifically, the provisions of TACA were similar to the ones contained in the TAA. The major difference consisted of the fact that the TACA further elaborated on the purposes of multimodal pricing by defining two cooperation programmes designed to improve the operations and management of containers in Europe. Specifically, these programmes consisted of the European Inland Equipment Interchange Arrangement

(EIEIA), aiming at enhancing the efficiency of the inland repositioning of empty containers in Europe, and programme two focusing on the development of Hub and Spoke networks in Europe.

Initially, the European Commission responded as follows to the rate stability claim, put forward by TACA members as a justification for the exemption (Nair, *et al.* 2001):

> *"A liner shipping conference brings stability to the trade it affects by fixing a uniform tariff which serves as a reference point for the market. Prices set in this way are likely to remain unchanged for a longer period of time than if they are set by individual lines. The reduction in the price fluctuations which would be expected in a normally competitive market may benefit shippers by reducing uncertainty as to future trading conditions."*

This stability in rates would also bring reliability in the services and ensure a satisfactory quality level. The agreement on rate fixing could benefit from the exemption as long as the members of the agreement remain subjected to competition. The commission's definition of the concept was deliberately restrictive in order to avoid difficulties with similar agreements in the future. In addition the Commission stated why inland price fixing was not under the scope of Regulation 4056/86 (Nair, *et al.* 2001):

- the Commission had rejected similar provisions in the TAA and the FEFC;
- the Report that was sent to the Council regarding the application of the Communities' competition rules to maritime transport concluded that the provision of multimodal services did not depend on fixing prices;
- the decision of the Court of Justice in the Spediporto case in which Regulation 4056/86 could not be applied due to transportation by road of goods unloaded from the vessel.

Subsequently, the Commission, similarly to the previous cases, tested whether the agreement could be exempted under Regulation 1017/68 and it deliberated that (Nair, *et al.* 2001):

- there was no evidence to prove that collective price fixing was conductive to improving the quality of inland transport, and that on the contrary improvements were derived from fruitful negotiations between shippers and carriers;
- rate stability was not an issue in the market for haulage transport;
- no increases in productivity of inland or multimodal services had been reported;
- there was no evidence of technical or economic improvement in the offered inland or multimodal services;

- the inland services were not provided by conference members but outsourced; therefore, benefits for consumers were limited if any.

On 26 of November 1996, the European Commission revoked the immunity to the TACA members on inland price fixing. On the 11th of April 1997, the Commission, following the European Court rulings, decided that collective inland price fixing was not under the scope of Regulation 4056/86 and therefore it could not grant an exemption.

10.6 Bundling and antitrust law

The previous paragraph has presented the basic arguments of the discussions on inland price fixing that set the scene for integrated pricing in the last decade. It should be noted that the European Commission did not believe that these agreements were to be considered as part of conference price fixing, but never condemned the application of integrated pricing as part of SC. On the contrary, the Commission in several cases rejected the agreements on the basis that they would restrict the flexibility of carriers to engage in SC. It is useful at this stage to examine what bundling practices may or may not come under the scrutiny of the antitrust authorities.

Although the literature on bundling and antitrust law is far from conclusive and in several occasions the antitrust authorities have clearly stated that it is not possible to deliberate on the desirability of bundling (Kobayashi, 2005*a*; 2006), it may be useful to summarise what practices are considered legal and what practices are forbidden.

In order to proceed with the understanding of the legality of bundling practices, in addition to the distinction between bundling and tying and pure and mixed bundling, another definition may be useful. The distinction, based on the definition provided by Stremersch and Tellis (2002), refers to the difference between *product* and *price* bundle. With the latter the authors refer to the sale of two or more products in a package at a discount, without any integration of the product at the production level. This implies that the reservation price for the bundle is equal to the linear sum of the reservation prices for the separate components. This type of strategy is common in consumer goods, for example when a certain shampoo is sold in a package with a hair conditioner. It should be noted that this type of strategy takes advantage of a certain degree of complementarity between the two products, and leverages on the likelihood that a consumer requiring one product will also need the bundled one.

The concept of product bundling is used instead when the creation of the bundle provides at least some of the consumers with an increase in value (Stremersch and Tellis, 2002). In other words, the bundle is somewhat perceived from the consumer as a different (new) product and as such consumer reservation prices are different than the linear sum of the prices of the individual bundle components (most likely higher). The sale of holiday travel packages is an example of this type of bundles that may include a return flight to Milan, a four nights' accommodation and two operas at the Scala theatre. Another example of product bundling is the integration of logistics services and ocean transportation. The provision of the two services in an integrated form generates added value to the consumer in terms of better coordination, supply chain visibility, etc.

The table below summarises the different possible bundling strategies between the two products X and Y, as outlined in the article of Stremersch and Tellis (2002). In the table (X,Y) indicates a price bundle, while (X⊕Y) indicates a product bundle. To this diagram we have added the case of tying, that similarly to pure bundling, does not allow the use of product X (the tying product) without product Y (the tied product) although product Y could be freely purchased independently from product X, and would generally be provided under more competitive conditions.

Table 37: Legality of bundling.

Form / Focus	Price bundling	Product bundling
Unbundling	X, Y	
Pure bundling	(X,Y)	(X⊕Y)
Mixed bundling	(X,Y), X, Y	(X⊕Y), X, Y
Tying	(X,Y), Y	

Source: Adapted from Stremersch and Tellis (2002)

In general pure price bundling (shaded in grey in table 37) is illegal under the provisions of antitrust law in Europe and in the US for firms with market power (Stremersch and Tellis, 2002). Similarly, tying is illegal (see for example the case of Microsoft and the bundling of Internet Explorer with Windows OS) in those cases where a firm has considerable market power in the market for the tying product, since it is perceived that by tying it may extend its power to the market for the tied product (Whinston, 2001).

This is summarised by Stremersch and Tellis (2002) in what they call *rule of reason*: '*Bundling is illegal under the rule of reason when it involves (1) pure bundling (2) of separate products (3) by a firm with market power, (4) involving a substantial amount of commerce, (5) which poses a threat that the bundling firm will acquire additional market power over at least one of the products that is being bundles with the tying product, and (6) no plausible consumer benefits offset the potential damage to competition.*' (Stremersch and Tellis, 2002: pp. 58-59).

Under the rule of reason, bundling of ocean transportation and logistics services would be illegal only when an ocean carrier that would have substantial market power (1) on a relatively important route (4) would sell ocean transportation only in conjunction (2) with a logistics service, that could be considered a separate product (3), with the objective of acquiring market power on either of the service markets (5) and with limited or no benefits for the consumers (6).

It goes without saying that as long as ocean transportation is still provided as a separate product and priced at levels that would not prevent customer firms to purchase the service alone, there are no objections under antitrust law to the practice of bundling. In fact all six conditions listed in the rule of reason need to apply simultaneously.

10.7 The practice of bundling in the future

There is unanimous agreement that the future of transportation is in integrated supply chain solutions. In this respect, the regulation in the US seems to be a step ahead of regulation in Europe, most likely also as a consequence of the differences in geography, demography and culture. It seems that in the US antirust regulation regarding inland transport services has adapted to ensure better performance (Lopez 2003). Two points show clearly the different approach that the US has followed in regulating intermodal transport. The first difference relates to the structure of the institutional environment where integrated transportation service providers operate, that is characterised by clear institutional responsibilities and tasks. This is the consequence of the existence in the US of institution active at federal level to promote intermodality such as the Office of Freight Management Operations or the Intermodal Association of North America (IANA). The second difference relates to the overall objective of competition regulation, which places more emphasis on the improvement of efficiency and performance, even when competition is reduced.

Companies in the US, in order to cope with competition and ensure long term contracts with shippers, are seeking forms of cooperation which help cost reduction and enhance efficiency. The regulator is aware of that and tries to promote competition by eliminating regulatory constraints with the exception of those regarding security concerns. Contrary to what is happening in Europe, regulation allows carries more flexibility in negotiating prices for intermodal activities, as regulatory institutions are of the opinion that this will bring stability in the market and stimulate investments (Lopez, 2003).

Although intermodal transport is a priority in Europe, there is no specific legislation regarding the regulation of intermodal activities (Lopez, 2003). This can be attributed to the fact that intermodal transport has been analyzed in terms of its separate constituent modes instead of as a whole. Policies and regulations have followed a unimodal approach and policy makers have neglected the fact that containerized cargo can switch modes without breaking the whole chain and with remarkable efficiency. The European Commission pointed out the importance of each mode's special characteristics, in order to apply effectively the competition legislation as presented in Articles 81 and 82 of the Treaty of Rome. Due to the fact that regulation concerning competition in transport derives from the general rules of competition, it should be possible for the Commission to decide which rules to apply in any case.

Although the impact of the repeal of Council Regulation 4056/86 in trades to and from Europe is deemed to be negligible, as a consequence of SC and IA (Benacchio, *et al.* 2007) it might have an important effect in favouring the development of all-inclusive prices. It is unlikely that ocean freight rates will in the future disappear, being replaced by all inclusive door-to-door rates, simply because some customers would still prefer unbundled pricing, in cases for example where the customer has access to cheaper haulage on his own account, or does not require any haulage at all.

As carriers have two major types of clients, direct shippers and Non-Vessel Operating Common Carriers (NVOCCs), it is likely that price bundling will develop differently according to the type of customer typology. Although some direct shippers often prefer to control their chain directly and are able to obtain from hinterland transport operators advantageous rates on the basis of their own volumes and long standing contractual relations, others, especially in sector such as automotives; footware; electronics; and chemicals, completely outsource their supply chain activities to LSPs. In the case of NVOCCs these companies are large logistics service providers, for which the provision of bundles is common practice. They are able therefore to provide bundles to their customers at a better price than the carriers often can.

This has as consequence the fact that hinterland transportation is performed for a large part through merchant haulage and only for a small part as carrier haulage. Rates in general on hinterland transportation are very low, and it is not particularly interesting for the carrier to provide this service for reasons other than strategic positioning.

10.8 Conclusions and recommendation for further research

This chapter aimed at analysing the feasibility of bundling of ocean transportation and other logistics services together against the regulatory constraints in the liner and in the logistics industries and on the practice of bundling. The chapter reviewed regulations in the USA and Europe and observed that the practice of bundling is not illegal in neither jurisdiction as long as (i) services are priced within the instrument of confidential service contracts, i.e. not as part of conference rate-fixing agreements, (ii) a service bundle is not provided exclusively, i.e. the shipper has always the possibility of purchasing the various bundle components independently, (iii) inland service rates and specifications are not negotiated jointly by carriers as a consortium, (iv) the ‘not below cost rule’ is respected for those trades where conference tariffs are applicable (v) in trades to and from the EU, no use is made of discussion agreements.

These provisions allow for the use of bundling strategies in all other circumstances and therefore the development of these strategies is strongly advised. The chapter argues also that the repeal of Council Regulation 4056/86 will favour the development of bundling strategies and that ocean carriers should aim at further investigating the advantages offered by this strategy.

11 Concluding Remarks and Issues for Further Discussion

11.1 Introduction

This chapter summarises the major conclusions and scientific contributing of the thesis and provides directions for further research. The thesis aimed at investigating the practice of bundling, its use and applicability to global supply chains, i.e. supply chains that are characterised by intercontinental transportation by means of container shipping.

The thesis is structured in nine chapters in addition to the introductory and the concluding chapters. Chapter 2 provides a review of the industrial organisation and the marketing management literature on bundling. Chapter 3 presents a review of the liner shipping economics concepts and characteristics that are important to the application of bundling. Chapter 4 summarises the results of two surveys of shippers' preference on outsourcing and bundling. Chapter 5 reviews the current practice of bundling in the liner industry and presents the finding of a set of interviews to representatives of ocean carriers and to other industry experts. The role of transaction costs and vertical integration revealed to be crucial in understanding the benefits deriving from the practice of bundling and therefore chapter 6 is dedicated to these two subjects. Chapter 7 focused on how optimal bundles can be assembled and suggests the use of conjoint analysis and linear programming as appropriate techniques for the selection of optimal bundles. Chapter 8 shows how a carrier can only fully understand the potential of bundling if it strategically refocuses so that to embed supply chain thinking in its organisation. Chapter 9 discusses the strategic implications of bundling through two game theory models, while chapter 10 expands on the legal and antitrust issues that might be relevant for carriers and society and that, unless resolved, could hinder the development of bundling practices in the future. This chapter provides a summary of the conclusions of the thesis and directions for further research.

The rest of the chapter has been structured around the seven themes from which the practice of bundling has been looked at. These themes are:

- Bundling impact on society and shippers;
- Bundling and carriers' competitive advantage;
- Transaction costs and bundling;
- Strategic bundling;
- Bundling and the supply chain;
- Competition issues and regulation.

11.2 Bundling impact on society and shippers

Bundling is a pervasive practice in most industries, however its application in the container industry is still limited. From the surveys presented in chapter 4 and the interviews conducted in chapter 5 it appears that shippers appreciate the advantages of bundling in terms of tariff simplification; easiness to compare quotes from different carriers through door-to-door prices; and the increase in the number and types of logistics solutions on offer. Notwithstanding the general agreement on the benefits of bundling, the maritime industry still looks at it with diffidence. This seems to be due to the rather confrontational nature of the past relationships between ocean carriers and shippers and the perception that bundled tariffs may conceal additional mark-ups.

It should be noted that when bundling is associated with the sale of its individual components, in what is generally referred to as *mixed bundling*, it always results in an increase of consumers' choice. Considerations on social welfare should therefore always be weighted against the benefits deriving from increased choice and variety. Especially in the case of certain supply chains, these benefits can be substantial. The results for society are in principle positive, although monitoring of the practice is essential and further research in this area is imperative.

11.3 Bundling and carriers' competitive advantage

Among the major findings of the thesis is that bundling is motivated in practice by: cost advantages; demand drivers; differentiation strategy; the possibility of obtaining higher margins by jointly offering ocean and hinterland transportation; the necessity to better control coordination costs with hinterland connections. Integration seems to be the business strategy that will prevail among carriers in the long term. Bundling provides a useful aid in implementing this strategy successfully. Not all bundles are advisable though. Depending on the distribution of reservation prices among the various customer segments served by each carrier, optimal bundles are those that result from the combination of services that have asymmetric conditional reservation prices, or, in other words, services for which the reservation prices in a segment of consumers complement the reservation prices of the same services for another segment of consumers.

11.4 Transaction costs and bundling

Successful implementation of bundling requires a focus on the nature of the transaction between shippers and ocean carriers. Only with this focus can ocean carriers build on bundling propositions and increase the profitability of bundling and its desirability in society. The use of transaction cost economics can be particularly valuable in the context of ocean transportation and logistics outsourcing and constitutes a solid ground on which ocean carriers can engage in bundling strategies. Although bundling does not necessarily require vertical integration, as discussed in chapter 6, when the transactions between the carrier and a logistics service provider are taken out of the market, carriers may have a better position to engage in bundling. This happens because of their better ability to harness transaction costs and reduce the impact of information asymmetries. These are the type of bundles that are referred to as *product bundles*. As explained in chapter 7, product bundling always yields better results than unbundling (proposition 3).

In order to fully appreciate the potential offered by product bundling ocean carriers should open up to the advantages offered by vertical integration. The thesis argues that for this to happen ocean carriers need to look beyond their traditional company boundaries and focus on transcorporate performance measures that are characteristic of supply chains. This approach, described more in detail in chapter 8, requires the modification of traditional performance measure indicators to include also transcorporate performance measures. This, it is argued, should not only take place at the carrier level, but also with the other members of the container supply chain, such as terminals, ports, hinterland transport providers, distributors, warehouses and third party logistics providers.

11.5 Strategic bundling

Although research in this area is still in its early stages, the applicability of bundling in a competitive market delivers interesting conclusions. In particular it emerged from the two models discussed in chapter 9 that bundling has mixed effects on consumer surplus and total welfare, depending on the efficiency of carriers and transaction costs. The most interesting finding of the thesis is that bundling allows for efficiency gains to be passed on to shippers and society, an eventuality that cannot take place when bundling is forbidden.

This desirable feature of bundling though comes at a risk since carriers may not necessarily have the highest levels of efficiency in providing the bundle. When this is the case, bundling tends to reduce consumer surplus and can even reduce social welfare. An important issue that remains open for further research, although it is partially addressed in chapter 6, is whether carriers are intrinsically better than other parties in the supply chain in providing bundles. If this is the case, competitive forces, even in the restrictive case of duopoly, ensure that this efficiency is passed on to consumers and society.

11.6 Bundling and the supply chain

The thesis brought attention to two important issues in supply chain management that require further investigation: supply chain pricing and performance metric selection. In particular the former area of investigation seems particularly interesting in view of the potential offered by price discrimination and revenue management techniques in the context of logistics service provision. The application of bundling as a technique to price integrated logistics services allows for discriminating among customers, improve the efficiency and the effectiveness of the chain and increase the competitive advantage of the integrated company. Chapter 7 offers examples on possible applications of bundling in the liner and logistics industries.

The latter issue relies on the hypothesis that ocean transportation is a subsystem within the supply chain and as such its performance should not be limited to the evaluation of its internal processes. It is the performance of the entire chain that really matters. This is reflected in the survey of shippers in chapter 4 and from the discussions in chapter 8. If the supply chain performs well, i.e. creates value, then it will be chosen and consequently also the carrier will be chosen. As the supply chain is as strong as its weakest link, a carrier may be extremely efficient in its operations, but if terminals, or hinterland transport providers do not provide adequate levels of service, or the access roads to the port are congested, this will impact the ability of the chain to create value and in essence also the competitiveness of the carrier.

The focus on the supply chain is required also by the fact that the performance of each link is influenced by the performance of other links. As such the performance of a liner company is affected by the performance of a terminal and in turn, the performance of the container terminal is affected for example by inefficient trucking, or inefficient port policy. The cooperative nature of supply chains requires a different approach to performance, where, next to traditional intra company measures, also inter chain metrics should be monitored and analysed.

This of course raises particular challenges for supply chain operators, as cooperation among the various stakeholders becomes then a fundamental prerequisite for the implementation of efficient supply chain strategies. From the side of the carriers, in particular of those that choose to provide third party logistics services, investment in ICT and in improving supply chain visibility should be on top of their development agendas. But this of course cannot and should not be done independently. The thesis concludes that a lack of supply chain focus in the evaluation of the carriers' performance has a crucial impact on the ability of a integrated carrier to exploit its competitive advantage and successfully implement bundling.

11.7 Competition issues and regulation

The thesis reviewed the regulation in the USA and Europe and observed that the practice of bundling is legal in both jurisdictions as long as (i) services are priced within the instrument of confidential service contracts, i.e. not as part of conference rate-fixing agreements, (ii) a service bundle is not provided alone, i.e. the shipper has always the possibility of purchasing the various bundle components independently, (iii) inland service rates and specifications are not negotiated jointly by carriers as a consortium, (iv) the 'not-below-cost rule' is respected for those trades where conference tariffs are applicable (v) in trades to and from the EU, no use is made of discussion agreements. Further discussion on these conditions is provided in chapter 2 and chapter 10.

These provisions allow for the use of bundling strategies in all other circumstances and therefore the development of these strategies is strongly advised. The thesis argues also that the repeal of the Council Regulation 4056/86 will favour the development of bundling strategies and that ocean carriers should aim at further investigating the advantages offered by this strategy.

11.8 Directions for further research

The transdisciplinary nature of bundling and the other topics discussed in the thesis revealed to be a very fertile ground for further research and opens new areas for investigation. This paragraph aims at providing some indication of the subjects that in our view are most likely to offer valuable opportunities for analysis.

An interesting area of research relates to the study and application of nonlinear pricing and revenue management in the logistics and transportation industry. Although the appropriateness of these techniques to the logistics industry seems obvious, very little research is available both from a theoretical and an empirical perspective. Pricing techniques such as auctions, dynamic pricing and overbooking have revealed very successful in a variety of industries, but their application in the logistics sector is still limited.

It would be interesting to connect these different forms of pricing with the characteristics of the various models of logistics service provider observable in practice in terms of asset control for example. Further research could test whether certain forms of yield management are better implemented by a fully integrated logistics provider or could be equally successful if implemented by an asset-light 3PL.

This discussion brings in the role of ocean transportation and the continuous trend in vertical integration. In addition to the discussions on the appropriateness of a vertical integration strategy and its benefits, other less debated issues are worth further investigation. The issue of competition among logistics service providers and ocean carriers, for example, requires surely further analysis.

The double role of many logistics providers as competitors and customers of the carriers is an interesting phenomenon that could be worth investigating also in more general terms. An interesting approach could entail the empirical testing of the conceptual transaction cost economics models discussed in chapter 6. This is surely interesting, since, although transaction costs economics paradigms have been empirically validated, no empirical testing has been performed on their applicability in the logistics and ocean transportation industries.

This is linked to the use of service contracts as the most common negotiation instrument in the industry. Service contracts have radically modified the nature of competition between carriers and the traditional logistics service providers. Carrier involvement in supply chain management has deepened and therefore their strategic scope has been adapted to better fulfil this new role. Research should address how the relation between carriers, shippers and logistics service providers has changed as a consequence of the development of service contracts.

Service contracts are of course linked to the change in the regulatory framework that has characterised the liner shipping industry in the last decades and that has its most recent turn with the repeal of the conference regulation in trades to and from Europe. The issue on the appropriateness of the current regulatory regime to foster trade is still the subject of a debate that goes beyond the role and importance of conferences, and addresses the impact of consortia and alliances on the industry and consumers, and is likely to remain an interesting subject for investigation.

In more general terms also the debate on the welfare effects of bundling on consumers and society by and large are still highly contested, and further research is required on the definition of the appropriate regulatory framework in this area. The liner and logistics industry could prove to be interesting sector examples. In particular, research on the effects of bundling in situations of (limited) competition is still inadequate although the potential of bundling as a market segmentation device seems to be widely accepted.

The relations among bundling practices, market segmentation research and contracting, appear an interesting area of analysis. More attention should be paid to the identification of the specific operational and contracting issues in the design of (service) bundle solutions in terms for example of their impact on price elasticities. Again the liner and the logistics industries could offer a large number of examples to test these concepts.

A variety of other operational issues are still open to discussion. In particular, the following areas of research should be further explored:

- The role of supply chain information and visibility in product and price bundling;
- The impact of changes in ocean transportation price elasticities and market structures on the profitability of bundling;
- The difference in price elasticities of ocean transportation and logistics services when they are provided as pure bundles, mixed bundles or unbundled;
- The feasibility of designing and developing modular logistics and transportation products aiming at providing flexibility in setting up bundled solutions.

References

A

Acciaro, M 2003. Il Sistema Porto: Organizzazione, Economia e Impatto Locale. MSc Thesis, University of Rome "La Sapienza", Rome (Italy), May 2003.

Acciaro, M 2004. Private Financing of Container Terminal Infrastructure. MSc Thesis, Erasmus University Rotterdam, the Netherlands, October 2004.

Acciaro, M 2005. The Role of Ports in the Development of Mediterranean Islands: the case of Sardinia. *Conference proceedings of the International Association of Maritime Economists (IAME) Annual Conference*, 23-25 June 2005, Limassol (Cyprus).

Acciaro, M 2006*a*. Port Policy in the Baltic States: Strategic Issues and Implications for the European Port Policy. *Conference proceedings of the International Association of Maritime Economists (IAME) Annual Conference*, 12-14 July 2006, Melbourne (Australia).

Acciaro, M 2006*b*. The future role of Mediterranean ports in European logistics supply chains. *Conference proceedings of the Third Maritime Transport Conference*, 16-19 May 2006, Barcelona (Spain).

Acciaro, M 2006*c*. What future for Mediterranean ports? *Conference proceedings Fourth MedTrade Summit*, 6-8 April 2006, Valletta (Malta).

Acciaro, M 2008*a*. Performance measurement and management in container terminals: the supply chain perspective. Paper presented at the Port Economics Reading Group Seminar, Erasmus University Rotterdam, 11 June 2008.

Acciaro, M 2008*b*. Product bundling in the container industry: What do we know about it? *Conference Proceedings of the International Association of Maritime Economists (IAME) Annual Conference*, 14-16 April 2008, Dalian (PR China).

Acciaro, M 2008*c*. The role of ports in the development of Mediterranean islands: the case of Sardinia. *International Journal of Transport Economics* 35(3): 295-324.

Acciaro, M 2008*d*. Private financing of container terminal infrastructure: a review of the major issues. *Conference proceedings of the Port Finance and Investment Conference*, 29-30 September 2008, Amsterdam (the Netherlands).

Acciaro, M 2009*a*. Bundling ocean transportation and logistics services: the shipper perspective. Working Paper, Center for Maritime Economics and Logistics (MEL), Erasmus University Rotterdam.

Acciaro, M 2009*b*. Container carriers' investment in dedicated terminals. *Conference proceedings of the Port Finance and Investment Conference*, 9-10 June 2009, Amsterdam.

Acciaro, M 2010*a*. Container terminal performance measurement: the supply chain perspective. *International Journal of Physical Distribution and Logistics Management*, submitted.

Acciaro, M 2010*b*. Hybrid organisation governance models for integrated ocean carriers. *Conference Proceedings of the 12th World Conference on Transport Research (WCTR)*, 11-15 July 2010, Lisboa (Portugal).

Acciaro, M 2010*c*. Price discrimination in liner shipping: advance booking and express services. *Conference Proceedings of the International Association of Maritime Economists (IAME) Annual Conference,* 16-18 July 2010, Lisboa (Portugal).

Acciaro, M 2010*d*. Best value logistics propositions: an application of conjoint analysis to global supply chains. *Conference Proceedings of the International Association of Maritime Economists (IAME) Annual Conference,* 16-18 July 2010, Lisboa (Portugal).

Acciaro, M and Haralambides, HE 2007. Product bundling in global ocean transportation. *Conference Proceedings of the International Association of Maritime Economists (IAME) Annual Conference*, 04-06 July 2007, Athens (Greece).

Acciaro, M and Liu, M 2009. Performance measurement and cost control in liner shipping: the supply chain perspective. *Conference proceedings of Fourth Maritime Transport Conference*, 27-29 April 2009, Barcelona (Spain).

Acciaro, M and Liu, M 2010. Transcorporate performance measurement in liner shipping. *International Journal of Logistics Management*, submitted.

Ackerman, KB 1996. Pitfalls in logistics partnerships. *International Journal of Physical Distribution and Logistics Management* 26(3): 35-7.

Adams, WJ and Yellen, JL 1976. Commodity bundling and the burden of monopoly. *Quarterly Journal of Economics* 90(3): 475-498.

Aertsen, F 1993. Contracting-out the physical distribution function: A trade-off between asset specificity and performance measurement. *International Journal of Physical Distribution and Logistics Management* 23(1): 23-9.

Agarwal, MK and Green, PE 1991. Adaptive conjoint analysis versus self-explicated models: some empirical results. *International Journal of Research in Marketing* 8(2): 141-146.

Akerlof, GA 1970. The market for lemons: quality, uncertainty and the price mechanism. *The Quarterly Journal of Economics* 84(3): 488-500.

Allen, DW 1991. What are transaction costs? *Research in Law and Economics* 14(1): 1-18.

Allen, DW 1999. Transaction costs. In Ménard, C (ed.). *Transaction costs and Property Rights* (pp. 893-926). Cheltenham: Edward Elgar.

Allenby, GM and Rossi, PE 1991. Quality perceptions and asymmetric switching between brands 10(3): 185-204.

Altinkemer, K 2001. Bundling e-banking services. *Communications of the ACM* 44(6): 45-47.

Anderson, JC and Narus, JA 1995. Capturing the value of supplementary services. *Harvard Business Review*, 73(1): 107-117.

Anderson, SP and Leruth, L 1993. Why firms may prefer not to price discriminate via mixed bundling. *International Journal of Industrial Organization* 11(1): 49-61.

Anderson, WR and Rogers, CP 1992. *Antitrust Law: Policy and Practice.* New York: Matthew Bender.

Andrade, G and Stafford, E 2001. New evidence and perspective on mergers. *Journal of Economic Perspectives* 15(2): 103-120.

Arksey, H and Knight, PT 1998. *Interviewing for Social Scientists: An Introductory Resource with Examples*. London: Sage.

Armstrong, M 1996. Multiproduct nonlinear pricing. *Econometrica* 64(1): 51-75.

Armstrong, M 2006. Recent developments in the economics of price discrimination. In Blundell, R, Newey, W K and Persson, T (eds.). *Advances in Economics and Econometrics: Theory and Applications: Ninth World Congress Volume 2* (pp. 97-141). Cambridge: Cambridge University Press.

Armstrong, M and Vickers, J 2010. Competitive nonlinear pricing and bundling. *Review of Economic Studies* 77(1): 30-60.

Arora, A and Bokhari, FAS 2007. Open versus closed firms and dynamics of industry evolution. *The Journal of Industrial Economics* 55(3): 499-527.

Arora, R 2008. Price bundling and framing strategies for complementary products. *Journal of Product and Brand Management* 17(7): 475-484.

Arrow, KJ 1967. The economic implications of learning by doing. *The Review of Economic Studies* 29(3): 155-173.

Arroyo, P, Gaytan, J and De Boer, L 2006. A survey of 3PL in Mexico and a comparison with reports on Europe and USA. *International Journal of Operations and Production Management* 26(6): 639-667.

Ashenbaum, B, Maltz, AB and Rabinovich, E 2005. Studies of trends in third-party logistics usage: what can we conclude? *Transportation Journal* 44(3): 39-50.

Ayres, I and Nalebuff, B 2005. Going soft on Microsoft? The EU's antitrust case and remedy. *The Economist's Voice* 2(2) article 4.

B

Baird, AJ 2002. The Economics of Container Transhipment. *International Journal of Maritime Economics* 4(4): 249-280.

Bakos, Y and Brynjolfsson, E 1999. Bundling Information Goods: Pricing, Profits, and Efficiency. *Management Science* 45(12): 1613–30.

Bakos, Y and Brynjolfsson, E 2000. Aggregation and Disaggregation of Information Goods: Implicatons for Bundling, Site Licensing, and Micropayment Systems. In D Hurley, et al. (eds.). *Internet Publishing and Beyond: The Economics of Digital Information and Intellectual Property*.

Bardi, EJ and Tracey, M 1991. Transportation outsourcing: a survey of US practices. *International Journal of Physical Distribution and Logistics Management* 21(3): 15-21.

Barnard, C 1938. *The Function of the Executive,* 15th printing 1962. Cambridge, MA: Harvard University Press.

Barney, J 1991. Advances in strategic management: Firm resources and sustained competitive advantage. *Journal of Management* 17(1): 99-120.

Barros, CP and Athanassiou, M 2004. Efficiency in European seaports with DEA: evidence from Greece and Portugal. *Maritime Economics and Logistics* 6(2): 122-140.

Barthélemy, J and Quélin, BV 2006. Complexity of Outsourcing Contracts and *ex-post* transaction costs: an empirical investigation. *Journal of Management Studies* 43(8): 1775-1797.

Bartlett, PA, Julien, DM and Baines, TS 2007. Improving supply chain performance through improved visibility. *International Journal of Logistics Management* 18(2): 294-313.

Barzel, Y 1977. Some fallacies in the interpretation of information costs. *Journal of Law and Economics* 20(2): 27-48.

Barzel, Y 1982. Measurement costs and the organisation of markets. *Journal of Law and Economics* 25(1): 27-48.

Barzel, Y 1985. Transaction costs: are they just costs? *Journal of Institutional and Theoretical Economics* 141(1): 4-16.

Bask, AH 2001. Relationships between 3PL providers and members of supply chains: a strategic perspective. *Journal of Business and Industrial Marketing* 16(6): 470-86.

Bauer, HH, Hermann, A and Mengen, A 1994. Eine Methode zur gewinnmaximalen Producktgestaltung auf der Basis des Conjoint Measurement. *Zeitschrift für Betriebswirtschaft* 64(1): 81-94.

Baumol, WJ 1982. Contestable markets: an uprise in the theory of industry structure. *The American Economic Review* 72(1): 1-15.

Beamon, BM 1999. Measuring supply chain performance. *International Journal of Operations and Production Management* 19(3): 275-292.

Bechtel, C and Jayaram, J 1997. Supply chain management: a strategic perspective. *The International Journal of Logistics Management* 8(1): 15-34.

Ben-Akiva, M and Gershenfeld, S 1998. Multi-featured products and services: Analysing pricing and bundling strategies. *Journal of Forecasting* 17(3-4): 175-196.

Benacchio, M, Ferrari, C and Musso, E 2007. The liner shipping industry and EU competition rules. *Transport Policy* 14(1): 1-10.

Bendall, H and Stent, A 1987. On measuring cargo handling productivity. *Maritime Policy and Management* 14(4): 337-343.

Benford, H 1985. Ships' capital costs: the approaches of economists, naval architects and business managers. *Maritime Policy and Management* 12(1): 9-26.

Bennathan, E and Walters, AA 1972. Shipping conferences: an economic analysis. *Journal of Maritime Law and Commerce* 4(1): 93-115.

Bergantino, AS and Veenstra, AW 2002. Interconnection and co-ordination: an application of network theory to liner shipping. *International Journal of Maritime Economics* 4(3): 231-248.

Berglund, M, van Laarhoven, P, Sharman, G and Wandel, S, 1999. Third-party logistics: Is there a future? *The International Journal of Logistics Management* 10(1): 59-70.

Besanko, D, Shanley, M and Dranove, D 2007. *Economics of Strategy*, London: John Wiley and Sons.

Bharadwaj, N and Matsuno, K 2006. Investigating the antecedents and outcomes of customer firm transaction cost saving in a supply chain relationship. *Journal of Business Research* 59(1): 62-72.

Bhatnagar, R and Viswanathan, S 2000. Re-engineering global supply chains: alliances between manufacturing and global logistics service providers. *International Journal of Physical Distribution and Logistics Management* 30(1): 13-34.

Bhatnagar, R, Sohal, AS and Millen, R 1999. Third party logistics services: a Singapore perspective. *International Journal of Physical Distribution and Logistics Management* 29(9): 569-87.

Bichou, K 2007. Review of port performance approaches and a supply chain framework to port performance benchmarking. In Brooks, MR and Cullinane, K (eds.) *Devolution, Port Governance and Port Performance* (pp. 567-598). Oxford: Elsevier.

Bichou, K and Gray, R 2004. A logistics and supply chain management approach to port performance measurement. *Maritime Policy and Management* 31(11): 47-67.

Bitran, GR and Ferrer, JC 2007. On pricing and composition of bundles. *Production and Operations Management* 16(1): 93-108.

Black, J 2002. *A Dictionary of Economics*. Oxford: Oxford University Press.

Blackstone, EA 1975. Restrictive practices in the marketing of electrofax copying machines and supplies: the SCM corporation case. *Journal of Industrial Economics* 23: 189-202.

Bolumole, YA 2001. The supply chain role of third-party logistics providers. *International Journal of Logistics Management* 12(2): 87-102.

Bolumole, YA 2003. Evaluating the supply chain role of logistics service providers. *International Journal of Logistics Management* 14(2): 93-107.

Borenstein, S and Rose, NL 1994. Competition and price discrimination in the US airline industry. *The Journal of Political Economy* 102(4): 653-683.

Bork, RH 1978. *The Antitrust Paradox*. New York: Basic Books.

Bouwman, H, Haaker, T and de Vos, H 2007. Mobile Service Bundles: The Example of Navigation Services. *Electronic Markets* 17(1): 20-28.

Bowersox, DJ and Closs, DJ 1997. Brazilian logistics: a time for transition. *Gestão andProdução* 4(2): 130-139.

Bowman, WS 1957. Tying arrangement and the leverage problem. *Yale Law Journal* 67: 19-36.

Boyson, S, Corsi, T, Dresner, M and Rabinovich, E 1999. Managing effective third partly logistics relationships: what does it take? *Journal of Business Logistics* 20(1): 73-100.

Bradley, P 1994. Contract logistics: it's all about costs. *Purchasing* 117(6): 56A3-A14.

Bradley, P, Thomas, J, Gooley, T and Cooke, JA 1999. Survey finds bottom line drives outsourcing. *Logistics Management and Distribution Report* 38(5): 24.

Braithwaite, A 2007. Performance measurement and management in the supply chain. In Waters, D (ed.) *Global Logistics, New Directions in Supply Chain Management,* Fifth Edition. (pp. 253-272). London: Kogan Page.

Branch, AE 1998. *Maritime Economics: Management and Marketing,* Third Edition. Cheltenham: Stanley Thornes Publisers Ltd.

Bredrup, H 1995. Performance measurement. In Rolstadås, A (ed.) *Performance Management: A Business Process Benchmarking Approach* (pp. 169-197). London: Chapman Hall.

Breitzmann, KH 1991. Liner conference and consortia: their interrelations and trends. In Breitzmann, KH and Peters, D (eds.). 1991. *Third Conference on Shipping Cooperation and Competition in the Common European Home*, Rostock, Germany.

Brooks, MR 1985. Limitations in carrier choice process: a study on Eastern Canadian exporters of containerisable cargo. *International Journal of Physical Distribution and Materials Management* 15(3): 38-46.

Brooks, MR 1995. Understanding the ocean container carrier market: a seven country study. *Maritime Policy and Management* 22(1): 39-50.

Brooks, MR 2000. *Sea Change in Liner Shipping*, Amsterdam: Pergamon.

Brooks, MR 2002*a*. International trade in manufactured goods. In Grammenos, C Th. (ed.). *The Handbook of Maritime Economics and Business* (pp. 90-104). London: LLP.

Brooks, MR 2002*b*. Liner shipping regulation in North America: a Canadian perspective. *International Journal of Maritime Economics* 4(3): 281-300.

Brooks, MR 2004. Is liner shipping unique? *Maritime Policy and Management* 31(4): 257-258.

Brooks, MR and Button, KJ 2006. Market structure and shipping security. *Maritime Economics and Logistics* 8(2): 100–120.

Brooks, MR and Fraser, G 2001. Maritime Logistics. In Brewer, AM, Button, KJ and Hensher, DA (eds.). *Handbook of Logistics and Supply Chain Management* (pp. 61-77). Oxford: Pergamon Press.

Brooks, MR, Blundel, RG and Bidgood, CI 1993. Strategic alliances in global container industry. In Refick, R (ed.). *Multinational Strategic Alliances* (pp. 221-250). London: International Business Press.

Brown, JH 1991. An economic model of airline hubbing-and-spoking. *Logistics and Transportation Review* 27(3): 225-240.

Browne, M and Allen, J 2001. Logistics outsourcing. In Brewer, AM, Button, KJ and Hensher, DA (eds.). *Handbook of Logistics and Supply-Chain Management* (pp. 253-267). Oxford: Pergamon.

Bryan, I 1974. Regression analysis of ocean liner freight rates on some Canadian export routes. *Journal of Transport Economics and Policy* 8(2): 161-173.

Brynjolfsson, E and Hitt, LM 2000. Beyond Computation: Information Technology, Organisational Transformation, and Business Performance. *Journal of Economic Perspective* 14(4): 24.

Burstein, ML 1960*a*. The economics of tie-in sales. *Review of Economics and Statistics* 42: 68-73.

Burstein, ML 1960*b*. A theory of full-line forcing. *North-western University Law Review* 55: 62-95.

Button, KJ 1979. The economics of port pricing. *Maritime Policy and Management* 6: 201-207.

Button, KJ 1993. *Transport Economics,* Second Edition. Cheltenham, UK: Edward Elgar.

Buxton, IL 1985. Fuel costs and their relationship with capital and operating costs. *Maritime Policy and Management* 12(1): 47-54.

C

Cahill, DL 2007. *Customer Loyalty in Third Party Logistics Relationships: Findins form Studies in Germany and the USA*. Hidelberg: Physica Verlag.

Campagnolo, D and Camuffo, A 2009. The concept of modularity in management studies: A literature review. *International Journal of Management Reviews* (in press).

Campo, S and Yagüe, MJ 2007. Effects of price promotions on the perceived price. *International Journal of Service Industry Management* 18(3): 269-286.

Campo, S and Yagüe, MJ 2008. Tourist loyalty to tour operator: effects of price promotions and tourist effort. *Journal of Travel Research* 46(3): 318-326.

Carbajo, J, de Meza, D and Seidmann, DJ 1990. A strategic motivation for commodity bundling. *Journal of Industrial Economics* 38(3): 383-298.

Carbone, V and Gouvernal, E 2007. Supply chain and supply chain management: appropriate concepts for maritime studies. In Wang, J, Oliver, D, Notteboom, T and Slack, B (eds.). *Ports, Cities and Supply Chains* (pp. 11-26). Aldershot, UK: Ashgate.

Cariou, P 2001 Vertical integration within the logistic chain: does regulation play rational? The case of dedicated container terminals. *European Transport* 7(17): 37-41.

Cariou, P 2008. Liner shipping strategies: an overview. *International Journal of Ocean Systems Management* 1(1): 2–13.

Cariou, P and Wolff, F-C 2006. An analysis of bunker adjustment factors and freight rates in the Europe/Far East market (2000–2004). *Maritime Economics and Logistics* 8(2): 187-201.

Carlton, DW and Perloff, JM 2005. *Modern Industrial Organization*, Fourth Edition. Boston: Pearson/Addison Wesley.

Carlton, DW and Waldman, M 2002. The strategic use of tying to preserve and create market power in evolving industries. *RAND Journal of Economics*, 33: 194-220.

Carlton, DW and Waldman, M 2005*a*. How economics can improve antitrust doctrine towards tie-in sales. *Competition Policy International* 27(1): 27-40.

Carlton, DW and Waldman, M 2005*b*. Tying, upgrades, and switching costs in durable-goods markets. NBER Working Paper W11407.

Carlton, DW and Waldman, M 2006. Why tie an essential good? in Hahn, RW (ed.). *Antitrust Policy and Vertical Restraints* (pp. 10-37). Washington, DC: Brookings.

Casson, M 1986. The role of vertical integration in the shipping industry. *Journal of Transport Economics and Policy* 20(1): 7- 29.

Cattin, P and Wittink, DR (1989). Commercial use of conjoint analysis: and update. *Journal of Marketing* 53: 91-96.

Cavinato, JL 1989. The logistics of contract manufacturing. *International Journal of Physical Distribution and Logistics Management* 19(1): 13-20.

Chakravarti, D, Krish, R, Paul, P and Srivastava, J 2002. Partitioned presentation of multi-component bundle prices: evaluation, choice and underlying processing effects, *Journal of Consumer Psychology* 12 (3): 215–230.

Chan, FTS 2003. Performance measurement in a supply chain. *The International Journal of Advanced Manufacturing Technology* 21(7): 534-548.

Chen, K-K, Chang, CT and Lai, CS 2009. Service quality gaps of business customers in shipping in the shipping industry. *Transportation Research Part E* 45(1): 222-237.

Chen, Y 1997. Equilibrium Product Bundling. *Journal of Business* 70(1): 85-103.

Chioveanu, I 2007. Is Bundling Anticompetitive? UFAE and IAE working papers 568.03, http://www.ucl.ac.uk/~uctpich/Bundling.pdf

Choi, JP 1996. Preemptive RandD, rent dissipation, and the leverage theory. *Quarterly Journal of Economics* 4: 1153-1181.

Choi, JP 2003. Bundling new products with old to signal quality, with application to the sequencing of new products. *International Journal of Industrial Organization* 21: 1179-1200.

Choi, JP 2004. Antitrust Analysis of Tying Arrangements. CESifo Working Paper no. 1336 2004.

Choi, JP 2008. Mergers with bundling in complementary markets, *Journal of Industrial Economics* 56(3): 553-577.

Choi, JP and Stefanadis, C 2001. Tying, Investment, and the Dynamic Leverage Theory. *RAND Journal of Economics* 32(1): 52-71.

Choi, JP and Stefanadis, C 2006. Bundling, entry deterrence, and specialist innovators. *Journal of Business* 79(5): 2575-2594.

Choi, TY and Krause, DR 2006. The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation. *Journal of Operations Management* 24(5): 637-652.

Chopra, S and Meindl, P 2004. *Supply Chain Management: Strategy, Planning and Operation*. Upper Saddle River, NJ: Pearson/Prentice Hall.

Christiansen, M, Fagerholt, R and Ronen, D 2004. Ship routing and scheduling: status and perspectives. *Transportation Science* 38(1): 1-18.

Christinasen, M, Fagerholt, K, Nygreen, B and Ronen, D 2007. Maritime transportation. In Barnhart, C and Laporte, G (eds.) *Transportation* (pp. 189-284). Amsterdam: North Holland.

Church, J and Ware, R 2000. *Industrial Organization: A Strategic Approach*, Boston: Irwin/McGraw Hill.

Clarke, RL 1997. An analysis of the international ocean shipping conference system. *Transportation Journal* 36(4): 17-29.

Clyde, PS and Reitzes, JD 1998. Market power and Collusion in the Ocean Shipping Industry: Is a Bigger Cartel a Better Cartel? *Economic Inquiry* 36(2): 292-304.

Coase, RH 1937. The nature of the firm. *Economica NS* 4: 386-405, reprinted in Williamson, OE and Masten, SE (eds.). 1999. *The Economics of Transaction Costs* Cheltenham, UK: Edward Elgar.

Coase, RH 1960. The problem of social costs. *Journal of Law and Economics* 22: 1-44.

Coase, RH 1988. *The Firm, the Market and the Law*. Chicago, IL: University of Chicago Press.

Cochrane, RA 2008. The effects of market differences on the throughput of large continer terminals with similar levels of efficiency. *Maritime Economics and Logistics* 10(1): 35-52.

Coelli, TJ, Rao, DSP, O'Donnell, CJ and Battese, GE 2005. *An Introduction to Efficiency and Productivity Analysis,* Second Edition. New York, NY: Springer.

Coltman, T, Bru, K, Perm-Ajchariyawong, N, Devinney, TM and Benito, GRG 2009. Supply chain contract evolution. *European Management Journal* 27(6): 388-401.

Cooper, H 1984. *The Integrative Research Review: A Systematic Approach*, Newbury Park, CA: Sage.

Corbett, CJ and Tang, CS 1999. Designing supply contracts: contract type and information asymmteries. In Tayur, S, Ganesham, R and Magazine, M (eds.) *Quantitative Models for Supply Chain Management*. Boston, MA: Kluwer Academic Publishing.

Coto Millan, P, Banos Pino, J and Rodriguez Alvarez, A 2000. Economic efficiency in Spanish ports: some empirical evidence. *Maritime Policy and Management* 27(2): 169-174.

Cournot, A 1838. *Recherches sur les Principes Mathématiques de la Théorie des Richesses*. Paris: Hachette. Translated by Bacon, NT as *Researches into the Mathematical Principles of the Theory of Wealth*. Homewood, IL: Richard D Irwin, 1963.

Cox, AW 1997. *Business success: A way of thinking about strategy, critical supply, chain assets and operational best practice*. Stratford-upon-Avon: Earlsgate Press.

Cox, AW, Ireland, P, Lonsdale, C, Sanderson, J, and Watson, G 2002. *Supply chains, markets and power*. London: Routledge.

Crampes, C and Hollander, A 2005. Product Specification, Multi-product Screening and Bundling: The Case of Pay TV. *Information Economics and Policy* 17(1): 35-59.

Craswell, R 1982. Tying requirements in competitive markets: the consumer protection aspects. *Boston University Law Review* 62: 661-700.

Crawford, G 2008. Discriminatory incentives to bundle in cable television industry. *Quantitative Marketing and Economics* 6(1): 41-78.

Crawford, G and Cullen, J 2007. Bundling, product choice and efficiency: Should cable television networks be offered *à la carte*? *Information Economics and Policy* 19(3-4): 379-404.

Cready, WM 1991. Premium bundling. *Economic Enquiry* 29(1): 173-179.

Creswell, JW 2003 *Research Design: Qualitative, Quantitative and Mixed Approaches,* Second Edition. Thousand Oaks: Sage Publications.

Cullinane, K 2003. The productivity and efficiency of ports and terminals: methods and applications. In Grammenos, CTh (ed.) *The Handbook of Maritime Economics and Business*, (pp. 803-831). London: LLP.

Cullinane, K 2005. The container shipping industry and the impact of China accession to the WTO. *Research in Transportation Economics*12(1): 221-245.

Cullinane, K and Khanna, M 1999. Economies of scale in large container ships. *Journal of Transport Economics and Policy* 33(2): 185-208.

Cullinane, K and Khanna, M 2000. Economies of scale in large containerships: optimal size and geographical implications. *Journal of Transport Geography* 8(3): 181-195.

Cullinane, K and Song, DW 2003. A stochastic frontier model of the productive efficiency of Korean container terminals. *Applied Economics* 35(3): 251-267.

Cullinane, K, Song, DW and Gray, R 2002. A stochastic frontier model of the efficiency of major container terminals in Asia: assessing the influence of administrative and ownership structures. *Transport Research Part A* 36(8): 743-762.

Cullinane, K, Song, DW and Wang, TF 2005. The application of mathematical programming approaches to estimating container port production efficiency. *Journal of Productivity Analysis* 24(1): 73-92.

Cullinane, K, Wang, TF, Song, DW and Ji, P 2006. The technical efficiency of container ports: comparing data envelopment analysis and stochastic frontier analysis. *Transport Research Part A* 40(4): 354-374.

Cummings, FJ and Ruther, WE 1979. The Northern Pacific case. *Journal of Law and Economics* 29(1): 329-50.

D

Daganzo, C 1997. *Multinomial Probit*. Academic Press: New York.

Dapiran, P, Lieb, RC, Millen, RA and Sohal, A 1996. Third party logistics service usage by large Australian firms. *International Journal of Physical Distribution and Logistics Management* 26(10): 36-45.

Daraio, C and Simar, L 2007. *Advanced Robust and Nonparametric Methods in Efficiency Analysis: Methodology and Applications*. New York, NY: Springer.

Darcy, RE and Aigner, H 1980. The uses of entropy in the multivariate analysis of categorical data. *American Journal of Political Science* 24: 155-74.

Daugherty, PJ and Droge, C 1997. Organizational structure in divisionalized manufacturers: the potential for outsourcing logistical services. *International Journal of Physical Distribution and Logistics Management* 27(5/6): 337-49.

Daugherty, PJ, Stank, TP and Rogers, DS 1996. Third party logistics service providers: purchaser's perceptions. *International Journal of Purchasing and Materials Management* 32 (2): 23-9.

Davies, JE 1983. An analysis of cost and supply conditions in the liner shipping industry. *The Journal of Industrial Economics* 31: 417-435.

Davies, JE 1984. *Pricing in the Liner Shipping Industry-a survey of conceptual models*. Canadian Transport Commission, Research Branch, Report No 1983/04E

Davies, JE 1986*a*. Competition, contestability and the liner shipping industry. *Journal of Transport Economics and Policy* 13: 299-312.

Davies, JE 1986*b*. *The theory of Contestable Markets and its Application to Liner Shipping Industry*. Ottawa: Canadian Transport Commissions.

Davies, JE 1988. Contestability theory and liner shipping: Some doubts about Pearson's doubts. *Maritime Policy and Management* 15(1): 15-18.

Davies, JE 1990. Destructive Competition and Market Sustainability in the Liner Shipping Industry. *International Journal of Transport Economics* 27(4): 227-245.

Davies, JE, Pirrong, CS, Sjostrom, W and Yarrow, G 1995. Stability and Related Problems in Liner Shipping: An Economic Overview. Hearing before the Committee on Commerce, Science, and Transportation, US Senate, 104th Congress, 1st Session, November.

De Graba and Mohammed 1999. Intertemporal mixed bundling and buying frenzies. *The RAND Journal of Economics* 30(4): 694-718.

De Koster, MBM, Balk, BM and Van Nus, WTI 2009. On using DEA for container terminal benchmarking. *International Journal of Operations and Production Management* 29(11): 1140-1155.

De Langen, PW 1999. Time centrality in transport. *International Journal of Maritime Economics* 1(1): 41-55.

De Langen, PW 2007. Port competition and selection in contestable hinterlands: the case of Austria. *European Journal of Transport and Infrastructure Research* 7(1): 1-14.

De Monie, G 1987. *Measuring and Evaluating Port Performance and Productivity*. Geneva: UNCTAD.

Deakin, BM and Seward, T 1973. *Shipping Conferences: A study of their origins, development and economic practises*. Cambridge: Cambridge University Press.

Deepen, J, Goldsby, TJ, Knemeyer, AM and Wallenburg, CM 2008. Beyond Expectations - Antecedents and Measurement of Logistics Outsourcing Performance. *Journal of Business Logistics* 29(2): 75-105.

Deepen, JM 2007. *Logistics Outsourcing Relationships: Measurement, Antecedents, and Effects of Logistics Outsourcing Performance*. Heidelberg: Physica-Verlag.

Deepen, JM, Goldsby, TJ, Knemeyer, AM and Wallenburg, CM 2008. Beyond expectations: an examination of logistics outsourcing goal achievement and goal exceedance. *Journal of Business Logistics* 29(2): 75-105.

Demsetz, H 1968. The cost of transacting. *Quarterly Journal of Economics* 82(2). 33-53.

Denbigh, KG and Denbigh, JS 1986. *Entropy in Relation to Incomplete Knowledge*. Cambridge, MA: Cambridge University Press.

Devanney III, JW, Livanos, VM and Stewart, RJ 1975. Conference ratemaking and the West Coast of South America. *Journal of Transport Economics and Policy* 9(2): 154-177.

Director, A and Levi, E 1956. Law and the future: trade regulation. *Northwestern University Law Review* 51: 281-296.

Dobson, G and Kalish, S 1988. Positioning and pricing a product line. *Marketing Science* 7(2): 107-125.

Dobson, G and Kalish, S 1993. Heuristics for pricing and positioning a product-line using conjoint and cost data. *Management Science* 39: 160-175.

Dolan, RJ and Simon, H 1996. *Power Pricing: How Managing Price Transforms the Bottom Line*, New York, NY: The Free Press.

Douglas, PS 1985. The effects of ship financing and leasing on the measurement of shipping costs. *Maritime Policy and Management* 12(1): 27-34.

Downward, P 2004. Post Keynesian pricing theory: alternative foundations and prospects for future research. *Journal of Economic Psychology* 25(5): 661-670.

Drewry Shipping Consultants 2008. *Ship Operating Costs Annual Review and Forecasts 2008-2009*. Drewry Shipping Consultants.

Drewry Shipping Consultants 2009. *Ship Operating Costs Annual Review and Forecasts 2009-2010*. Drewry Shipping Consultants.

Drumwright, ME 1992. A demonstration of anomalies in evaluations of bundling. *Marketing Letters* 3(4): 311–321.

Dubois, A, Hulthén, K and Pedersen, A-C 2004. Supply chains and interdependence: a theoretical analysis. *Journal of Purchasing and Supply Management* 10(1): 3-9.

Durvasula, S, Lysonski, S and Mehta, SC 2000. Business-to-business marketing Service recovery and customer satisfaction issues with ocean shipping lines. *European Journal of Marketing* 34(3/4): 433-454.

E

Economides, N 1989. Desirability of compatibility in the absence of network externalities. *American Economic Review* 79: 1165-1181.

Economides, N 1993. Mixed bundling in duopoly. Working paper EC- 93- 29. Stern School of Business, New York University, November 1993.

Edlin, AS and Rubinfeld, DL 2004. Exclusion or efficient pricing? The big deal bundling of academic journals. *Antitrust Law Journal* 72(1): 119-157.

Edlin, AS and Rubinfeld, DL 2005. The bundling of academic journals. *American Economic Review* 95(2): 441-46.

Efimov, A and Whalley, J 2004. Location and product bundling in the provision of WiFi. *Communications and Strategies* 53: 125-35.

Ellram, LM and Cooper, MC 1990. Supply chain management, partnerships and the shipper-third party relationship. *International Journal of Logistics Management* 1(2): 1-10.

Eppen, GD, Hanson, WA and Martin, RK 1991. Bundling: new products, new markets, low risks. *Sloan Management Review* 32: 7-14.

EUR and SMU 2006. *Bundling of Liner and Logistics Services, Deliverable 1*, Research Programme under the NOL Fellowship: Erasmus University Rotterdam and Singapore Management University – Unpublished report.

EUR and SMU 2007. *Survey on Liner Transportation and Logistics Services, Deliverable 2*, Research Programme under the NOL Fellowship: Erasmus University Rotterdam and Singapore Management University – Unpublished report.

Evangelista, P 2005. Trough logistics and ICT. In Leggate, H, McConville, J and Morvillo, A (eds.). *International Maritime Transport Perspectives* (pp. 191-220). London: Rutledge.

Evangelista, P and Morvillo, A 1999. Alliances in liner shipping: An instrument to gain operational efficiency or supply chain integration? *International Journal of Logistics: Rresearch and Applications* 2(1): 21-38.

Evangelista, P and Morvillo, A 2000. Co-operative strategies in international and Italian liner shipping. *International Journal of Maritime Economics* 2(1): 1-16.

Evans, DS and Salinger, M 2004. An empirical analysis of bundling and tying: Over the counter pain relief and cold medicines. CESifo Working Paper no. 1297.

Evans, DS and Salinger, M 2005. Why do firms bundle and tie? Evidence from competitive markets and implications for tying law. *Yale Journal on Regulation* 22(4): 37-89.

F

Fang, H and Norman, P 2006. To bundle or not to bundle. *The RAND Journal of Economics* 37(4): 946-963.

Farrell, J and Saloner, G 1985. Standardzation, compatibility, and innovation. *The RAND Journal of Economics* 16(1): 70-83.

Farrell, J and Saloner, G 1986. Installed based and compatibility: Innovation, product preannouncements, and predation. *The American Economic Review* 76(5): 940-955.

Farrell, J and Shapiro, C 1990. Horizontal mergers: and equilibrium analysis. *American Economic Review* 80(1): 107-126.

Farrell, J, Monroe, HK and Saloner, G, 1998. The vertical organization of industry: systems competition versus component competition. *Journal of Economics and Management Strategy* 2(2). 143- 182.

Farthing, B. 1993. *International Shipping: An Introduction to the Policies, Politics, and Institutions of the Maritime World*, Second Edition. London: Lloyd's of London Press.

Fawcett, SE and Cooper, MB 1998. Logistics performance measurement and customer success. *Industrial Marketing Management* 27(4): 341-357.

Fawcett, SE, and Clinton, SR 1997. Enhancing logistics to improve the competitiveness of manufacturing organizations: a triad perspective. *Transportation Journal*, 37(1): 18-28

Fayle, EC 1933. *A Short History of the World's Shipping Industry*. London: George Allen and Unwin.

Federal Maritime Commission, 1989. *An Analysis of the Maritime Industry and the Effects of the 1984 Shipping Act*. Washington DC: Federal Maritime Commission.

Ferrari, C, Parola, F and Benacchio, M 2008. Network economies in liner shipping: the role of home markets. *Maritime Policy and Management* 35(2): 127-143.

Foster, TA and Muller, EJ 1990. Third parties: your passport to profits. *Distribution*, October: 30-32.

Fourgeaud, F 2000. *Measuring port performance*. Washington, DC: The World Bank.

Fox, NR 1992. An empirical analysis of ocean liner shipping. *International Journal of Transport Economics* 19(2): 205-225.

Fox, NR 1994. An oligopoly model of ocean liner shipping. *Review of Industrial Organization* 9(3): 343-355.

Francis, V 2008. Supply chain visibility: lost in translation? *Supply Chain Management: An International Journal* 13(3): 180-184.

Franck, B and Bunel, J-C 1991. Contestability, competition and regulation. The case of liner shipping. *International Journal of Industrial Organisation* 9(1): 141–159.

Frankel, EG 1991. Port performance and productivity measurement. *Ports and Harbours* 36(8): 11-13.

Frankel, EG 1996. The need for port alliances. *Ports and Harbors* June: 30–2.

Frankel, EG 1999*a*. Intermodal integration. *Lloyd's Shipping Economist* 21(3): 10-11.

Frankel, EG 1999*b*. The economics of total trans-ocean supply chain management. *International Journal of Maritime Economics* 1(1): 61-69.

Frémont, A 2006. Shipping lines and logistics. *Proceedings of the International Association of Maritime Economists Annual Conference*, 12-14 July 2006, Melbourne (Australia).

Frémont, A 2007. Global maritime networks: the case of Maersk. *Journal of Transport Geography* 15(6): 431-442.

Frémont, A 2009. Shipping lines and logistics. *Transport Reviews* 29(4): 537-554.

Fudenberg, D and Tirole J 1984. The fat-cat effect, the puppy-dog ploy, and the lean and hungry look. *American Economic Review Papers and Proceedings* 74: 361-68.

Fürderer, R 1999. Optimal price bundling. In Fürderer, R, Herrmann, A and Wübker, G (eds.). *Optimal Bundling: Marketing Strategies for Improving Economic Performance* (pp. 31-59). Berlin: Springer.

Fürderer, R, Herrmann, A and Wübker, G 1999. Introduction to price bundling. In Fürderer, R, Herrmann, A and Wübker, G (eds.). *Optimal Bundling: Marketing Strategies for Improving Economic Performance* (pp. 1-5). Berlin: Springer.

Fürderer, R, Huchzermeier, A and Schrage, L 1999. Stochastic option bundling and bundle pricing. In Fürderer, R, Herrmann, A and Wübker, G (eds.). *Optimal Bundling, Marketing Strategies for Improving Economic Performance* (pp. 61-86). Berlin: Springer.

Fusillo, M 2003. Excess capacity and entry deterrence: the case of ocean liner shipping markets. *Maritime Economics and Logistics* 5(2): 100-115.

Fusillo, M 2004. Is liner shipping supply fixed? *Maritime Economics and Logistics* 6(3): 220-235.

Fusillo, M 2006. Some notes on structure and stability in liner shipping. *Maritime Policy and Management* 33(5): 463–475.

Fusillo, M 2009. Structural factors underlying mergers and acquisitions in liner shipping. *Maritime Economics and Logistics* 11(2): 209-226.

G

Gaeth, GJ, Levin, IP, Chakraborty, G and Levin, AM 1991. Consumer evaluation of multi-product bundles: An information integration analysis. *Marketing Letters* 2(1): 47-57.

Gardner, B, Marlow, P and Nair, VNPR 2002. The Economics Regulation of Liner Shipping: the impact of US and EU regulation in US trades. In Grammenos, C Th. (ed.). *The Handbook of Maritime Economics and Business* (pp. 307-326). London: LLP.

Geng, X, Stinchcombe, MB and Whinston, AB 2005. Bundloing information goods of decreasing value. *Management Science* 51(4): 662-667.

Germanischer Lloyd and Global Institute of Logistics 2008. *Container Terminal Quality Indicator Standard*. Hamburg: Germanischer Lloyd and Global Institute of Logistics.

Geyskens, I, Steenkamp, J-BEM and Kumar, N 2006. Make, buy, or ally: a meta-analysis of transaction cost theory. *Academy of Management Journal* 49(3): 519-543.

Giaume, S and Guillou, S 2004. Price discrimination and concentration in European airline markets. *Journal of Air Transport Management* 10(5): 305-310.

Gibson, BJ, Cook, RL 2001. Hiring practices in US third-party logistics firms. *International Journal of Physical Distribution and Logistics Management* 31(10): 714-32.

Gill, J 2005. An entropy measure of uncertainty in vote choice. *Electoral Studies* 24(3): 371-392.

Gillen, D 2001. Benchmarking and performance measurement: the role of quality management. In Brewer, A, Button, KJ and Hensher, DA (eds.) *Handbook of Logistics and Supply Chain Management* (pp. 325-338). Amsterdam: Pergamon.

Gilman, S 1985. A review of ships' costs. *Maritime Policy and Management* 12(1): 91-98.

Gilman, S 1999. Size economies and network efficiency of large container ships. *International Journal of Maritime Economics* 1(1): 39-59.

Gilman, S and Williams, GF 1976. The economics of multi-port itineraries for large container ships. *Journal of Transport Economics and Policy* 10(2): 137.

Golbe, DL and White, LJ 1988. A time-series analysis of mergers and acquisitions in the US Economy. In Auerbach, AJ (ed.). *Corporate Takeovers: Causes and Consequences* (pp. 265-310). Cambridge, MA: NBER.

Gooley, TB 1997. The state of third-party logistics in Europe. *Logistics Management* 36(1): 80A–81A.

Goss, R 1985. Ships' costs: The overall problem and some solutions. *Maritime Policy and Management* 12(1): 1-8

Goss, R and Stevens, H 2001. Marginal cost pricing in seaports. *International Journal of Maritime Economics* 3(3): 128-38.

Goyder, D 1995. *EC Competition Law, Third Edition.* Oxford: Clarendon Press.

Green, PE 1984. Hybrid models for conjoint analysis: an expository review. *Journal of Marketing Research* 21: 155-169.

Green, PE and Krieger, AM 1992. Modelling competitive pricing and market share: Anatomy of a decision support system. *European Journal of Operational Research* 60(1): 31-44.

Green, PE and Srinivasan, V 1990. Conjoint analysis in marketing: new developments with implications for research and practice. *Journal of Marketing* 54: 3-19.

Green, PE and Wind, Y 1973. *Multi-attribute decisions in marketing: A measurement approach*, Dryden Press, Hinsdale, IL

Green, PE, Krieger, AM and Agarwal, MK 1991. Adaptive conjoint analysis: some caveats and suggestions. *Journal of Marketing Research* 28(2): 215-222.

Grossman, SJ and Hart, OD 1986. The costs and beliefs of ownership: a theory of vertical and lateral integration. *Journal of Political Economy* 94(4): pp. 691-719.

Guiltinan, JP 1987. The price bundling of services: a normative framework. *Journal of Marketing* 51: 74-85.

Gustafsson, A, Herrmann, A and Huber, F 2006. Conjoint Analysis as an Instrument of Market Research Practice. In Gustafsson, A, Herrmann, A and Huber, F (eds.) *Conjoint Measurement: Methods and Applications,* Fourth Edition. (pp. 3-30). Berlin: Springer.

H

Hahn, RW 2006. Introduction. In Hahn, RW, (ed.). 2006. *Antitrust policy and vertical restraints* (pp. 1-9). Washington, DC: Brookings.

Hailey, R 2009. Box lines may need to sell port assets to raise cash. *Lloyds List,* July 31, 2009.

Hair, JF Jr, Money, AH, Samuel, P and Page, M 2007. *Research methods for Business*. Chichester: John Wiley and Sons Ltd.

Handfield, RB and Nichols EL, Jr. 1999. *Introduction to Supply Chain Management*. Upper Saddle River, NJ: Prentice-Hall.

Hanson, W and Martin, RK 1990. Optimal bundle pricing. *Management Science* 32: 155-174.

Hanssen, FA 2000. The block booking of films re-examined. *Journal of Law and Economics* 43(2): 395-426.

Haralambides, HE 2000. Liner Shipping Economics. Working Paper, Center for Maritime Economics and Logistics, Erasmus University Rotterdam.

Haralambides, HE 2002. Competition, excess capacity and the pricing of port infrastructure. *International Journal of Maritime Economics* 4(4): 323-347.

Haralambides, HE 2004. Determinants of price and price stability in liner shipping. Paper presented at the Workshop 'The Industrial Organization of Shipping and Ports', National University of Singapore, 5-6 March 2004, Singapore.

Haralambides, HE 2007. Structure and operations in liner shipping industry. In Button, KJ and Hensher, DA (eds.). *Handbook of Transport Modelling* (pp. 607-621). Oxford: Pergamon-Elsevier Science.

Haralambides, HE and Acciaro, M 2010. Bundling in global ocean transportation. In Cullinane, K (ed.). *Handbook of Maritime Transport*, (in press).

Haralambides, HE and Veenstra, AW 2000. Modelling Performance in Liner Shipping. In Button, KJ and Hensher, DA (eds.). *Handbook of Transport Modelling*. Pergamon-Elsevier Science.

Haralambides, HE, Acciaro, M and Karydis, A 2009. Vertical integration in liner shipping: a transaction costs approach. Working Paper, Center for Maritime Economics and Logistics (MEL).

Haralambides, HE, Barros, CP, Hussain, M and Peypoch, N 2010. A new approach in benchmarking seaport efficiency and technological change. *International Journal of Transport Economics*, forthcoming.

Haralambides, HE, Cariou, P and Benacchio, M 2002. Cost, benefits and pricing of dedicated terminals. *International Journal of Maritime Economics* 4(1): 21- 34.

Haralambides, HE, Veenstra, AW, Fusillo, M, Sjostrom, W and Hautau, U 2003. *Contract of Services for the Assistance in Processing Public Submissions to be Received in Response to the Consultation Paper on the Review of Council Regulation 4056/ 86*, Final Report prepared for the European Commission Competition DG.

Harbour, JL 2009. *The Basics of Performance Measurement.* New York, NY: CRC Press.

Hayek, FA 1945. The use of knowledge in society. *American Economic Review* 35(9): 519-530.

Hayuth, Y 1987, *Intermodality: Concepts and Practise. Structural Changes in the Ocean Freight Transport Industry*. London, UK: Lloyd's of London Press Ltd.

Hayuth, Y 1992. Multimodal freight transport'. In Hoyle, B and Knowles, R (eds.). 1992. *Modern Transport Geography* (pp. 200–214). London, UK: Belhaven.

Heath, TB, Chatterjee, S and France, KR 1995. Mental accounting and changes in price: The frame dependence of reference dependence. *Journal of Consumer Research* 22(3): 268-284.

Heaver, TD 1972. Trans Pacific trade, liner shipping and conference rates. *Transportation and Logistics Review* 8(2): 3-28.

Heaver, TD 1973*a*. The structure of liner conference rates. *The Journal of Industrial Economics* 21(3): 257-265.

Heaver, TD 1973*b*. A theory of shipping conference pricing and policies. *Maritime Policy and Management* 1(1): 17-30.

Heaver, TD 1985. The treatment of ships' operating costs. *Maritime Policy and Management* 12(1): 35-47.

Heaver, TD 2002*a*. Supply chain and logistics management: implications for liner shipping. In Grammenos, C. Th. (ed.) *The Handbook of Maritime Economics and Business* (pp. 375- 396). London: LLP.

Heaver, TD 2002*b*. The evolving role of shipping lines in international logistics. *International Journal of Maritime Economics* 4(2): 210-230.

Heaver, TD 2005. Responding to shippers' supply chain requirements. In Leggate, H, McConville, J and Morvillo, A (eds.) *International Maritime Transport Perspectives* (pp. 202-214). London: Routledge.

Heaver, TD, Meersman, H, Moglia, F and Van de Voorde, E 2000. Do mergers and alliances influence European shipping and port competition? *Maritime Policy and Management* 27(4): 363-373.

Heide, M, White, C, Grønhaug, K and Østrem, TM 2008. Pricing strategies in the restaurant industry. *Scandinavian Journal of Hospitality and Tourism* 8(3): 251-269.

Henriksson, L, Chow, G and Heaver, TD 1994. Trends in Logistics: Implications for Carriers, Researchers and Policymakers. *Proceedings of the Canadian Transport Research Forum*, May 1994. Victoria, Canada: Canadian Transport Research Forum.

Hensher, DA and Brewer, AM 2001. *Transport: An Economic and Management Perspective*. Oxford: Oxford University Press.

Herrmann, A, Huber, F and Coulter, RH 1997. Product and service bundling decisions and their effects on purchase intention. *Pricing Strategy and Practice* 5(3): 99-107.

Hertz, S and Alfredsson, M 2003. Strategic development of TPL providers. *Industrial Marketing Management* 32(2): 139-149.

Hicks, JR 1946. *Value and Capital: An Inquiry into Some Fundamental Principles of Economic Theory*, Second Edition. Oxford: Clarendon Press.

Hieber, R and Schönsleben, P 2002. *Supply Chain Management: A Collaborative Performance Measurement Approach*. Zurich: VDF Hochschulverlag AG.

Hines, P and Samuel, D 2007. The development of supply chain relationships: a multi-lens approach. In Waters, CDJ (ed.) *Global Logistics: New Directions in Supply Chain Management* (pp. 107-128). London: Kogan Page.

Hirshleifer, J 1956. On the economics of transfer pricing. *The Journal of Business*, 29(3): 172184.

Hong, J, Chin, A and Lin, B 2004*a*. Logistics outsourcing by manufacturers in China: a survey of the industry. *Transportation Journal* 43 (1): 17-25.

Hong, J, Chin, A and Lin, B 2004*b*. Firm-specific characteristics and logistics outsourcing by Chinese manufacturers. *Asia Pacific Journal of Marketing and Logistics* 16(3): 23-36.

Horne, R 1989. Charting a course for integrated logistics. *Transportation and Distribution* 30(10): 45-51.

Hoyt, J and Huq, F 2000. From arms-length to collaborative relationships in the supply chain: an evolutionary approach. *International Journal of Physical Distribution and Logistics Management* 30(9): 750-764.

Hummels, D, Lugovsky, V and Skiba, A 2009. The trade reducing effects of market power in international shipping. *Journal of Development Economics* 89(2): 84-97.

I

Ibragimov, R 2005. Optimal bundling strategies for complements and substitutes with heavy-tailed distributions. Harvard Institute of Economic Research Discussion Paper # 2088 2005.

ILO 2004. *The Global Seafarer: Living and Working Conditions in a Globalised Industry*, Geneva: International Labour Office.

Imai, A, Nishimura, E, Papadimitriou, S, and Liu, M 2006. The economic viability of container mega-ships. *Transportation Research Part E* 42(1): 21-41.

J

Jané, J and de Ochoa, A 2007. *The Handbook of Logistics Contracts: a Practical Guide to a Growing Field*. Basingstoke: Palgrave-MacMillan.

Janiszewski, C and Cunha, M Jr 2004. The influence of price discount framing on the evaluation of a product bundle. *Journal of Consumer Research* 30(4): 534-546.

Jankowski, WB and Davies, JE 1989. Competition, contestability and the liner shipping industry (comment and rejoinder). *Journal of Transport Economic and Policy* 23(2): 199-208.

Jansson, JO and Shneerson, D 1978. Economics of Scale of General Cargo Groups. *Review of Economics and Statistics* 60(2): 287-293.

Jansson, JO and Shneerson, D 1985. Economies of trade density in liner shipping and optimal pricing. *Journal of Transport Economics and Policy* 19(1): 7-22.

Jansson, JO and Shneerson, D 1987. *Liner Shipping Economics*. London: Chapman and Hall.

Jenkins, HW Jr. 1996. Antitrust pirates the high seas. *Wall Street Journal*, December 3.

Jessop, B 1994. Post-fordism and the State. In Amin, A (ed.). *Post-fordism, a reader. Studies in Urban and Social Change* (pp. 251-279). Blackwell: Oxford.

Johnson, MD 1991. Comment on “Adaptive conjoint analysis: some caveats and suggestions”. *Journal of Marketing Research* 28(2): 223-225.

Johnson, MD, Herrmann, A and Bauer, HH 1999. The effects of price bundling on consumer evaluations of product offerings. *International Journal of Research in Marketing* 16: 129-142.

K

Kahneman, D and Tversky, A 1979. Prospect theory: an analysis of decision under risk. *Econometrica* 47: 263-291.

Kaicker, A, Bearden, WO and Manning, KC 1995. Component versus bindle pricing: The role of selling price deviations from price expectations. *Journal of Business Research* 33(3): 231-239.

Kamakura, WA and Russel, GJ 1989. A probabilistic choice model for market segmentation and elasticity structure. *Journal of Marketing Research* 26(4): 379-390.

Kaplan, RS and Norton, DP 1992. The balanced scorecard: measures that drive performance. *Harvard Business Review* 70(1): 71-79.

Kaplan, RS and Norton, DP 1996. *Translating Strategy into Action: The balanced Scorecard*, Boston, MA: Harvard Business School Press.

Karydis, A 2007. Anatomy of Transaction Costs in Intermodal Networks: an Entropy Simulation. MSc Thesis, Center for Maritime Economics and Logistics, Erasmus University Rotterdam.

Kaysen, C and Turner, DF 1959. *Antitrust Policy: An Economic and Legal Analysis*, (1971 Ed.). Cambridge, MA: Harvard University Press.

Khinchin, AI 1957. *Mathematical Foundations of Information Theory*. New York, NY: Dover.

Kim, J, Bojanic, DC and Warnick, RB 2009. Price bundling and travel product pricing practices used by online channels of distribution. *Journal of Travel Research* 47(4): 403-412.

Kim, M and Sachish, A 1986. The structure of production, technical change and productivity in ports. *Journal of Industrial Economics* 35(2): 209-223.

Klein, B, Crawford, RA and Alchian, AA 1978. Vertical integration, appropriable rents, and the competitive contracting process. *Journal of Law and Economics* 21(2): 297-326.

Klein, CC and Kyle, R 1997. Technological change and the production of ocean shipping services. *Review of Industrial Organization* 12(5/6): 733-750.

Knemeyer, AM, Corsi, T and Murphy, PR 2003. Logistics outsourcing relationships: customer perspectives. *Journal of Business Logistics* 24(1): 77-109.

Kobayashi, BH 2005*a*. Does economics provide a reliable guide to regulating commodity bundling by firms? A Survey of the Economic Literature. *Journal of Competition Law and Economics* 1(4): 707-746

Kobayashi, BH 2005*b*. The economics of loyalty discounts and antitrust law in the United States. *Competition Policy International* 1(115): 115-148.

Kobayashi, BH 2006. Two tales of bundling: implications for the application of antitrust law to bundled discounts'. In Hahn, RW *Antitrust Policy and Vertical Restraints* (pp. 10-37). Washington, DC: Brookings.

Kohli, R and Krishnamurti, R 1987. A heuristic approach to product design. *Management Science* 33(12): 1523-1533.

Kohli, R and Park, H 1994. Coordinating buyer-seller transactions across multiple products. *Management Science* 40(9): 1145-1150.

Kohli, R and Sukumar, R 1990. Heuristics for product-line design using conjoint analysis. *Management Science* 36(12): 1464-1478.

Köhn, S 2008. The economic determinants of vessel operating expenses: a semi-parametric approach. *Maritime Economics and Logistics* 10(3): 275-294(20)

Kolmogorov, AN 1959. Entropy per unit time as a metric invariant of automorphisms. *Doklady Akademii Nauk SSSR* 124: 754-55

Kotler, P and Keller, KL 2006. *Marketing Management,* Twelfth Edition. Upper Saddle River, NJ: Pearson Prentice Hall.

Krämer, J 2007*a*. Bundling as a Quality Leverage Device in Oligopoly: The Case of Digital Convergence (September 3, 2007). Available at SSRN: http://ssrn.com/abstract=1014562.

Krämer, J 2007*b*. Bundling Telecommunications Services: Competitive Strategies for Converging Markets. Doctoral Thesis, University of Karlsruhe, Studies on eOrganisation and Market Engineering, 10. Karlsruhe: Universitätsverlag Karlsruhe.

Kridel, DJ and Taylor, LD 1993. The demand for commodity packages: the case of telephone custom calling features. *Review of Economics and Statistics* 75(2): 362-367.

Krüger-Kopiske, KK 2008. Cost management. In Heideloff, C and Pawlik, T, *The Handbook of Container Shipping Management 2: Management Issues in Container Shipping* (pp. 87-122). Bremen: Institute of Shipping Economics and Logistics (ISL).

Krugman, P and Venables, AJ 1995. Globalization and the inequality of nations. *The Quarterly Journal of Economics* 110(4): 857-880.

Kühn, KU, Stillman, R and Caffarra, C 2005. Economic theories of bundling and their policy implications in abuse cases: an assignment in light of the Micorsoft case. CEPR Discussion Paper, No 4756, 1-33.

Kumar, S and Hoffmann, J 2002. Globalisation: The Maritime Nexus. In Grammenos, C Th (ed.). *The Handbook of Maritime Economics and Business* (pp. 35-62). London: LLP.

L

La Londe, BJ and Maltz, AB 1992. Some propositions about outsourcing the logistics function. *International Journal of Logistics Management* 3(1): 1-11.

La Londe, BJ and Pohlen, TL 1996. Issues in supply chain costing. *The International Journal of Logistics Management* 7(1): 1-12.

Lacity, MC, Wilcoks, LP and Feeny, DF 1995. IT outsourcing: maximize flexibility and control. *Harvard Business Review* 73(3): 86-7.

Lam, JSL, Yap, WY and Cullinane, K 2007. Structure, conduct and performance on the major liner shipping routes. *Maritime Policy and Management* 34(4): 359-381.

Lawless, MW 1991. Commodity bundling for competitive advantage: strategic implications. *Journal of Management Studies* 28: 267-280.

Leader, PGF 1985. Protection and indemnity insurance. *Maritime Policy and Management* 12(1): 71-89

Lee, HL and Billington, C 1992. Managing supply chain inventory: pitfalls and opportunities. *Sloan Management Review* 33(3): 65-73.

Lee, HL, So, KC and Tang, CS 2000. The value of information sharing in a two-level supply chain. *Management Science* 46(5): 626-643.

Lele, MM 1992. *Creating Strategic Leverage*. New York, NY: Wiley.

Leng, M and Parlar, M 2005. Game theoretic applications in supply chain management: a review. *INFOR* 43(3): 187-220.

Levinson, M 2006. *The box: how the shipping container made the world smaller and the world economy bigger*. Princeton, NJ: Princeton University Press.

Lewbel, A 1985. Bundling of substitutes or complements. *International Journal of Industrial Organization* 3(1): 101-107.

Lewis, I and Talalayersky, A 2000. Third party logistics: leveraging information technology. *Journal of Business Logistics* 21(2): 173-85.

Liao, CH and Tauman, Y 2002. The role of bundling in price competition. *International Journal of Industrial Organization* 20(3): 365- 389.

Liao, CH and Urbano, SA 2002. Pure component pricing in a duopoly'. *The Manchester School* 70(2): 150-163.

Liberatore, MJ and Miller, T 1995. A decision support approach for transport carrier and mode selection. *Journal of Business Logistics* 16(2): 85-116.

Lieb, RC 1992. The use of third-party logistics services by large American manufacturers. *Journal of Business Logistics* 13(2): 29-42.

Lieb, RC and Bentz, BA 2004. The use of 3PL services by large American manufacturers: the 2003 survey. *Transportation Journal* 43 (3): 24-33.

Lieb, RC and Bentz, BA 2005*a*. The North American third party logistics industry in 2004: the provider CEO perspective. *International Journal of Physical Distribution and Logistics Management* 35(8): 595-611.

Lieb, RC and Bentz, BA 2005*b*. The use of 3PL services by large American manufacturers: the 2004 Survey. *Transportation Journal* 44(2): 5-15.

Lieb, RC and Kendrick, S 2003. The year 2002 survey: CEO perspectives on the current status and future prospects of the 3PL industry in the US. *Transportation Journal* 43(2): 5-16.

Lieb, RC and Miller, J 2002. The use of 3PL services by large American manufacturers: the 2000 survey. *International Journal of Logistics: Research and Applications* 5(1): 1-12.

Lieb, RC and Randall, HL 1996. A comparison of the use of third-party logistics services by large American manufacturers, 1991, 1994 and 1995. *Journal of Business Logistics* 17(1): 305-20.

Lieb, RC and Randall, HL 1999. 1997 CEO perspectives on the current status and future prospects of the 3PL industry in the US. *Transportation Journal* 38(3): 28-41.

Lieb, RC, Millen, RA, and Van Wassenhove, LN 1993. Third party logistics: a comparison of experienced American and European manufacturers. *International Journal of Physical Distribution and Logistics Management* 23(6): 35-44.

Liebowitz SJ, and Margolis, SE 2009. Bundles of joy: the ubiquity and efficiency of bunldes in new technology markets. *Journal of Competition Law and Economics,* 5(1): 1-47.

Liebowitz, SJ 1983. Tie-in sales, risk reduction and price discrimination. *Economic Inquiry* 21(3): 387–99.

Liebowitz, SJ and Margolis, SE 1999. *Winners, Losers and Microsoft: Competition and Antitrust in High Technology*. Oakland, CA: Independent Institute.

Lingnau, V 1999. Management accounting and product variety. In Fürderer, R, Herrmann, A and Wübker, G (eds.). *Optimal Bundling: Marketing Strategies for Improving Economic Performance* (pp. 133-156). Berlin: Springer.

Londoño, M 2006. *Institutional Arrangements that Affect Free Trade Agreements: Economic Rationality Versus Interest Groups*. Doctoral Thesis, Erasmus University Rotterdam, ERIM Series EPS-2006-078-LIS. Rotterdam: Erasmus Research Institute of Management (ERIM), Erasmus University Rotterdam.

Lopes, LL 1982. Toward a procedural theory of judgment. Working paper 17, Wisconsin Human Information Processing Programme, Wisconsin, Madison, USA.

Lopez, E 2003. The Antitrust Ambiguity Concerning Intermodal Transport in Europe. Paper presented at the European Transport Conference, 8-10 October 2003, Strasbourg.

Louviere, JJ and Woodworth, G 1983. Design and analysis of simulated consumer choice or allocation experiments: and approach based on aggregated data. *Journal of Marketing* 20(4): 350-367.

Lu, CS, Lai, KH and Cheng, TCE 2007. Application of structural equation modeling to evaluate the intention of shippers to use Internet services in liner shipping. *European Journal of Operational Research* 180(2): 845-867

Lutz, S and Ritter, T 2009. Outsourcing, supply chain upgrading and connectedness of a firm's competencies. *Industrial Marketing Management* 38(4): 387-393.

Lynch, CF 2000*a*. *Logistics Outsourcing: A Management Guide*. Oak Brook, IL: Council of Logistics Management.

Lynch, CF 2000*b*. Managing the Outsourcing Relationship. *Supply Chain Management Review* 4(4): 90-96.

Lynch, ME, Imada, SJ and Bookbinder, JH 1994. The future of logistics in Canada: a Delphi-based forecast. *Logistics and Transportation Review* 30(1): 95-112.

Lyridis, DV, Fyrvik, T, Kapetanis, GN, Ventikos, N, Anaxagorou, P, Uthaug, E and Psaraftis, HN 2005. Optimizing shipping company operations using business process modelling. *Maritime Policy and Management* 32(4): 403-420.

M

Malinowski, WR 1974. The code of conduct for liner conferences. *Intereconomics* 9(8): 234-237.

Maltz, AB 1994*a*. Outsourcing the warehousing function: economic and strategic considerations. *Logistics and Transportation Review* 30(3): 245-65.

Maltz, AB 1994*b*. The relative importance of cost and quality in the outsourcing of warehousing. *Journal of Business Logistics* 15(2): 45-62.

Maltz, AB and Ellram, LM 2000. Selling inbound logistics services: understanding the buyer's perspective. *Journal of Business Logistics* 21(2): 69-88.

Maltz, AB, Riley, L and Boberg, K 1993. Purchasing logistics services in a trans-border situation: logistics outsourcing in US–Mexico co-production. *International Journal of Physical Distribution and Logistics Management* 23(8). 44–54.

Mandebvu, TP 2009. Leveraging distinctive competencies to enhance competitiveness in liner shipping: Strategic analysis and sustainability explored. MSc Thesis, MSc in Maritime Economics and Logistics, AY 2008-2009, Center for Maritime Economics and Logistics (MEL). Rotterdam: Erasmus University Rotterdam.

Mangan, J, Lalwani, C and Fynes, B. 2008. Port centric logistics. *The International Jounral of Logistics Management* 19(1): 29-41.

Manski, C 1975. Maximum score estimation of the stochastic utility model of choice. *Journal of Econometrics* 3(3): 205-228.

Marasco, A 2008. Third-party logistics: a literature review. *International Journal of Production Economics* 113(1): 127-147.

Marlow, PB and Nair, VNPR 2006. Liner shipping and information exchange: a European perspective. *Marine Policy* 30(6): 681-688.

Marlow, PB and Nair, VNPR 2008. Service contracts: An instrument of international logistics supply chain under United States and European Union regulatory framework. *Marine Policy* 32(3): 489–496.

Marlow, PB, and Paixão Casaca, AC 2003. Measuring lean ports performance. *International Journal of Transport Management* 1(4): 189-202.

Marshall, C and Rossman, GB 1999. *Designing Qualitative Research,* Third Edition. Thousand Oaks, CA: Sage.

Martinez Budria, E, Diaz Armas, R, Navarro Ibanez, M and Ravelo Mesa, T 1999. A study of the efficiency of Spanish ports authorities using data envelopment analysis. *International journal of Transport Economics* 26(2): 237-253.

Marx, D Jr. 1953. *International Shipping Cartels: a Study of Industrial Self-Regulation by Shipping Conferences*, Princeton University Press: Princeton, NY

Masten, SE, Meehan Jr, JW and Snyder, EA 1991. The costs of organization. *Journal of Law, Economics and Organisation* 7(1): 1-25.

Mathewson, F and Winter, R 1997. Tying as a response to demand uncertainty. *The RAND Journal of Economics* 28(3): 566-583.

Matutes, C and Regibeau, P 1988. Mix and match product compatibility with out network externalities. *RAND Journal of Economics* 19: 221-234.

Matutes, C and Regibeau, P, 1992. Compatibility and bundling of complementary goods in a duopoly. *The Journal of Industrial Economics* 40 (1) 37- 54.

Mazumdar, T and Jun, SY 1993. Consumer evaluations of multiple versus single price change. *The Journal of Consumer Research* 20(3): 441-450.

McAfee, RP, McMillan, J and Whinston, MD 1989. Multiproduct monopoly, commodity bundling and correlation of values. *The Quarterly Journal of Economics* 104: 371- 383

McBride, RD and Zufryden FS 1988. An integer programming approach to the optimal product line selection problem. *Marketing Science* 7(2): 126-140.

McCormack, K, Bronzo Ladeira, M andValadares de Oliveira, MP 2008. Supply chain maturity and performance in Brazil. *Supply Chain Management: An International Journal* 13(4): 272-282.

McCormick, RE, Shughart, WF and Tollison, RD 2006. A theory of commodity bundling in final product markets: Professor Hirshleifer meets Professor Becker. *International Review of Law and Economics* 26(2): 162-179.

McDermott, R, Fowler, JH and Smirnov, O 2008. On the evolutionary origin of prospect theory preferences. *Journal of Politics* 70(2): 335-350.

McFadden, D 1974. *Conditional Logit analysis of quantal choice behaviour. Frontiers in Econometrics.* Academic Press: New York.

McFadden, D 1980. Econometric models for probabilistic choice among products. *Journal of Business* 53(3): 13-34.

McFadden, D 1986. The choice theory approach to market research. *Marketing Science* 5(4): 275-297.

McGinnis, MA, Kochunny, CM and Ackerman, KB 1995. Third party logistics choice. *International Journal of Logistics Management* 6(2): 93-101.

McIvor, R 2000. A practical framework for understanding the outsourcing process. *Supply Chain Management: An International Journal* 5(1): 22-36.

McKie-Mason, J and Metzler, J 2004. Links between markets and aftermarkets: Kodak. In Kwoka, JE and White, LJ (eds.). *The Antitrust Revolution: Economics, Competition, and Policy,* Fourth Edition. Oxford: Oxford University Press.

Meersman, H and Van de Voorde, E 2001. International logistics: a continuous search for competitiveness. In Brewer, AM, Button, KJ and Hensher, DA (eds.). *Handbook of Logistics and Supply Chain Management* (pp. 61-77). Oxford: Pergamon Press.

Ménard, C (ed.) 2004*a*. *Transaction Costs and Property Rights*. Cheltenham: Edward Elgar.

Ménard, C 2004*b*. The economics of hybrid organizations. *Journal of Institutional and Theoretical Economics* 160(3): 345-376.

MergeGlobal Value Creation Initiative 2008*b*. Insomnia: Why challenges facing the world container shipping industry make for more nightmares than they should. *American Shipper*, July 2008: 68-86.

Midoro, R and Parola, F 2006. Logistics services and vertical integration: new challenges for shipping lines. In Olivella Puig, J, Marcet i Barbé, R and García Carcellé, V (eds.). *Maritime Transport. Proceedings of the Third International Congress on Maritime Transport*, 16-19 May 2006, Barcelona (Spain).

Midoro, R, Musso, E and Parola, F 2005. Maritime liner shipping and the stevedoring industry: market structure and competition strategies. *Maritime Policy and Management* 32(2): 89-106.

Midoro, R. and Pitto, A 2000. A critical evaluation of strategic alliances in liner shipping. *Maritime Policy and Management* 27(1): 31-40.

Miller, DC 1991. *Handbook of Research Design and Social Measurement,* Fifth Edition. Newbury Park, CA: Sage.

Monroe, KB 1990. *Pricing: Making Profitable Decisions*. New York: McGraw-Hill.

Monroe, KB and Lee, AY. Remembering versus knowing: issues in buyers' processing of price information. *Journal of the Academy of Marketing Science* 27(2): 207-225.

Morash, EA and Clinton, SR 1997. The role of transportation capabilities in international supply chain management. *Transportation Journal* 36(3): 5-17.

Moreby, DH 1985. Crew costs. *Maritime Policy and Management* 12(1): 55-60.

Morton, J 1989. The economics of price. In Seymour, DT (ed.). *The Pricing Decision.* Illinois: Probus Publishing Co.

Murphy, PR and Hall, PK 1995. The relative importance of cost and service in freight transportation choice before and after deregulation: an update. *Transportation Journal* 35(1): 30-38.

Murphy, PR and Poist, RF 1998. Third-party logistics usage: an assessment of propositions based on previous research. *Transportation Journal* 37(4): 26-35.

Murphy, PR and Poist, RF 2000. Third party logistics: some user versus provider perspectives. *Journal of Business Logistics* 21(1): 121-33.

N

Nagle, TT and Holden, RK 2002. *The Strategy and Tactics of Pricing: A Guide to Profitable Decision Making,* Third Edition. New York: Prentice Hall.

Nair VNPR, Gardner BM and Banomyong, R 2001. Theories and Practices of Multimodal Transport in Europe. *Proceedings of the Ninth World Conference on Transport Research (WCTR)*. Seoul, Korea, 22-27 July 2001.

Nalebuff, B 2000. Competing Against Bundles. In Hammond, P and Myles G (eds.). *Incentives, Organization, and Public Economics* (pp. 323-336). Oxford: Oxford University Press.

Nalebuff, B 2004*a*. Bundling as an entry barrier. *Quarterly Journal of Economics* 119: 159-187.

Nalebuff, B 2004*b*. Bundling as a way to leverage monopoly. Yale SOM Working Papers ES-36.

Nalebuff, B 2005. Exclusionary Bundling. *Antitrust Bulletin* 50(3): 321-370.

Nalebuff, B 2008. Bundling and tying. In Durlauf, SN and Blume, LE (eds.) *The New Palgrave Dictionary of Economics*, Second Edition. Basingstoke: Palgrave Macmillan.

North, DC 1990. Institutions and transaction-cost theory of exchange. In Alt, JE and Shepsle, KA (eds.). *Perspectives on positive political economy* (pp. 182-194). Cambridge: Cambridge University Press.

Notteboom, TE 2002. The independence between liner shipping networks and intermodal networks. *Proceeding of the International Association of Maritime Economists (IAME) Annual Conference*, 13-14 November 2002, Panama City, Panama.

Notteboom, TE 2004*a*. A carrier's perspective on container network configuration at sea and on land. *Journal of International Logistics and Trade* 1(2): 65–87.

Notteboom, TE 2004*b*. Container shipping and ports: an overview. *Review of Network Economics* 3(2): 86-106.

Notteboom, TE 2006. The time factor in liner shipping services. *Maritime Economics and Logistics* 8(1): 19-39.

Notteboom, TE and Merckx, F 2006. Freight integration in liner shipping: a strategy serving global production networks. *Growth and Change* 37(4): 550-569.

Notteboom, TE and Rodrigue, JP 2008. Containerisation, box logistics and global supply chains: the integration of ports and liner shipping networks. *Maritime Economics and Logistics* 10(1/2): 152-174.

Notteboom, TE and Vernimmen, B 2009. The effect of high fuel costs on liner service configuration in container shipping. *International Journal of Transport Geography* 17(5): 325-337.

Notteboom, TE and Winkelmans, W 2001*a*. Reassessing public sector involvement in European seaports. *International Journal of Maritime Economics* 2(4): 242-259.

Notteboom, TE and Winkelmans, W 2001*b*. Structural changes in logistics: how do port authorities face the challenge? *Maritime Policy and Management* 28(2): 71-89.

Notteboom, TE, Coeck, C and Van der Broeck, J 2000. Measuring and explaining the relative efficiency of container terminals by means of bayesian stochastic frontier models. *International Journal of Maritime Economics* 2(2): 83-106.

O

Ocean Shipping Consltants 2009. *North European Containerport Markets to 2020*. Chertsey: Ocean Shipping Consultants.

OECD, 2001. *Regulatory Issues in International Maritime Transport*. Paris: Organization for Economic Co-operation and Development.

OECD, 2002. *Competition Policy in Liner Shipping: Final Report*. Paris: Organization for Economic Co-operation and Development.

OECD/ITF, 2009. Integration and competition between transport and logistics businesses. Joint transport Research centre, Discussion paper no. 2009-8, updated 2009.

Ogawa, K 1987. An approach to simultaneous estimation and segmentation in conjoint analysis. *Marketing Science* 6: 66-81.

Olivier, D, Parola, F, Slack, B and Wang, JJ 2007. The time scale of internationalisation: the case of the container port industry. *Maritime Economic and Logistics* 9(1): 1-34.

Orbach, BY and Einav, L 2007. Uniform prices for differentiated goods: The case of the movie-theater industry. *International Review of Law and Economics* 27(2): 129-153.

Oum, TH, Waters II, WG and Yong, JS 1992. Concepts of price elasticities of transport demand and recent empirical estimates: an interpretative survey. *Journal of Transport Economics and Policy* 26(2): 139-154.

Özer, Ö. and Raz, G 2006. Supply chain sourcing under asymmetric information. Working Paper, Stanford University.

P

Paixão Casaca, AC and Marlow, PB 2005. The competitiveness of short sea shipping in multimodal logistics supply chains: service attributes. *Maritime Policy and Management* 32(4): 363-382.

Palfrey, TR 1983. Bundling decisions by a multiproduct monopolist with incomplete information. *Econometrica* 51: 463-84.

Pallis, AA, Vitsounis, TK and De Langen, PW 2010. Port economics, policy and management: review of an emerging research field. *Transport Reviews* 30(1): 115-161.

Panayides, PM 2002. Economic organization of intermodal transport. *Transport Review* 22(4): 401-414.

Panayides, PM 2007*a*. Global Supply Chain Integration and Competitiveness of Port Terminals. In Wang, J, Oliver, D, Notteboom, T and Slack, B (eds.). *Ports, Cities and Supply Chains* (pp. 28-40). Aldershot, UK: Ashgate.

Panayides, PM and Gong, X 2002. The stock market reaction to merger and acquisition announcements in liner shipping. *International Journal of Maritime Economics* 4(1): 55-80.

Parameritis, J 2009. Liner Shipping Regulation and Pricing for Integrated Logistics Services. MSc Thesis, Erasmus University Rotterdam.

Parola, F and Musso, E 2007. Market structures and competitive strategies: the carrier-stevedore arm wrestling in northern European ports. *Maritime Policy and Management* 34(3): 259–278.

Parola, F and Veenstra, AW 2008. The spatial coverage of the shipping lines and container terminal operators. *Journal of Transport Geography* 16(4): 292-299.

Paroush, J and Peles, YC 1981. A combined monopoly and optimal packaging. *European Economic Review* 15(3): 373-383.

Payne, JW, Bettman, JR and Johnson, EJ 1988. Adaptive strategy selection in decision making. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 14(3): 534-552.

Pearce, B. and Winter, H 1996. Pure vs. mixed commodity bundling. *Review of Industrial Organization* 11: 811-21.

Penrose, E 1959. *The Theory of the Growth of the Firm*. Oxford: Oxford University Press.

Penttinen, E and Palmer, J 2007. Improving firm positioning through enhanced offerings and buyer-seller relationships. *Industrial Marketing Management* 36(5): 552-564.

Persson, G and Virum, H 2001. Growth strategies for logistics service providers: a case study. *International Journal of Logistics Management* 12(1): 53-64.

Peterman, JL 1979. The International Salt Case. *Journal of Law and Economics* 22(2): 351-364.

Peters, HJF 2001. Developments in global sea-trade and container shipping markets: their effects on the port industry and private sector involvement. *International Journal of Maritime Economics* 3(1): 3-26.

Phlips, L 1989. *The Economics of Price Discrimination.* Cambridge, MA: Cambridge University Press.

Pirrong, SC 1992. An application of core theory to the analysis of ocean shipping markets. *Journal of Law and Economics* 35(1): 89-131.

Porter, ME 1979. How competitive forces shape strategy. *Harvard Business Review* (March–April). Reprinted in Porter, ME. *On Competition* (1998, pp. 21–38). Boston, MA: Harvard Business Review Book Series.

Porter, ME 1985. *Competitive Advantage*. New York, NY: The Free Press.

Porter, ME 1990. *The Competitive Advantage of Nations.* London: Macmillan.

Porter, ME 1996. What is strategy? *Harvard Business Review* 74: 61-78.

Posner, RA 1976. *Antitrust Law, An Economic Perspective*. Chicago, IL: University of Chicago Press.

Post, T, Van den Assem, MJ, Baltussen, G and Thaler, RH 2008. Deal or no deal? Decision making under risk in a large-payoff game show'. *American Economic Review* 98(1): 38-71.

Proctor, NC 1985. Marine insurance. *Maritime Policy and Management* 12(1): 61-69.

Psaraftis, HN 2004. Letter to the editor. *Maritime Economics and Logistics* 6(2): 195-196.

Q

R

Rabinovich, E, Windle, R, Dresner, M and Corsi, T 1999. Outsourcing of integrated logistics functions: An examination of industry practices. *International Journal of Physical Distribution and Logistics Management* 29(6): 353-373.

Rao, K and Young, RR 1994. Global supply chains: factors influencing outsourcing of logistics functions. *International Journal of Physical Distribution and Logistics Management* 24(6): 11-19.

Rao, PK 2003. *The Economics of Transaction Costs, Theory, Methods, Applications*. Basingstoke: Palgrave Macmillan

Razzaque, MA and Sheng, CC 1998. Outsourcing of logistics functions: a literature survey. *International Journal of Physical Distribution and Logistics Management* 28(2): 89-107.

Reid, AB, Dally, HK and Wellard, DJ 1978. Costs and charges. In National Port Council. *Containers: Their Handling and Transport: A Survey of Current Practice* (pp. 218-232). London: National Port Council.

Reitzes, JD and Sheran, KL 2002. Rolling seas in liner shipping. *Review of Industrial Organization* 20(2): 51-59.

Rennhoff, AD and Serfes, K 2009. The role of upstream-downstream competition on bundling decisions: Should regulators force firms to unbundle? *The Journal of Economics and Management Strategy* 18(2): 547-588.

Rewtrakunphaiboon, W and Oppewal, H 2008. Effects of package holiday information presentation on destination choice. *Journal of Travel Research* 47(2): 127-136.

Richardson, HL 1995. Logistics help for the challenged. *Transportation and Distribution* 36(1): 60-64.

Rimmer, PJ 1998. Ocean liner shipping services: corporate restructuring and port selection/competition. *Asia Pacific Viewpoint* 39(2): 193-208.

Ringbeck, J, Neumann, C-S and Cornet, A 1999. Market-oriented complexity management using the micromarket management concept. In Fürderer, R, Herrmann, A and Wübker, G (eds.). *Optimal Bundling, Marketing Strategies for Improving Economic Performance* (pp. 119-132). Berlin: Springer.

Robinson, R 2002. Ports as elements in value-driven chain systems: The new paradigm. *Maritime Policy and Management* 29(4): 241-255.

Robinson, R 2003. Port authorities: Defining functionality within a value-driven chain paradigm. *Proceedings of the International Association of Maritime Economists (IAME) Annual Conference, Pusan, 3-5 September 2003* (pp. 654–674). Pusan: IAME.

Robinson, R 2005. Liner shipping strategy, network structuring and competitive advantage: A chain system perspective. *Research in Transportation Economics* 12(1): 247-289.

Rodrigue, J-P, Comtois, C and Slack, B 2009. *The Geography of Transport Systems*, Second Edition. New York: Routledge.

Roll, Y and Hayuth, Y 1993. Port performance comparison applying data envelopment analysis (DEA). *Maritime Policy and Management* 20(2): 153-161.

Rolstadås, A (ed.) 1995*a*. *Benchmarking: Theory and Practice*. London: Chapman Hall.

Rolstadås, A 1995*b*. *Performance Management: A Business Process Benchmarking Approach.* London: Chapman Hall.

Rolstadås, A 1998. Enterprise performance measurement. *International Journal of Operations and Production Management*, 18(9/10): 989-999.

Rubinfeld, DL 2005. 3M's bundled rebates: an economic perspective. *University of Chicago Law Review* 72: 243-264.

Rubinfeld, DL 2009. Maintenance of monopoly: US vs Microsoft (2001). In Kwoka, JE Jr and White, LJ (eds.). *The Antitrust Revolution: Economics, Competition, and Policy,* Fifth Edition. New York, NY: Oxford University Press, pp. 530-557.

Rushton, A and Walker, S 2007. *International Logistics and Supply Chain Outsourcing: From Local to Global.* London: Kogan Page.

Ryoo, D-K and Thanopoulou, HA 1999. Liner alliances in the globalization era: A strategic tool for Asian container carriers. *Maritime Policy and Management* 26(4): 349-367.

S

Sachish, A 1996. Productivity functions as a managerial tool in Israeli ports", *Maritime Policy and Management* 23(4): 341–369.

Sahay, BS and Mohan, R 2006. Third-party logistics practices: an Indian perspective. *International Journal of Physical Distribution and Logistics Management* 36(9): 666-689.

Saldanha, JP, Russell DM and Tyworth, JE 2006. A disaggregate analysis of ocean carriers' transit time performance. *Transportation Journal* 35(2): 39-60

Salinger, MA 1995. A graphical analysis of bundling. *Journal of Business* 68: 85-98.

Sankaran, J, Mun, D and Charman, Z 2002. Effective logistics outsourcing in New Zeland: an inductive empirical investigation. *International Journal of Physical Distribution and Logistics Management* 32(8): 682-702.

Sarel, D and Zinn, W 1992. Customer and non-customer perceptions of third party services: are they similar? *International Journal of Logistics Management* 3(1): 12-22.

Sarin, S, Sego, T and Chanvarasuth, N 2003. Strategic use of bundling for reducing consumers' perceived risk associated with the purchase of new high-tech products. *Journal of Marketing Theory and Practice* 11(3): 71-83.

Sauvage, T 2003. The relationship between technology and logistics third party providers. *International Journal of Physical Distribution and Logistics Management* 33(3): 236-53.

Schmalensee, RL 1982. Commodity bundling by single-product monopolies. *Journal of Law and Economics* 25: 67-71.

Schmalensee, RL 1984. Gaussian demand and commodity bundling. *Journal of Business* 57: S211-S230.

Seidmann, DJ 1991. Bundling as a facilitating device: a reinterpretation of leverage theory. *Econometrica* 58: 491-499.

Selviaridis, K and Spring, M 2007. Third party logistics: a literature review and research agenda. *International Journal of Logistics Management* 18(1): 125-150.

Selviaridis, K Spring, M, Profillidis, V and Botzoris, G 2008. Benefits, risks, selection criteria for third-party logistics services. *Maritime Economics and Logistics* 10, (4): 380-392.

Shannon, CS 1948. A mathematical theory of communication. *Bell System Technical Journal* 27(3): 379-423 and 27(4): 623-656.

Shapiro, JF 2007. *Modelling the Supply Chain*, Second Edition. Cambridge, MA: MIT Press.

Sheffi, Y 1990. Third party logistics: present and future prospects. *Journal of Business Logistics* 11(2): 27-39.

Shepherd, WG 1997. *The Economics of Industrial Organisation,* Fourth Edition. Prospect Heights, IL: Waveland Press.

Sheppard, EJ and Seidman, D 2001. Ocean shipping alliances: The wave of the future? *International Journal of Maritime Economics* 3(4): 351-367.

Shneerson, D 1976. The structure of liner freight rates: A comparative route study. *Journal of Transport Economics and Policy* 10(1): 52-67.

Shy, O 2008. *How to Price: A Guide to Pricing Techniques and Yield Management.* Cambridge: Cambridge University Press.

Sidak JG 2001. An antitrust rule for software integration. *Yale Journal on Regulation* 18(1): 1-83

Simon, H 1989. *Price Management*. Amsterdam: North-Holland.

Simon, H and Wübker, G 1999. Bundling: a powerful method to Better exploit profit potential, in Fürderer, R, Herrmann, A and Wübker, G (eds.). 1999. *Optimal Bundling: Marketing Strategies for Improving Economic Performance* (pp. 7-28). Berlin: Springer.

Simon, H, Faßnacht, M and Weubker, G 1995. Price Bundling. *Pricing Strategy and Practice* 3(1): 34-44.

Simonin, BL and Ruth, JA 1995. Bundling as a strategy for new product introduction: effects on consumers' reservation prices for the bundle, the new product, and its tie-in. *Journal of Business Research* 33(3): 219-230.

Sink, DS and Tuttle, TC 1989. *Planning and Measurement in Your Organization of the Future*. Norcross, GA: Industrial Engineering and Management Press.

Sink, HL and Langley, CJ 1997. A managerial framework for the acquisition of third-party logistics services. *Journal of Business Logistics* 18(2): 163-89.

Sjostrom, W 1989. Collusion in ocean shipping: A test of monopoly and empty core models. *Journal of Political Economy* 97(5): 1160-1179.

Sjostrom, W 1992. Price discrimination by shipping conferences. *Logistics and Transportation Review* 28(2): 207-216.

Sjostrom, W 1993 Antitrust immunity for shipping conferences: an empty core approach. *Antitrust Bulletin* 38(Summer): 419-423.

Sjostrom, W 2002. Liner shipping: modelling competition and collusions. In Grammenos, C Th. (ed.). *The Handbook of Maritime Economics and Business* (pp. 327-345). London: LLP.

Sjostrom, W 2004. Ocean shipping cartels: a survey. *Review of Network Economics* 3(2): 107-134.

Skjoett-Larsen, T 2000. Third party logistics: From an interorganizational point of view. *International Journal of Physical Distribution and Logistics Management* 30(2): 112-127.

Slack, B 1993. Pawns in the game: ports in a global transport system. *Growth and Change* 24(4): 579-588.

Slack, B 2001. Globalisation in Maritime Transportation: Competition, Uncertainty and Implications for Port Development Strategy. FEEM Working Paper no. 8.2001.

Slack, B and Frémont, A 2008. Fifty years of organisational change in container shipping: regional shift and the role of family firms. *GeoJournal* 74(1): 23-34.

Slack, B, Comtois, C and Stelmo, G 1996. Shipping lines agents of change in the port industry. *Maritime Policy and Management* 23(3): 289- 300.

SMU and EUR 2008*a*. *A Review of Strategic Bundling Theory*. Report prepared for the NOLF Project ‘Product Bundling in Liner and Logistics Industries’, September 23, 2008.

SMU and EUR 2008*b*. *Report on Liner Transportation and Logistics Service Survey 2007*. Report prepared for the NOLF Project, ‘Product Bundling in Liner and Logistics Industries’, November 2008.

Sohail, MS and Al-Abdali, OS 2005. The usage of third party logistics in Saudi Arabia: current position and future prospects. *International Journal of Physical Distribution and Logistics Management* 35(9): 637-653.

Sohail, MS, and Sohal, A 2003. The use of 3PL services: a Malaysian perspective. *Technovation* 23(5): 401-8.

Sohail, MS, Bhatnagar, R and Sohal, AS 2006. A comparative study on the use of third party logistics services by Singaporean and Malaysian firms. *International Journal of Physical Distribution and Logistics Management* 36(9): 690-701.

Sohal, A, Millen, RA and Moss, S 2002. A comparison of the use of 3PL services by Australian firms between 1995-1999. *International Journal of Physical Distribution and Logistics Management* 32(1): 59-68.

Soman, D and Gourville, JT 2001. Transaction decoupling: how price bundling affects the decision to consume. *Journal of Marketing Research* 38(1): 30-44.

Song, D-W and Panayides, PM 2002. A conceptual application of cooperative game theory to liner shipping strategic alliances. *Maritime Policy and Management* 29(3): 285-301.

Soofi, ES 1992. A generalizable formulation of conditional logit with diagnostics. *Journal of the American Statistics Association* 87(419): 812-816.

Soppé, M, Parola, F and Frémont, A 2009. Emerging inter-industry partnerships between shipping lines and stevedores: from rivalry to cooperation? *Journal of Transport Geography* 17(1): 10-20.

Speckmann, RE, Kamauff, J and Spaer, J 1999. Towards more effective sourcing and supplier management. E*uropean Journal of Purchasing and Supply Management*, 5(2): 103-16.

Spector, D 2007. Bundling, tying, and collusion. *International Journal of Industrial Organization* 25(3): 575–581.

Spence, M 1973. Job market signalling. *Quarterly Journal of Economics* 87(3): 355-374.

Ständer, B 2008. CTQI: A Container Terminal Performance Indicator Established by GLC in Co-operation with Global Institute of Logistics (GIL). In Wittig, W and Prieser, C (eds.) *The Human Element at the Ship/Port Interface*, Proceedings of the 1st International Ship-Port-Interface Conference (ISPIC), Bremen, Germany, 19-21 May 2008. Kiel: Buchwerft-verlag.de.

Stank, TP and Maltz, AB 1996. Some propositions on third-party choice: Domestic vs. International logistics providers. *Journal of Marketing Theory and Practice* 4(2). 45–54.

Stavins, J 2001. Price discrimination in the airline market: the effect of market concentration. *The Review of Economics and Statistics* 83(1): 200-202.

Stigler, GJ 1961. The economics of information. *Journal of Political Economy* 69(3): 213–225.

Stigler, GJ 1968. A note on block booking. In Stigler, GJ (ed.). *The Organization of industries*. Homewood: Irwin.

Stiglitz, JE 1975. The theory of screening, education, and the distribution of income. *The American Economic Review* 65(3): 283-300.

Stole, L 1995. Nonlinear pricing and oligopoly. *Journal of Economics and Management Strategy* 4(4): 529-562.

Stole, L 2007. Price discrimination and competition. In Armstrong, M and Porter, R (eds.). *Handbook of Industrial Organization: Volume III* (pp. 2221-2300). Amsterdam: North-Holland.

Stopford, M 1997. *Maritime Economics*, Second Edition. London: Routledge.

Stopford, M 2002. Shipping markets cycles. In Grammenos, C Th. (ed.). *The Handbook of Maritime Economics and Business* (pp. 203-224). London: LLP.

Stopford, M 2009. *Maritime Economics*, Third Edition. London: Routledge.

Stremersch, S and Tellis, GJ 2002. Strategic bundling of products and prices: a new synthesis for marketing. *Journal of Marketing* 66(1): 55-72.

Stremersch, S, Wuyts, S and Frambach, RT 2001. The purchasing of full-service contracts: an exploratory study within the industrial maintenance market. *Industrial Marketing Management* 30(1): 1-12.

Sum, C-C, Teo, C-B 1999. Strategic posture of logistics service providers in Singapore. *International Journal of Physical Distribution and Logistics Management* 29(9): 588-605.

Suri, R and Monroe, KB 2003. The effects of time constraints on consumers' judgments of price and products. *Journal of Consumer Research* 30(1): 92-104.

Svensson, G 2001. The impact of outsourcing on inbound logistics flows. *International Journal of Logistics Management* 12(1): 21-35.

Sys, C 2009. Is the container liner shipping industry an oligopoly? *Transport Policy* 16(5): 259-270.

T

Talley, WK 1994. Performance indicators and port performance evaluation. *Logistics and Transportation Review* 30(4): 339-352.

Talley, WK 2007. Port performance: an economics perspective. In Brooks, MR and Cullinane, K (eds.) *Devolution, Port Governance and Port Performance* (pp. 499-516). Oxford: Elsevier.

Tallury, KT and Van Ryzin, GJ 2004. *The Theory and Practice of Revenue Management*. Boston: Kluwer Academic Publishers.

Tauman, Y, Urbano, A and Watanabe, J 1997. A model of multiproduct price competition. *Journal of Economic Theory* 77(2): 377-401.

Tellis, GJ 1986. Beyond the many faces of price: an integration of pricing strategies. *The Journal of Marketing* 50(4): 146-160.

Telser, LG 1965. Abuse and trade practices: an economic analysis. *Law and Contemporary Problems* 30: 488-505.

Telser, LG 1978. *Economic Theory and the Core*. Chicago: University of Chicago Press.

Telser, LG 1979. A theory of monopoly of complementary goods. *Journal of Business* 52: 211-230.

Telser, LG 1987. *A Theory of Efficient Cooperation and Competition*. Cambridge: Cambridge University Press.

Telser, LG 1994. The usefulness of core theory in economics. *Journal of Economic Perspectives* 8(2): 151-164.

Telser, LG 1996. Competition and the core. *Journal of Political Economy* 104(1): 85-107.

Thaler, RH 1980. Towards a positive theory of consumer choice. *Journal of Economic Behavior and Organization* 1: 39-60.

Thaler, RH 1985. Mental accounting and consumer choice. *Marketing Science* 4(3): 199–214.

Thaler, RH 1999. Mental accounting matters. *Journal of Behavioral Decision Making* 12(3): 183–206.

Thanassoulis, J 2007. Competitive mixed bundling and consumer surplus. *Journal of Economics and Management Strategy* 16(2): 437-467.

Thanopoulou, HA, Ryoo, D-K and Lee, T-W 1999. Korean liner shipping in the era of global alliances. *Maritime Policy and Management* 26(3): 209-229.

Theil, H 1967. *Economics and Information Theory*. Amsterdam: North Holland Publishing Co.

Theil, H and Fiebig, DG 1984. *Exploiting Continuity: Maximum Entropy Estimation of Continuous Distributions*. Cambridge: Ballinger Publishing Company.

Thomas, DJ and Griffin, PM 1996. Coordinated supply chain management. *European Journal of Operations Research* 94(1): 1-15.

Tirole, J 1988. *The Theory of Industrial Organisation*, Eleventh Edition. Cambridge, MA: The MIT Press.

Tirole, J 2005. The analysis of tying cases: a primer. *Competition Policy International* 1(1): 1-25.

Tolofari, S, Button, KJ and Pitfield, D 1986. Shipping costs and the controversy over open registry. *Journal of Industrial Economics* 34(4): 409-427.

Tongzon, JL 1995. Determinants of port performance and efficiency. *Transportation Research Part A* 29(4): 245-252.

Tongzon, JL 2001. Efficiency measurement of selected Australian and other international ports using data envelopment analysis. *Transportation Research Part A* 35(2): 113-128.

Tönshoff, N, Fine, C and Huchzermeier, A 1999. Bundling and pricing of modular machine tools under demand uncertainty. In Fürderer, R, Herrmann, A and Wübker, G (eds.). *Optimal Bundling: Marketing Strategies for Improving Economic Performance* (pp. 87-117). Berlin: Springer.

Trace, K 2002. Globalisation of container shipping: Implications for the North-South liner shipping trades. *Economic Papers* 21(4): 1-22.

Treacy, M and Wieresma, F 1993. Customer intimacy and other value disciplines. *Harvard Business Review* 71(1): 84-93.

Trujillo, L and Tovar, B 2007. The European port industry: an analysis of its economic efficiency. *Maritime Economics and Logistics* 9(2): 148-171.

Twersky, A and Kahneman, D 1982. Judgement under uncertainty: Heuristics and biases. In Kahneman, D and Twersky, A (eds.). *Judgement under Uncertainty: Heuristics and Biases* (pp. 3-22). Cambridge: Cambridge Univerisity Press.

U

Ulrich, KT and Eppinger, SD 2004. *Product Design and Development,* Fourth Edition. New York, NY: McGraw-Hill.

UNCTAD 1974. *Convention on a Code of Conduct for Liner Conferences*. Geneva: UNCTAD.

UNCTAD 1976. *Port Performance Indicators*, TD/B/C.4/131/Supp.1/Rev.1. Geneva: UNCTAD.

UNCTAD 1983. *Manual on a Uniform System of Port Statistics and Performance Indicators*. Geneva: UNCTAD.

UNCTAD 1999. Technical Note: Fourth generation port. *UNCTAD Ports newsletter* 19: 9-12.

Urban, GL and Hauser JR 1993. *Design and Marketing of New Products,* Second Edition. Englewood Cliffs, NJ: Prentice-Hall.

V

Van Asperen, E 2009. *Essays on Port, Container, and Bulk Chemical Logistics Optimization*. Doctoral Thesis, Erasmus University Rotterdam, ERIM Series EPS-

2009-181-LIS. Rotterdam: Erasmus Research Institute of Management (ERIM), Erasmus University Rotterdam.

Van Damme, DA and Ploos van Amstel, MJ 1996. Outsourcing logistics management activities. *International Journal of Logistics Management* 7(2): 85-95.

Van de Voorde, E and Vaneslander, T 2009. Market power and vertical and horizontal integration in the maritime shipping and port industry, Department of Transport and Regional Economics, University of Antwerp, Discussion Paper no. 2009-2.

Van der Horst, M and De Langen, PW 2008. Coordination in hinterland transport chains: A major challenge for the seaport community. *Maritime Economics and Logistics* 10(1/2): 108-129.

Van Hoek, RI 1998. Measuring and improving performance in the supply chain. *Supply Chain Management* 3(4): 187-192.

Van Hoek, RI 2000*b*. Role of third party logistics services in customization through postponment. *International Journal of Service Industry Management* 11(4): 374-87.

Van Hoek, RI 2000*c*. The purchasing and control of supplementary third-party logistics services. *Journal of Supply Chain Management* 36(4): 14-26.

Van Hoek, RI 2001. The contribution of performance measurement to the expansion of third party alliances in the supply chain. *International Journal of Operations and Production Management* 21(1/2): 15-25.

Van Hoek, RI and Dierdonck, R 2000. Postponed manufacturing supplementary to transportation services? *Transportation Research: Part E* 36(3): 205-17.

Van Laarhoven, P, Berglund, M and Peters, M 2000. Third party logistics in Europe: five years later. *International Journal of Physical Distribution and Logistics Management* 30(5): 425-42.

Varian, HR 1992. *Microeconomic Analysis*. New York, NY: Norton.

Venkatesh, R and Kamakura, W 2003. Optimal bundling and pricing under a monopoly: contrasting complements and substitutes from independently valued products. *Journal of Business* 76(2): 211-231.

Venkatesh, R and Mahajan, V 1993. A probabilistic approach to pricing a bundle of products or services. *Journal of Marketing Research* 30(4): 494-508.

Vinay, VP, Kannan, G and Sasikumar, P 2009. Conceptula study on 3PL/4PL: new trends for the service industry. *International Journal of Services Technology and Management* 12(1): 3-22.

Virum, H 1993. Third party logistics development in Europe. *Logistics and Transportation Review* 29(4): 355-61.

Vriens, M 1995. *Conjoint Analysis in Marketing: Developments in Stimulus Representation and Segmentation Methods*. Doctoral Thesis, Rijksuniversiteit Groningen, Research Institute SOM (Systems, Organisations and Management). Groningen: Rijksuniversiteit Groningen.

W

Wallenburg, CM 2009. Innovation within logistics outsourcing relationships: Proactive improvement of logistics service providers as a driver of customer loyalty. *Journal of Supply Chain Management* 45(2): 75-93.

Walters, AA 1975. Marginal cost pricing in ports. *Logistics and Transportation Review* 11(4): 299-308.

Wang, Q, Zantow, K, Lai, F and Wang, X 2006. Strategic postures of third-party logistics providers in mainland China. *International Journal of Physical Distribution and Logistics Management* 36(10): 793-819.

Wang, TF, and Cullinane, K 2006. The efficiency of European container terminals and implications for supply chain management. *Maritime Economics and Logistics*, 8(1): 82-99.

Wang, TF, Cullinane, K and Song, DW 2005. *Container Port Production and Economic Efficiency*. Basingstoke: Palgrave MacMillan.

Warhit, E 1980. The economics of tie-in sales. *Atlantic Economic Journal* 8: 81-88.

Weidenbaum, M 2005. Outsourcing: pros and cons. *Business Horizons* 48(4): 311-315.

Wentworth, F 2003. Outsourcing services: the case against. *Journal of the Institute of Logistics and Transport* 5 (2): 57-59.

Whinston, MD 1990. Tying, foreclosure, and exclusion. *American Economic Review* 80(4): 837-59.

Whinston, MD 2001. Exclusivity and tying in *US v. Microsoft*: What we know, and don't know. *Journal of Economic Perspectives* 15(2): 63-80.

White, LJ 2002. Trends in Aggregate concentration in the United States. *Journal of Economic Perspectives* 16(4): 137-160.

Wijnolst, N and Wergeland, T 2009. *Shipping Innovation*. Delft: IOS Press.

Wijnolst, N, Scholtens, M and Waals, F. 1999. *Malacca-Max: The Ultimate Container Carrier: Design Innovation in Container Shipping*. Delft: Delft University Press.

Wilding, R. and Juriado, R 2004. Customer perceptions on logistics outsourcing in the European consumer goods industry. *International Journal of Physical Distribution and Logistics Management* 34(8): 628-644.

Williamson, OE 1968. Economies as an antitrust defense: The welfare trade-offs. *American Economic Review* 58(1): 18-36.

Williamson, OE 1975. *Markets and Hierarchies*, Free Press: New York.

Williamson, OE 1979. Transaction cost economics: the governance of contractual relations. *Journal of Law and Economics* 22(2): 233-261.

Williamson, OE 1983. Credible commitments: using hostage to support exchange. *American Economic Review* 73(4): 519-540.

Williamson, OE 1985. *Economic Institutions of Capitalism*. New York, NY: The Free Press.

Williamson, OE 1991. Comparative economic organization: the analysis of discrete structural alternatives. *Administrative Science Quarterly* 36(2): 269-296.

Williamson, OE 1996. *The Mechanisms of Governance*. Oxford: Oxford University Press.

Williamson, OE 2008. Outsourcing: transaction cost economics and supply chain management. *Journal of Supply Chain Management* 44(2): 5-16.

Wilson, LO, Weiss, AM and John, G 1990. Unbundling of industrial systems. *Journal of Marketing Research* 23: 123-138.

Wilson, RB 1993. *Nonlinear Pricing.* New York, NY: Oxford University Press.

Womack, P, Jones, DT and Ross, D 1990. *The Machine that Changed the World*. New York, NY: Rawson Associates.

Wong, PC, Yan, H and Bamford, C 2008. Evaluation of factors for carrier section in the China Pearl River delta. *Maritime Policy and Management* 35(1): 27-52.

Wong, WP and Wong, KY 2008. A review on benchmarking of supply chain performance measures. *Benchmarking: An International Journal* 15(1): 25-51.

Wong, Y-Y, Maher, TE, Nicholson, JD, Gurney, NP 2000. Strategic alliances in logistics outsourcing. *Asia Pacific Journal of Marketing and Logistics* 12(4): 3-21.

Wright, C 2001. *Make a Bundle with Bundling (Part 2).* Rating Matters Newsletter, issue 4, Service Level Corporation, viewed 25 May 2009, < http://www.servicelevel.net/rating_matters/newsletters/issue04.htm>

Wübker, G and Mahajan, V 1999. A conjoint analysis based procedure to measure reservation price and to optimally price product bundles. In Fürderer, R, Herrmann, A and Wübker, G (eds.). *Optimal Bundling: Marketing Strategies for Improving Economic Performance* (pp. 157-175). Berlin: Springer.

X

Y

Yadav, MS 1994. How buyers evaluate product bundles: a model of anchoring and adjustment. *Journal of Consumer Research* 21: 342-353.

Yadav, MS 1995. Bundle evaluation in different market segments: The effects of discount framing and buyers' preference heterogeneity. *Journal of the Academy of Marketing Science* 23(3): 206.

Yadav, MS and Monroe, KB 1993. How buyers perceive savings in a bundle price: An examination of a bundle's transaction value. *Journal of Marketing Research* 30(3): 350-358.

Yang, J 2009. *Towards the Restructuring and Co-ordination Mechanisms for the Architecture of Chinese Transport Logistics*. Doctoral Thesis, Erasmus University Rotterdam, ERIM Series EPS-2009-157-LIS. Rotterdam: Erasmus Research Institute of Management (ERIM), Erasmus University Rotterdam.

Yeung, J, Selen, W, Sum, CC and Huo, B 2006. Linking financial performance to strategic orientation and operational priorities: an empirical study of third-party logistics providers. *International Journal of Physical Distribution and Logistics Management* 36(3): 210-230.

Z

Zerby, JA 1988. Clarifying some issues relating to contestability in the liner shipping industry (and perhaps also eliminating some doubts). *Maritime Policy and Management* 15(1): 5-14.

Zerby, JA and Conlon, RM 1978. An analysis of capacity utilisation in liner shipping. *Journal of Transport Economics and Policy* 12(1): 27-46

Zinn, W 1996. The new logistics in Latin America: an overview of current status and opportunities. *The International Journal of Logistics Management* 7(1): 61-71.

Zufryden, FS 1977. A conjoint-measurement-based approach for optimal new product design and production positioning. In Shocker, AD (ed.). *Analytical Approaches to Product and Market Planning* (pp. 100-114). Cambridge, MA: Marketing Science Institute.

APPENDIX 1 – INTERVIEW GUIDELINES

PRODUCT BUNDLING IN LINER AND LOGISTICS BUSINESS

SHIPPING LINES INTERVIEW GUIDELINES

Company	: ____________________
Interviewee	: ____________________
Position	: ____________________
Date and Time	: ____________________

1. Can you briefly define the logistics strategy of your company?

2. For each of the following statements you should mention if you strongly agree, agree, disagree, strongly disagree, do not know.
   a. Strategically our company considers logistics as important as ocean transportation.
   ❑ strongly agree ❑ agree ❑ disagree ❑ strongly disagree ❑ do not know
   b. Logistics is strategically important for our company but in the end our core business is ocean transportation.
   ❑ strongly agree ❑ agree ❑ disagree ❑ strongly disagree ❑ do not know
   c. The major reason for which we have stepped into logistics is because margins in ocean transportation are too small.
   ❑ strongly agree ❑ agree ❑ disagree ❑ strongly disagree ❑ do not know
   d. Competition in the logistics business is more intense than in ocean transportation.
   ❑ strongly agree ❑ agree ❑ disagree ❑ strongly disagree ❑ do not know
   e. Our only interest in logistics lies with its provision in conjunction with ocean transportation.
   ❑ strongly agree ❑ agree ❑ disagree ❑ strongly disagree ❑ do not know
   f. Our company aims at becoming a fully integrated logistics operator.
   ❑ strongly agree ❑ agree ❑ disagree ❑ strongly disagree ❑ do not know
   g. Our company aims at being in the forefront in the provision of logistics services.
   ❑ strongly agree ❑ agree ❑ disagree ❑ strongly disagree ❑ do not know

   Do you have any comments on the previous statements?

3. Could you provide a rough breakdown of your liner / logistics costs and revenues? (e.g. 80% liner, 20% logistics).

4. Are you planning to change this ratio in order to favour logistics through investments in, say, warehousing, etc.?

5. How many components (e.g. warehousing, tracking, RFID, etc.) does one have in a door-to-door supply chain?

6. Does your company provide all inclusive packages to customers, i.e. does it organise door-to-door transportation for at least one of its customers under a single all-inclusive price? If so can you mention what percentage of your port to port business is also door-to-door?

7. If we define bundling as the provision of ocean transportation together with one or more logistics services under a single tariff, why might bundling be an attractive proposition?

8. What are the difficulties you face in trying to sell bundled products?

9. Are your competitors better or worse in providing bundled products and in selling them?

1. Which of the following logistics services provided by your company is priced jointly with ocean transportation? Can you indicate on a scale from 0 to 5, where 0 means never and 5 means always, how often does this occur?

Terminal Handling Charges	❑ yes	❑ no	[ ]
Warehousing	❑ yes	❑ no	[ ]
Stripping/stuffing containers and cargo consolidation	❑ yes	❑ no	[ ]
Container services (fumigation, maintenance, repairs, etc)	❑ yes	❑ no	[ ]
Container logistics	❑ yes	❑ no	[ ]
Cargo logistics	❑ yes	❑ no	[ ]
Value added logistics services	❑ yes	❑ no	[ ]
Hinterland transportation	❑ yes	❑ no	[ ]
Other (specify)	❑ yes	❑ no	[ ]

2. How many of the door-to-door supply chain components listed before, in your view, could be successfully bundled?

3. Which of the above components can you provide yourself and which ones do you have to outsource?

4. If you have to outsource, do you do this strategically in advance, or after you have stricken a deal/contract with a customer?

5. How do you price a bundle?

6. If we consider three services, s_1, s_2 and s_3, each one priced individually as p_1, p_2 and p_3, is the bundle price equal to $p_b=p_1+p_2+p_3$, higher or lower?

7. Which methods (how) do you use to assess your customers' willingness to pay for differentiated services?

8. Could bundled products be developed and priced by alliance members? E.g. Trucking by company X, warehousing by company Y, liner by company Z and the bundle sold by all at the same price?

9. Which of the following topics do you think would require a better understanding from an academic point of view?
   - ❑ The role that logistics may play in granting shipping lines a better control of demand for ocean transportation.
   - ❑ The way in which the provision of logistics services jointly with ocean transportation may increase profitability in the liner business.
   - ❑ The reasons for which shippers are reluctant to accept all-inclusive pricing mechanisms that include ocean transportation.
   - ❑ The identification, from an operational and marketing point of view, of better mixes of services that would suit shippers better.
   - ❑ The competitive advantage that the provision of ocean transportation jointly with logistics services might grant to shipping lines.
   - ❑ The way in which the provision of ocean transportation jointly with logistics services might be affected by the geographical differences in the logistics markets of the world.
   - ❑ The benefits for shipping lines deriving from the provision of services under a single pricing mechanism.
   - ❑ The benefits for shippers deriving from the provision of services under a single pricing mechanism.
   - ❑ The eventual competitive advantage obtained by the provision of services under a single pricing mechanism to a shipping line in the ocean transportation market.
   - ❑ How bundling might affect competition among shipping lines.
   - ❑ How bundling might affect competition between shipping lines and freight forwarders.
   - ❑ Other (specify).

Appendix 2 – Selected Interview Reports

Interview 1 – October 2nd, 2006

Interviewer: Can you briefly define the logistics strategy of your company?

Interviewee: OK, the logistics strategy of [...]?

Interviewer: Yes.

Interviewee: [...] is quite a versatile company, it operates in various parts of shipping, various in terms of bulk, car carrier, liner shipping and then also it has recently bought […], a freight airline. It has a forwarding division, […] and it also has a logistics division, [...] Logistics. The logistics division, unlike other carriers, was not an extension of the liner, but actually a self standing logistics division, mainly to look after some of the Japanese customers who were getting into big foreign direct investments, so, for instance the logistics in Europe really stepped up in the mid-eighties, when quite a few Japanese companies were investing in assembling in Europe, and didn't prefer to use the local logistics providers so [...] bought one or two companies and started operating from there. So nowadays logistics for [...] is quite a wide spread series of activities from warehousing to distribution, forwarding, supply chain sections, so it is quite wide spread. I think it is recognised by the industry as something not being a liner extension, but as being a business in its own right.

Interviewer: OK, thank you. The second question that I have deals with a set of statements and I would like to ask you if you strongly agree, just agree, disagree or strongly disagree with the statement, or if you do not wish to express any judgment on it.

Interviewee: OK

Interviewer: The first statement is: 'Strategically our company considers logistics as important as ocean transportation'.
Interviewee: True. Agree.
Interviewer: Agree or fully agree?
Interviewee: Fully agree.
Interviewer: The second statement is: 'Logistics is strategically important for our company but in the end our core business is ocean transportation'.
Interviewee: Disagree.
Interviewer: The third statement is: 'The major reason for which we have stepped into logistics is because margins in ocean transportation are too small'.
Interviewee: Disagree.
Interviewer: the fourth statement is: 'Competition in the logistics business is more intense than in ocean transportation'.
Interviewee: Disagree.
Interviewer: The fifth statement is: 'Our only interest in logistics lies with its provision in conjunction with ocean transportation'.
Interviewee: Disagree.
Interviewer: The next statement is: 'Our company aims at becoming a fully integrated logistics operator'.
Interviewee: Fully agree.
Interviewer: The last statement is: 'Our company aims at being in the forefront in the provision of logistics services'.
Interviewee: Fully agree.
Interviewer: Do you have any comments on some of the previous statements?
Interviewee: No, I… hopefully in my previous remarks I hope it becomes clear that [...] Logistics is not a sort of a product extension of [...] line, it was set up as a separate division.
Interviewer: OK.
Interviewee: The only thing I would like to add is that one of the reasons it was set up is, although the returns in logistics, in terms of returns on capital employed, are not particularly high, they tend to be steadier, than those particularly in the container liner industry. And I think that it was felt that [...] wanted to increase its amount of revenues in the sort of businesses that had a very steady cash flow and income to offset the fluctuations of the liner business. That's part of this construction.
Interviewer: OK. I move to the third question, that is if you could you provide a rough breakdown of your liner and logistics costs and revenues? for example 80% liner and 20% logistics as far as costs and as far as revenues are concerned.
Interviewee: Well, I do not know in terms of costs, but certainly in terms of revenues, liner is about, of the total company, liner is bout 35 and logistics is about 30.

Interviewer: Are you planning to change this ratio in order to favour logistics through investments in other logistics activities? To increase the logistics side of the business I mean.

Interviewee: I don't … not necessarily, [...] is also investing heavily in liner as well as in logistics, so, I have a thought that that ratio will probably be maintained.

Interviewer: How many components such as warehousing, tracking, RFID, etc, does one have in a door-to-door supply chain in your view?

Interviewee: I don't think you could describe the number, but, out of though, probably more than ten in an average transaction. But all our customers are different in somewhat additional features rather.

Interviewer: OK. The next question is: Does your company provide all inclusive packages to customers? that means: Does it organise door-to-door transportation for at least one of its customers under a single all-inclusive price? If so can you mention what percentage of your port to port business is also door-to-door?

Interviewee: Right. Those are two really different aspects, one is the company where we do the complete supply chain, including warehousing and things like that, I will tell you the just the difference between businesses… hum, can we came back to the fist part of the question?

Interviewer: Yes. If your company provides all inclusive packages to customers, or in other words if it organises door to door transportation for at least one of its customers under a single all-inclusive price.

Interviewee: Right. Yes it does that.

Interviewer: OK. And the second part is: if it does that, what percentage of your port to port business is also door to door?

Interviewee: OK, I would say probably about 20%. It varies from region to region. Like in the UK is approximately 50%, in Scandinavia also just about 50, in the Mediterranean, no more than 10%.

Interviewer: Do you have an idea of the ratios in Asia for example, or in other parts of the world?

Interviewee: Hum, no, I think I'd have to guess.

Interviewer: OK. Let's move on to another question then: 'If we define bundling as the provision of ocean transportation together with one or more logistics services under a single tariff, why might bundling be an attractive proposition?

Interviewee: To the carrier or to the customer?

Interviewer: To the carrier.

Interviewee: To the carrier?

Interviewer: To the carrier and also to the customer if you want to add anything.

Interviewee: To the carrier, I think bundling is interesting because it allows to have a deeper relation with the customer, that is, I suppose if a customer is treated under a logistics contract, it is more likely to give us a multi-year agreement, as opposed to a purely sea freight agreement, that frankly, if you get a one-year contract you'd be lucky. So it gives longevity to the relationship. So from the customer point of view it means you don't have to coordinate so much of your transport activity, than you would have with separate transport providers, obviously with the necessary safe cards.

Interviewer: What are the difficulties you face in trying to sell bundled products?

Interviewee: [...] is known as a logistics provider and it is also known as a liner company, and I think there is a difficulty in selling bundled products in whether we would provide neutrality in terms of choosing the best carrier, alternative when we recommend [...] Logistics for warehousing to our carrier customers, again they want to be sure that we have researched the market and provide in fact the best opportunity.

Interviewer: Are your competitors better or worse in providing bundled products and in selling them?

Interviewee: I think one or two of our competitors have specific products which do involve some bundling that they sell, but… they tend to be quite rigid in terms of what they offer, so that they cannot be altered or changed. What we would say, it that we can work from scratch with our customers, because we can provide a large set of products that we can bundle, so we can give our customers more flexibility.

Interviewer: I move to the following question. Which of the following logistics services provided by your company is priced jointly with ocean transportation? Can you indicate on a scale from 0 to 5, where zero means never and five means always, how often does this occur? Ok the service I mention is Terminal Handling.

Interviewee: I would say a two.

Interviewer: then I have warehousing.

Interviewee: I would say zero.

Interviewer: Stripping/stuffing containers and cargo consolidation.

Interviewee: Two, no sorry, that's a one.

Interviewer: Container services (fumigation, maintenance, repairs, etc) ?

Interviewee: Zero.

Interviewer: Container logistics?

Interviewee: You mean trucking and so on?

Interviewer: Exactly.

Interviewee: Two.

Interviewer: Cargo logistics?

Interviewee: One.

Interviewer: Value added logistics services, like labelling, packaging, etc.?

Interviewee: One.

Interviewer: Hinterland transportation?

Interviewee: That would be a three.

Interviewer: Are there any important services or activities that I did not mention and that you think should be included?

Interviewee: No I do not think so.

Interviewer: OK, then I will move to the following question. How many of the door-to-door supply chain components listed before, in your view, could be successfully bundled?

Interviewee: Terminal handling and inland transport quite effectively. Those would be certainly the main ones.

Interviewer: Which of the above components can you provide yourself and which ones do you have to outsource?

Interviewee: We can provide all of them ourselves.

Interviewer: If you have to outsource, do you do this strategically in advance, or after you have stricken a deal or a contract with a customer?

Interviewee: That does not apply; we would not be keen on offering bought in services for a bundle.

Interviewer: How do you price a bundle?

Interviewee: Taking full recognition of the costs and revenue potential for all individual elements. The intention of bundling is that this isn't a discount.

Interviewer: If we consider three services, s_1, s_2 and s_3, each one priced individually as p_1, p_2 and p_3, is the bundle price equal to $p_b=p_1+p_2+p_3$, higher or lower?

Interviewee: It is the revenue opportunity for each individual component that matters. So we would consider what it costs you and what the value for somebody else is. And normally bundling allows you to obtain the potential revenue for every component plus a margin, because of the convenience to the customer in having a single price. And you may have to take a little bit of risk on some of those components, in terms of the contractual obligations that you may have with the customer, so you would like to have a margin on top. So, all in all, the price of the bundle would be probably at the sum of the individual prices or slightly above.

Interviewer: The following question is: 'Which methods do you use to, or in other words how do you, assess your customers' willingness to pay for differentiated services?

Interviewee: Through negotiations.

Interviewer: Then I go to the last but one question. Could bundled products be developed and priced by alliance members? For instance, trucking by company X, warehousing by company Y, liner by company Z and the bundle sold by all at the same price?

Interviewee: I suspect that's illegal, but we wouldn't want to do it anyway.

Interviewer: Why not?

Interviewee: Well, I think it may be illegal because within a consortium you are not supposed to do single pricing. Normally we would prefer providing the bundle ourselves, if, you say we are in a strategic alliance with someone in a different field in order to put together our product and their product, then possibly. But we would then not be supposed to know the figure at which we would be selling them, and not both sell them at the same price. Because then you would get into price competition.

Interviewer: OK. Then I would move to the last question. I will read you a set of topics and I would like to ask you which one of the following topics you think would require a better understanding from an academic point of view.

Interviewee: OK.

Interviewer: The role that logistics may play in granting shipping lines a better control of demand for ocean transportation.

Interviewee: Yes.

Interviewer: The way in which the provision of logistics services jointly with ocean transportation may increase profitability in the liner business.

Interviewee: Yes.

Interviewer: The reasons for which shippers are reluctant to accept all-inclusive pricing mechanisms that include ocean transportation.

Interviewee: Also yes.

Interviewer: The identification, from an operational and marketing point of view, of better mixes of services that would suit shippers better.

Interviewee: Yes.

Interviewer: The competitive advantage that the provision of ocean transportation jointly with logistics services might grant to shipping lines.

Interviewee: Yes, that is important.

Interviewer: The way in which the provision of ocean transportation jointly with logistics services might be affected by the geographical differences in the logistics markets of the world.

Interviewee: Yes that's also very important.

Interviewer: The benefits for shipping lines deriving from the provision of services under a single pricing mechanism.

Interviewee: Yes.

Interviewer: The benefits for shippers deriving from the provision of services under a single pricing mechanism.

Interviewee: Yes

Interviewer: The eventual competitive advantage obtained by the provision of services under a single pricing mechanism to a shipping line in the ocean transportation market.

Interviewee: Yes.

Interviewer: How bundling might affect competition among shipping lines.

Interviewee: Yes.

Interviewer: How bundling might affect competition between shipping lines and freight forwarders.
Interviewee: Yes.
Interviewer: Do you have any other topics that I have not mentioned that you think might be interesting to be further analysed from an academic point of view?
Interviewee: Well, no, I cannot think of any at the moment.
Interviewer: Is there anything you would like to comment on the interview that we had?
Interviewee: No, that's fine.
Interviewer: OK. Thank you very much.

Interview 2 (Report) – October 5th, 2006.

Introduction

After a brief introduction on the objectives of the study and the aim of the interview, it is agreed to proceed with the discussion of the major points of the interview guidelines. It is made clear by the interviewees that the questionnaire presented is not appropriate to an interview with a Logistics provider or a 3PL. It is explained to the interviewees that the focus of the project is bundling of logistics services with ocean transportation, and that the idea behind an interview with them was to obtain better insight to the meaning of bundling from a 3PL provider.

The nature of the business

It is clarified by the interviewees that [...] is an independent 3PL and as such it is not required to combine its logistics services with ocean transportation, and nonetheless with ocean transportation provided by the liner company within the group. The interviewees explain that in the view of a logistics provider ocean transportation is just another logistics service, and it might well be that in some cases to some customers the do not arrange for it. It is also specified that [...] when arranging for transportation that involves ocean transportation does not necessarily uses the liner company within the group. What the two companies have in common is the fact that they are part of a group, but cooperation and the provision of joint services, although encouraged, is not a necessary condition for the provision of services for both the companies. In other words, [...] may make use of ocean transport services provided by other lines and the liner company may make use of 3PL services provided by companies other than [...].

Customers' preference

The choice of using one line, in place of another, is generally determined by the preference of the shipper. [...] may choose to use the liner within our group or some other liner operator but sometimes shippers may have specific requirements as to which liner operator is used.

Customers' preferences are also important in the choice of the way bundles are marketed and proposed. If it is true that in general the provision of a bundle of services, may grant the shipper a lower price, it is also true that very few shippers entrust their entire door-to-door chain to a single 3PL. This, as it is clarified later in the interview, is a result of the attempt of shippers to reduce the exposure to risk of their supply chain, and originates from the geographical and physical differences inherent to the supply chain of different good in different regions of the world. [...] is nevertheless able to provide full door-to-door logistics, and it des it for a very limited number of customers.

Bundling Pricing

The way a bundle is priced to the shipper is also a matter of customer preferences. If a shipper allows [...] to provide a set of logistics services (that may or may not include ocean transportation, but that generally includes at least a form of international transportation either by sea, air or land) under a single price, most likely this price will be lower than the sum of the prices of the individual services. This is the result of the opportunity that is given by a bundle to play with profit margins and the advantages obtainable from lower costs and better coordination. If the shipper requires it, it is possible to break down the price for the various components, which would be most likely lower for every component of the stand-alone price. This of course under the condition that the components are not sold separately.

An additional point worth noting is that certain bundles may rise invoicing problems and internal accountability problems.

Economies or diseconomies of scope?

From the interview it is asked whether the cost of providing the various services may increase due to the obligation of bundling. In the opinion of the interviewee this would not be the case, and he can think mostly of cases where the costs might be reduced. When asked though, he acknowledges the possibility of certain bundles to cost more that the linear sum of their stand alone costs. In the end are the savings for shippers arising from reduced transaction costs that make such bundles viable business propositions. If these savings are not present, how would one try to rationalize the existence of such bundles? In exceptional cases, the characteristics of the supply chain, in terms of cargo, geography and time sensitivity may allow for such "uneconomical" bundles to be provided and bought.

An example of the reduction of costs obtainable through bundling is the possibility to top up a container with other cargo, and thus reduce the shipment costs. Another example of reduction in costs comes from combining the delivery with the repositioning of an empty container. If a customer requires the delivery of an empty, this may facilitate repositioning containers for another customer.

Policy issues

Some of those cost reduction effects seem though to be constrained at times by government policy. The transhipment status of a container, as instance, does not allow a logistics operator to perform any type of operation with the cargo of the container outside the port area. This means that the container cannot be brought outside of the port, and this brings the additional problem of custom procedures etc, that generate costs that are higher than the savings obtainable by the better use of the capacity of the container. It is asked if there might be other circumstances or other issues where policy is a hindrance to the better exploitation of the advantages obtainable from the bundling of services.

Definition of the spectrum of logistics services

The possibility to reduce costs and identify profitable bundles seems to boil down to the characteristics of logistics service. Those characteristics depend mostly on the supply chain characteristics, the product that is transported and the geography of the departure and destination as well as the modality used for transportation. Another point is risen referring to the basic consolidation, i.e. some services, e.g. invoicing, or custom clearance, are automatically bundled, e.g. with transportation or terminal handling. The occurrence of basic consolidation is generally a result of local practice, geographical differences in the preferences of shippers, legal framework, the trade lines and the characteristics of the cargo.

Feasible and infeasible bundles including ocean transportation

From the point of view of the interviewees ocean transportation is successfully bundled with, terminal handling, container services and often hinterland transportation and container logistics, depending on the location (for example it is common practice for shipping lines to provide city-to-city rates in the US). Other services such as stripping and stuffing of containers and cargo consolidation (that traditionally was done by the line) and warehousing, etc, are most of the time done by the logistics operator, and not by the line. Cargo logistics and value added logistics do not seem to fall within the scope of the bundling with ocean transportation.

In what circumstances to outsource?

The company interviewed takes the decision to outsource services to other companies on the basis of the requests of the customers. The decision to provide certain services in specific areas of the world is a strategic decision that is made after careful evaluation of the following factors, among others: the knowledge of the area, the business environment, the demand from the shippers from the area. So for those services that are likely to be demanded, the general attempt is to secure facilities in advance, while for those services in areas that are more exceptional local suppliers may be selected.

The assessment of the preferences of the shipper
The preferences of a shipper for bundled or not bundled services are generally assessed during the negotiation phase. Apart from market analysis then, the interest of the shipper is assessed on the basis of the requests he makes. In general smaller shippers will have a preference for bundled products (all inclusive door to door supply chain solutions), while the larger shippers may balance several logistics service providers in various parts of the world on the basis of the type of cargo, the preferences of the other parties involved (suppliers, retailers) and the location.

Conclusion
From the interview emerged that bundling is a common practice for the company interviewed, as this is the essence of the activity of a third party logistics provider, even if not to the degree of providing fully integrated door-to-door services for all customers. The major driver in this case is the demand from the customers that set the way prices are proposed to them and the various services bundled. There seems to be very much scope for bundling in the 3PL market.

Interview 3 – October 7th, 2006
Interviewer: Can you briefly define the logistics strategy of your company?
Interviewee: We say we want to provide a variety of shipping services, and this has to be interpreted in the sense that we remain a shipping company and the core of our business is shipping at the moment. Logistics is defined in a way to support shipping. That's the definition of logistics in our company. If we go through question two then, I think this would help more to define what the definition of logistics for us is. The first statement was: 'Strategically our company considers logistics as important as ocean transportation'. And we do not disagree with this, in the sense that we believe that logistics is an important part of our business in supporting shipping that is our core business. So I agree to the first statement. But when I move to statement two that says: 'Logistics is strategically important for our company but in the end our core business is ocean transportation'. Well with this we strongly agree. This statement clearly states the direction in which we are going.
Interviewer: Just as a specification, then, there is no company that is providing third party logistics services to [...].
Interviewee: There are many!
Interviewer: Also as part of the [...] group?

Interviewee: We have companies within the group, such as [...] Logistics, that have a wide spread network, and we closely work with [...] Logistics, and of course their mission is to maximise their profit and increase, what they call their shareholders wealth, and this is surely the objective of [...] Logistics, but when it comes to cooperation between the logistics company and the shipping company, especially within the [...] group, we think shipping is more important, and the logistics activity are there to support the shipping activities within the group.

Interviewer: Ok thank you, we can move then to the thirst statement, that is: 'The major reason for which we have stepped into logistics is because margins in ocean transportation are too small'.

Interviewee: I think, it depends, I do not agree with this statement, because I cannot say that the margins in ocean transportation are too small, this is not correct to my belief. Because margins in ocean transportation in the last three, four years are very good! But if you take the average for ten years or twenty years, I think the margins in ocean transportation, I would not say too small, I think they are fair, mostly because of the cycles in the business.

Interviewer: Maybe logistics is more stable.

Interviewee: yes, with that I agree, logistics tends to be more stable. That means that if you diversify into logistics, this means that there is an influence in your profits and losses that will have a stabilising effect on your profits and losses. Because the profitability in ocean transportation goes up and down, up and down drastically, diversification into logistics gives a stabilisation of those ups and downs, smoothing the transition in the profitability. That effect we expect from the logistics business.

Interviewer: Thank you. The fourth statement is: 'Competition in the logistics business is more intense than in ocean transportation'.

Interviewee: Yes, I think there are more players in the logistics field than in ocean transportation. But remember the number of players in ocean transportation is very limited, because it is a very capital intensive industry. But the logistics is much less capital intensive, you can start with a telephone and some paper, and some PCs you need these days. It is a much less capital intensive business, and in that sense everybody can start a logistics business. In the end the entry barriers in the logistics business are very low, while in ocean transportation, entry barriers are very high.

Interviewer: Statement E is: 'Our only interest in logistics lies with its provision in conjunction with ocean transportation'.

Interviewee: Oh, yes with this we agree, but not only in conjunction with ocean transportation, because the logistics business in our group is not treated as a cost centre, but as a profit centre, so they have to try to make profits for themselves, not only to support ocean transportation but also to make their own business, and deliver profits to their share holders. That is another mission we have. But from the liner prospective, logistics is more to be seen as a supporting business.

Interviewer: When you mention that logistics activities are not run as cost centres, are you referring to logistics activities perfumed within the liner or are you referring to the separate third party logistics operator within the [...] group?

Interviewee: When we come to [...], we have separate companies, so logistics is done only within the logistics company.

Interviewer: So the liner company only performs port to port transportation?

Interviewee: We do carriers haulage and feeder.

Interviewer: So the liner company does not, for example delivers containers to an inland location, and this is done by the liner company, without the intervention of the logistics company.

Interviewee: Oh, yes, this is possible. If the container is discharged in Rotterdam, and goes to a Scandinavia port, for example, we arrange the feeder connection, and as well, if the container is going to Düsseldorf by truck, and the carrier has been asked to deliver the container to the final destination, then we would arrange. By truck or rail or another mode, but that's all we would do.

Interviewer: OK, thank you. The next statement is: 'Our company aims at becoming a fully integrated logistics operator'.

Interviewee: No, I disagree. Our mission is still, as I said, of a shipping company, a global strong shipping company, not a logistics company.

Interviewer: Then statement G is: 'Our company aims at being in the forefront in the provision of logistics services'.

Interviewee: No, as I said in the previous question, we are not aiming at becoming a fully integrated logistics service provides, we are aiming at a global strong shipping company which can provide a variety of shipping services, so I do not think we are aiming at being the frontrunners in the provision of logistics services.

Interviewer: Do you have any comments on some of the previous statements?

Interviewee: I think question one and two are totally related, so by answering question two in all the points you should have a clear definition of our logistics strategy.

Interviewer: OK. Then I move to question number three, that is if you could you provide a rough breakdown of your liner and logistics costs and revenues?

Interviewee: Yes, well, liner is – forget about the unit of measurement, dollars or yen, does not matter – liner is about 4000, and logistics is around 600. I think you can see the portion, right? Liner is about 4000 and logistics is 600. If you divide 4000 on 4600, you have 87%. So 87% liner and 13% logistics.

Interviewer: And this is revenues, I suppose.

Interviewee: Yes, revenues.

Interviewer: Is your company planning to change this ratio in order to favour logistics through investments in warehousing and other logistics activities?

Interviewee: I think it is not the ratios we are focussing on, we are focussing on expanding our total revenue, so if by increasing the warehousing activity, for example, we accelerate our revenue increase then we would do so. But I do not think, you know, the expansion in trucking, warehousing and so on, I do not think this would bring an increase in revenues in the liner and logistics as a total. So I think, that, you know, this is a good question, we are not so much concerned with the ratios, but if a customer comes to us and says ok, I want to use [...] from Europe to Japan, but please provide warehousing service in Europe and also trucking, etc, and then we will use [...] as a total carrier, then we would do so. We would combine our services and try to offer a package to our customer. But that's not because we wanted to increase the ratio, but because we wanted to increase the revenue.

Interviewer: Ok, how many components does one have in a door-to-door supply chain in your opinion?

Interviewee: I think we are not very big in the logistics services, but we have all components. For example if the container is discharged in Rotterdam, we can make custom clearance, transport the container, we can empty the container and take the cargo within the container, we can store the cargo, we can order-pick it, we can assemble it, we can control with radio frequencies, perform inventory control, we can send smaller pieces to the final destination and the consumers as well. Although our activities are very small, we have all these capabilities.

Interviewer: This would be done by [...] Logistics I suppose, not by the liner.

Interviewee: Yes, these activities would be passed to [...] Logistics.

Interviewer: Does your company provide all inclusive packages to customers? that is if it does it organise door-to-door transportation for at least one of its customers under a single all-inclusive price?

Interviewee: Yes we do this. But I think when you say door-to-door, you should be careful. Because door-to-door has two meanings, in ocean transportation, door-to-door means to transport containers from a warehouse door to a warehouse door. But from a supply chain perspective, this is from the door of the producer or even of the supplier of raw materials to the door of the consumer. So the scope is much bigger. And if you ask our liner division, if we have door-to-door services, yes we do. For a container, that's also possible. But if you ask our logistics division, can you do door-to-door, that means the door of the factory that produces the product to the door of the consumer or the distribution warehouse, that is a larger scope, and as I said in question five we do have all the elements to provide services from the door-to-door in the larger sense. And we are charging sometimes all inclusive rates, which is based on the revenue of the customer. That means it is not divided into trucking, customs clearance, storage, packing, small parcel delivery, not those components separately. We are charging, let's say, two percent, three percent of the total revenue of the customer, something like that. In this case it is better to charge a single all inclusive price, instead of charging for every single segment of the chain separately, or each sub-chain within the supply chain.

Interviewer: OK, and if you had to give a percentage, what percentage of your port to port business is also door to door?

Interviewee: It depends, I think it really depends, if we are dealing with a kind of very inexpensive retailer shop, which sells very cheap goods, the percentage is very small. But if they are very valuable goods, like medical appliances and high value machineries, this percentage is high. But we do not charge twenty or thirty percent, this percentage is only a one digit percentage.

Interviewer: OK. I move to question seven: 'If we define bundling as the provision of ocean transportation together with one or more logistics services under a single tariff, why might bundling be an attractive proposition?

Interviewee: I think it is, it is a very attractive proposition, especially for customers who want a one stop shopping option. This happens when a customer does not want to speak to a shipping company and a trucking company and a customs broker and a warehousing company, and they want one person to whom they can speak, one person that can arrange all kind of transportation from point A to point B in the most efficient way. If we can sell the services like, as I said, a percentage of the first turn over, or so, than I think it would be a very attractive proposition for many customers. But in the meantime, we have also to bear in mind that some customers do not prefer that. They want a strong control on each leg of the transportation, like from port to port they have a service contract, and they really like to negotiate it with the shipping company because their volumes are so large, and also they want to have separate negotiation with the warehouse company because they require so large warehouses, etc. So I think in the end it depends on the volumes and the type of strategy each customer has in their supply chain. Currently, especially middle size and small size customers, they do not want to have to call five persons to arrange the transportation from A to B. They only make one call, and transportation from A to B is done. I think that is the best way, and that's why bundling is a very attractive proposition.

Interviewer: So it depends mostly on the type of customers, and it depends also on the volumes transported?

Interviewee: Yes, definitely.

Interviewer: Ok, and let's suppose we are considering customers who might be interested in bundling, what are then the difficulties – and I move to question eight – that you face in trying to sell bundled products?

Interviewee: Bundle services sometimes should be provided on a global scale. I do not think for a customer to say we need a bundles service for the USA, but not for Europe. Or I want a very seamless service to Asia, but I do not need such a seamless service to India, for example. That would be very inefficient and inconsistent. So I think when we sell bundled products, I think we need a global network. One stop shopping needs to be based on a global network, requires establishing a global network, and this is very difficult. Every forwarder is striving to do so at this moment.

Interviewer: Do you think that your competitors are better or worse in providing bundled products and in selling them?

Interviewee: Oh, they are much better I think! Maersk Line, APL … Maersk and Mearsk Logistics work very closely, and they are very good at selling bundled products. And APL and APL Logistics also. NYK and NYK Logistics also. When it comes to [...], I think we are not so god at selling bundles, because the one thing… the philosophy – and again we come to question one – behind logistics is that it is a supporting function for us, a complementary function.

Interviewer: Thanks, I will move then to question ten, I will read a list of several components in a logistics chain and then I will ask you which of the each of the logistics services provided by your company is priced jointly with ocean transportation and how often? so zero if they are never priced jointly with ocean transportation and five if they are always priced jointly.

Interviewee: Ok

Interviewer: Terminal Handling Charges?

Interviewee: Yes, THC is always charged by the ocean transportation company. We always do. As well as CAF and BAF, currency adjustment factors and bunker adjustment factors.

Interviewer: Warehousing?

Interviewee: Only upon request. So no more than a one or two, a one maybe. If a customer asks, do you know a good warehousing company in, let's say Rotterdam, then I would introduce them to [...] Logistics. But if they ask, can you suggest a good warehouse somewhere in Africa, then we have no idea at all.

Interviewer: Stripping/stuffing containers and cargo consolidation services?

Interviewee: Yes, if we are asked, we provide consolidations services within our group. So we would introduce our consolidation service division to the customer. These days, the customers that might require cargo consolidation and customers who do not require cargo consolidation are clear, and the markets are very different. Our cargo consolidation service company goes to the cargo consolidation services market. If you look at the transpacific business, Wal-Mart is the largest company that needs consolidation. Kmart, you know, those kinds of retailers are buying from thousands of vendors in China, and so they need to consolidate their cargo. So we know who needs consolidation. Going back to the question I think a shipping line is rarely asked to provide cargo consolidation, they would go directly to a consolidation company. So in this case it is probably a one or even a zero.

Interviewer: Container services (fumigation, maintenance, repairs, etc)?

Interviewee: Yes, this we will do. We will always fumigate the containers, maintenance and repairs, yes, of course we will do. Because the container itself, the equipment, belongs to us. Se we need to perform maintenance, repairs, etc., yes.

Interviewer: Container logistics?

Interviewee: Container logistics, I think, meaning rail, truck, transport of containers in general, right?

Interviewer: Yes.

Interviewee: Well also in this case if we are asked by the customer, from a port to an inland location, then we would do. Only upon request.

Interviewer: So maybe something more than a one, a two?

Interviewee: No, more. Two, three.

Interviewer: If we consider cargo logistics?

Interviewee: What do you mean by cargo logistics?

Interviewer: The logistics of the cargo inside the container.

Interviewee: Ok, so the larger scope of the door-to-door, right? I think this will be done by the logistics division within the group. And I think this would be charged separately. So considering the liner, this is a zero.

Interviewer: Value added logistics services, like labelling, packaging, etc.?

Interviewee: The same. Those customers will not go to a ocean transportation company but to a logistics company.

Interviewer: Hinterland transportation?

Interviewee: Hinterland transportation of the container by truck can be arranged by us, of course. As I already said in general the container logistics. Door-to-door in container transportation can also be arranged, but door-to-door in the case of the retailer and consumer will be done by the logistics company.

Interviewer: Do you think there any other important logistics that are done by the liner that should be included in this list?

Interviewee: I think the payment of custom duties, on behalf of the shipping consignee. This is also a service that the shipping line is doing whenever necessary. Yes, customs clearance is one of the things, so the liner company pays those duties on behalf of the shipper or the consignee. And inventory control also. It is very important because the consignee always want to see where is the cargo, how much is in storage, etc.

Interviewer: OK, and in these cases custom clearance is done also very often by the shipping line, or not?

Interviewee: No, no, as a shipping line we do not do that. That would be done by the logistics company.

Interviewer: And the same holds for the inventory control, right?

Interviewee: Yes, exactly.

Interviewer: How many of the door-to-door supply chain components listed before, in your view, could be successfully bundled?

Interviewee: I think again it depends on the type of commodity. If we are talking about the retailer business, I think, when you go to retail shops, there is a large number of products that are made in China where there are many small vendors, so the retailer in Europe or in the USA, when they buy in China, have to collect all the products from thousands of places in China. In this sense, then, consolidation, but also bundle together logistics services can be very effective, because they need it. But when you come, for example to the automotive industry, the supply chain is close to the factory, with just in time deliveries, etc… and that is separated from the ocean transportation, and also at the factory side, before the products reach the factory, there is another logistics chain. So the logistics is very different, as it cannot be a total integrated logistics chain. You have origin logistics, container logistics and the logistics at the destination. I really think it depends on the type of the commodity, and on the industry in the end. But all industries are becoming increasingly interested in one-stop services. So there is a general trend towards putting together as many components as possible, and trying to bundle them together.

Interviewer: Ok, you have already answered question twelve in the answer to the previous question, so I move to question thirteen, that is : 'If you have to outsource, do you do this strategically in advance, or after you have stricken a deal or a contract with a customer?'. And then I think it may be useful in this case to distinguish between the services provided within the liner company and the services provided by the logistics operator.

Interviewee: OK, I think in the liner business it is clear generally what we need to outsource. We have been doing this for hundred years, and of course every year the economic situation changes, but we know how many containers we need to move from A to B, from Rotterdam to Gothenburg, Rotterdam to Hamburg, so we know what to outsource in advance: trucking services, feeder services, rail services necessary to move all our containers. Based on the volumes and the discounts we can obtain, we will strategically decide which provider to use. But for the logistics part, I think, that mostly they will negotiate and outsource in advance, but for value added service which is not requested regularly, or services that are requested ad hoc, or with very high standards value added services, they have to provide them themselves, and they cannot outsource them in advance.

Interviewer: How would the price of a bundle be set?

Interviewee: I think the easiest way is to base the price on a win-win scenario, where we share the cost savings between the customer, the carrier and the other logistics service provider. I think that would be the best way. I would not say, one parcel one dollar or so, but the total logistics cost savings deriving from combining the logistics services can be shared between the cargo owner and the logistics service provider. That is, I think, the ideal way, but it is not done in such a way. But if you ask me how do I price such bundles of services, then the savings sharing, is in my view the best way. So if I look at question fifteen, if we consider three services, s_1, s_2 and s_3, each one priced individually as p_1, p_2 and p_3, the bundle price is <u>not</u> equal to the sum of the three prices, but much, much lower. That's why, you know, the single service provider of s_1, s_2 and s_3 individually, cannot compete with the comprehensive service provider. If I can only do s_1, and someone can do s_1, s_2 and s_3, and they provide them all together, I will be never able to compete on the bundle. And I think that is the strategy behind many shipping companies going logistics.

Interviewer: Do you think that the combination of some of the logistics services with ocean transportation may actually increase the cost of the provision of the two services, because for example the coordination that is necessary, etc. do you think this might be a case? Or the fact putting together two services will always reduce the overall cost of producing them?

Interviewee: I think if you combine the services, is not done manually, this is done by computer and many companies are providing seamless services, what we call a 'glass pipeline'. You can see the pipeline, because it is made of glass, you can see inside, and you can easily see with the help of the computer, where is your cargo now. Is it at the port? Is it in the warehouse? Has it already been loaded on a vessel? Is it sailing? That pipeline inventory, the seamless service of course it increases the development costs, the initial costs, but once this product has been developed, I do not think that combining services would lead to a cost increase. Once you have a good system, a good tool, then combination of services, does not lead to an increase in costs. That's what I believe.

Interviewer: Ok, then I move to the following question, that is: 'Which methods do you use to assess your customers' willingness to pay for differentiated services?'.

Interviewee: IT, definitely, that's IT. The pipeline inventory, as I said, or visible inventory systems that customers can access from the internet and see any time, anywhere in the world, where the cargo is and how many inventories they have. And we know that a customer will be willing to pay more for such services.

Interviewer: So it will depend on what a current customer asks you, in a way. In this way you can assess what their needs are.

Interviewee: Yes, that's also, yes.

Interviewer: Then we move to the next question. Could bundled products be developed and priced by alliance members? So for example, trucking by company X, warehousing by company Y, liner by company Z and the bundle sold by all companies at the same price?

Interviewee: I think it is difficult in two ways, for two reasons. The first reason is: within the alliance, whatever alliance, they have different customer profiles. APL is good at American customers, Hapag-Lloyd is good with the German automotive industry, China Shipping is very strong at Chinese customers and they are selling at all different prices, I think it is difficult because the members of the alliance have strengths in all different fields, different from the other members. So I think it is difficult to combine the prices, and sell a bundle at the same prices.

Interviewer: This means they would have to share information on certain customers, and maybe those customers with which they are strong.

Interviewee: Yes, that's right. And the second reason is that you may know that the EU, last week, repealed the block exemption for shipping conferences. You know that shipping conferences were exempted form antitrust law, but now they are not allowed anymore in Europe. In America, I think because of the Shipping Act in the nineties, there are no conferences anymore, and so also Europe has abolished the conference exemption. So fixing prices among the lines and adjusting the space capacity plans for the future will not be allowed anymore. So for these two reasons, a marketing reason and a regulation reason, I think it is difficult to sell a similar service at the same price.

Interviewer: OK, thank you, and I just have the last question. I would like to ask, which one of the following topics you think would require a better understanding from an academic point of view.

Interviewee: Yes, the interesting point is as I said earlier, many shipping companies are going logistics, APL has APL Logistics, Maersk, Maersk Logistics, OOCL, OOCL Logistics, etc, and by doing that they are expanding their scope of services, form port-to-port to warehouse-to-warehouse, and then from the factory to the retailer. And although we understand the notion behind that, we understand the way of thinking and why they are doing it – and that is why [...] is also doing the same, expanding the scope of our services beyond the traditional scope of port to port – my question is: is the way we are going profitable enough to make shipping companies survive competition in the long term? The essence of the argument is, as I said in question fifteen, s_1, s_2 and s_3, with individual prices p_1, p_2 and p_3, if services are bundled, the price will be less. And that means more competitive. Bundled services are sold more competitively than individual services. That's what I believe. But still in my company, there are not yet many people who believe this. Theoretically maybe, but practically shipping is shipping, and shipping is still profitable by itself. So I am in a dilemma, that theoretically, bundling is OK, but practically I think a shipping company has to control equipment, capacity, etc. very much oriented on the equipment side and not on the service side. Maybe many shipping companies are also increasingly focussing on services, I think of APL, Hapag-Lloyds or NYK, they are doing a similar thing, they are maximising their asset utilisation, not maximising the satisfaction of their customers, but from the logistics point, you always need to maximise the satisfaction of the customer. And these are two very contradicting approaches I think. Shipping is very much equipment oriented, Logistics is very much customer oriented. And we are combining them together, whether it is the right direction to go or not. The points you mention in your questionnaire are all interesting, but this is really the question I have.

Interviewer: Ok, then I thank you very much for your time.

Interview 4 – October 8th, 2006.

Interviewer: Can you briefly define the logistics strategy of your company?

Interviewee: Our Company operates within the Group strategy of "Differentiated Liner and Focused Logistics" By Focussed Logistics we offer 4 verticals within the Industry, - Warehouse management, Contract logistics, Consolidation services and Freight Forwarding. Commodity focus is, FMCG, Electronic goods, Auto sector and Garment Industry

Interviewer: For each of the following statements you should mention if you strongly agree, agree, disagree, strongly disagree, do not know. The first statement is: 'Strategically our company considers logistics as important as ocean transportation'.

Interviewee: Strongly agree.

Interviewer: Logistics is strategically important for our company but in the end our core business is ocean transportation.

Interviewee: Agree.

Interviewer: The major reason for which we have stepped into logistics is because margins in ocean transportation are too small.

Interviewee: Disagree.

Interviewer: Competition in the logistics business is more intense than in ocean transportation.

Interviewee: Disagree.

Interviewer: Our only interest in logistics lies with its provision in conjunction with ocean transportation.

Interviewee: Disagree.

Interviewer: Our company aims at becoming a fully integrated logistics operator.

Interviewee: Agree.

Interviewer: Our company aims at being in the forefront in the provision of logistics services.

Interviewee: Strongly agree.

Interviewer: Do you have any comments on the previous statements?

Interviewee: Logistics provision without ocean capabilities and vice versa is an outdated sales model. Our customer profile shows that both are a requirement.

Interviewer: Could you provide a rough breakdown of your liner / logistics costs and revenues?

Interviewee: 80%/20% Liner/Logistics.

Interviewer: Are you planning to change this ratio in order to favour logistics through investments in, say, warehousing, etc.?

Interviewee: Not at this time as our logistics strategy is asset light model. However the logistic revenue percentage may increase without such investments.

Interviewer: How many components (e.g. warehousing, tracking, RFID, etc.) does one have in a door-to-door supply chain?

Interviewee: Too many to mention, the basis of the complete supply chain involves vendor management, procurement, finance and physical product flow, console/deconsole, milk runs and ocean freight.

Interviewer: Does you company provide all inclusive packages to customers, i.e. does it organise door-to- door transportation for at least one of its customers under a single all-inclusive price? If so can you mention what percentage of your port to port business is also door-to-door?

Interviewee: My company does offer door/door to customers who require a single document, with the logistics arm issuing a house Bill of Lading. The ocean piece,(Port/Port) within the current door/door contracts is currently a small segment of the total port/port liner business, - I would suggest a maximum of 10%.

Interviewer: If we define bundling as the provision of ocean transportation together with one or more logistics services under a single tariff, why might bundling be an attractive proposition?

Interviewee: The attraction is not a single tariff, the attraction is more of outsourcing the transportation chain under one management, allowing the Transport department of the customer to simply issue purchase order information and sit back while the 3PL provider takes care of the rest. The overused term is a "one stop shop", but in essence it greatly simplifies the customer interaction requirements.

Interviewer: What are the difficulties you face in trying to sell bundled products?

Interviewee: Customers want to see the individual cost components, and then negotiate individually, – this is counter productive to the aim of a package. Equally customers hear "bundled services" and feel it is a one size fits all product, whereas clearly we are able to tailor make a bundled service dependant on their individual needs.

Interviewer: Are your competitors better or worse in providing bundled products and in selling them?

Interviewee: Difficult to comment on this, - we feel of course that we understand our customer needs better than most.

Interviewer: Which of the following logistics services provided by your company is priced jointly with ocean transportation? Can you indicate on a scale from 0 to 5, where 0 means never and 5 means always, how often does this occur? Terminal Handling Charges?

Interviewee: Never. A zero, the charge remains always separate.

Interviewer: Warehousing.

Interviewee: Three.

Interviewer: Stripping/stuffing containers and cargo consolidation.

Interviewee: Four.

Interviewer: Container services, such as fumigation, maintenance, repairs, etc.

Interviewee: Four.

Interviewer: Container logistics.

Interviewee: A five, always.

Interviewer: Cargo logistics.

Interviewee: Four.

Interviewer: Value added logistics services.

Interviewee: Three.

Interviewer: Hinterland transportation.

Interviewee: Four.

Interviewer: How many of the door-to-door supply chain components listed before, in your view, could be successfully bundled?

Interviewee: There is no reason why all of the elements of door/door supply chain cannot be bundled, always depending on the terms of purchase. Working to bundle across two customers, CNF, is more difficult than with one, FCA.

Interviewer: Which of the above components can you provide yourself and which ones do you have to outsource?

Interviewee: Land transportation, warehousing, and airfreight tend to be a mixture of contracting and owned dependant on geography specifications, all others are provided by the 3PL company within the group.

Interviewer: How do you price a bundle?

Interviewee: Several models, – component parts sum at cost plus, or Contribution Margin parameters, or what the market will bear. In each case minimum EBIT levels are required.

Interviewer: Which methods (how) do you use to assess your customers' willingness to pay for differentiated services?

Interviewee: Engaging the customer with his current cost of Supply Chain and breaking it down into it's component parts, will ascertain where there is low hanging opportunity, if any. The end result of the bundled service has to be either increased efficiency for customer or reduced inventory carrying cost. Provided the value our bundled service brings exceeds the cost of our offering, we can sell.

Interviewer: Could bundled products be developed and priced by alliance members? E.g. Trucking by company X, warehousing by company Y, liner by company Z and the bundle sold by all at the same price?

Interviewee: Theoretically yes, however we only need to see that alliances offering sea freight alone still compete on price, bundling would be no different, in fact it may run foul of competition laws.

Interviewer: Which of the topics listed in the interview guidelines do you think would require a better understanding from an academic point of view?

Interviewee: The way in which the provision of logistics services jointly with ocean transportation may increase profitability in the liner business; the competitive advantage that the provision of ocean transportation jointly with logistics services might grant to shipping lines; and the eventual competitive advantage obtained by the provision of services under a single pricing mechanism to a shipping line in the ocean transportation market.

EXECUTIVE SUMMARY

The thesis aims at studying the viability and the benefits of the sale of multiple services in a single package, generally referred to as *bundling*, in the container industry, and specifically with reference to the joint provision of ocean transportation and other logistics services. Bundling is a pervasive practice in most industries, but its study and application in the container industry has been rather limited, partially as the result of the very special regulatory regime that has characterised ocean transportation and partially as a consequence of the rather conservative nature of the liner industry. The involvement of liner shipping companies in the logistics sector has characterised the industry since the late eighties and is a continuing trend. The changes in regulation and market conditions, has offered liner companies the opportunity of design new and more flexible forms of non linear pricing, such as bundling, that allow for better serving customers and develop synergies.

One of the most relevant directions for analysis was the investigation of the impact of bundling on shippers and society by and large. Shippers appreciate the advantages of this business practice in terms of simplification of tariffs; easiness to compare quotes from different carriers; and the increase in the number and types of logistics solutions on offer. However the practice in the maritime sector is still looked at with diffidence. This appears to be due to the rather confrontational relationships between ocean carriers and shippers and the perception that bundled tariffs may conceal hidden mark-ups.

It should be noted in addition that, when the sale of bundled offers is combined with the sale of the individual components, under what is generally referred to as mixed bundling, it results in an increase in choice for consumers. Considerations on social welfare should then additionally be weighted against the value of increased choice and variety. Especially in the case of integrated supply chains, these benefits can be substantial. The results for society are positive, although monitoring of the practice is essential and further research in this area is imperative.

A second area of research aimed at assessing the value of bundling for carriers in terms of enhancing their competitive advantage. Among the major findings of the thesis is that bundling is in practice motivated by: cost saving advantages; demand drivers; differentiation strategy; the possibility of obtaining higher margins by jointly offering ocean and hinterland transportation; the necessity to better control coordination costs with hinterland connections. Integration seems to be the business strategy that will prevail among carriers in the long term. Bundling provides a useful aid in implementing this strategy successfully. Not all bundles are advisable though. Depending on the distribution of reservation prices among the various customer segments served by each carrier, optimal bundles are those that result from the combination of services that have asymmetric conditional reservation prices.

One of the important observations of the thesis refers to the superiority of bundling propositions that allow for exploiting consumption complementaties and cost advantages deriving for example from economies of scope or of route density. For these advantages to be identified though a focus on interfaces among the various logistics components, in particular with ocean transportation, is required. Successful implementation of bundling, in fact, requires a focus on the nature of the transactions among shippers; liner companies; and logistics service providers. Only in this way can ocean carriers develop product bundling propositions that increase the profitability of bundling and its desirability for society.

The use of transaction cost economics can be particularly valuable in the context of ocean transportation and logistics outsourcing and constitutes a solid ground on which ocean carriers can assess their willingness to engage in bundling strategies. Although bundling does not necessarily require vertical integration, when the transaction between the carrier and a logistics service provider are taken out of the market, carriers may acquire a better position to provide bundles. This happens because of their better ability to harness transaction costs and reduce the impact of information asymmetries. These *product bundles*, as explained in chapter 7, always yield better results than unbundling (proposition 3).

In order to fully appreciate the potential offered by product bundling ocean carriers should open up to the advantages offered by vertical integration. The thesis argues that for this to happen ocean carriers need to look beyond their traditional company boundaries, focusing on transcorporate performance that is characteristic of supply chains. This approach requires the modification of traditional performance measures to include also transcorporate performance indicators. This, it is argued, should not only take place at the carrier level, but also with the other members of the container supply chain, such as terminals, ports, hinterland transport providers, distributors, warehouses and third party logistics providers.

A further area of research cantered around the potential offered by bundling as a device aiming at providing carriers with some sort of strategic advantage. Although research in this area is still scant, the applicability of bundling in a competitive market may deliver interesting conclusions. In particular it emerged from the two models discussed in the thesis that bundling has mixed effects on consumer surplus and total welfare. The model adds to the discussion on the strategic dimensions of bundling decisions. This is done by evaluating the outcomes of competition in a duopoly where carriers compete on prices; can sell individual components or bundles; and both carriers and the shipper incur a cost in assembling the bundle. The most interesting finding of the thesis is that bundling allows for efficiency gains to be passed on to shippers and society, an eventuality that cannot take place when bundling is forbidden.

This desirable feature of bundling though comes at a risk since carriers may not necessarily have the highest levels of efficiency in providing the bundle. When this is the case, bundling tends to reduce consumer surplus and can even reduce social welfare. An important issue that remains open for further research is whether carriers are intrinsically better than other parties in the supply chain in providing bundles. If this is the case, competitive forces, even in the restrictive case of duopoly, ensure that this efficiency is passed on to consumers and society.

At the basis of the thesis there is the development of supply chain thinking that has characterised the transportation industry in the last three decades and the emergence of the logistics outsourcing as a significant business practice. The contribution of the thesis in this area is twofold: there is a great potential in applying yield management techniques to the supply chain and performance metric selection are a decisive factor in the success of vertical integration strategies along the chain. The area of supply chain pricing is still relatively underdeveloped and the thesis suggests that the application of the extensive toolbox of non-liner pricing developed in the industrial organisation literature may point towards new and interesting research directions.

As far as the second contribution is concerned, its starting observation is that ocean transportation is a subsystem within the supply chain and as such performance should not be limited to the evaluation of its internal processes. It is the performance of the entire chain that really matters. If the supply chain performs well, i.e. creates value, then it will be chosen and as consequence also the carrier will be chosen. As the supply chain is as strong as its weakest link, a carrier may be extremely efficient in its operations, but if terminals, or hinterland transport providers do not provide adequate levels of service, or the access roads to the port are congested, this will impact the ability of the chain to create value and in essence also the competitiveness of the carrier.

The focus on the supply chain is required also by the fact that the performance of each link is influenced by the performance of the other links. As such the performance of a liner company is affected by the performance of a terminal and in turn, the performance of the container terminal is affected, for example, by inefficient trucking, or port services. The cooperative nature of supply chains requires a different approach to performance, where, next to traditional intracompany measures, also inter-chain metrics should be monitored and analysed.

This of course raises particular challenges for supply chain operators, as cooperation among the various stakeholders becomes then a fundamental prerequisite for the implementation of efficient supply chain strategies. From the side of the carriers, in particular of those that choose to provide third party logistics services, investment in ICT and in improving supply chain visibility should be on top of their development strategies. But this of course cannot and should not be done independently.

A final area of investigation relates to government intervention in regulating bundling in the container industry. Although mixed bundling is a practice that is always permitted under antitrust regulation for companies with no or limited market power, there is no complete legal accordance on the issue.

The thesis reviewed the regulation in the USA and Europe and observed that the practice of bundling is not illegal in neither jurisdiction as long as (i) services are priced within the instrument of confidential service contracts, i.e. not as part of conference rate-fixing agreements, (ii) a service bundle is not provided exclusively, i.e. the shipper has always the possibility of purchasing the various bundle components independently, (iii) inland service rates and specifications are not negotiated jointly by carriers as a consortium, (iv) the 'not below cost rule' is respected for those trades where conference tariffs are applicable (v) in trades to and from the EU, no use is made of discussion agreements.

These provisions allow for the use of bundling strategies in all other circumstances and therefore the development of these strategies is strongly advised. The thesis argues also that the repeal of the Council Regulation 4056/86 will favour the development of bundling strategies and that ocean carriers should aim at further investigating the advantages offered by this strategy. The thesis also argues that the regulator should on the contrary aim at supporting the development of inter industry bundling practices as these are bound to stimulate cooperation among supply chain partners.

The thesis is structured in eleven chapters, that analyse the various issues outlined above. Chapter one is the introduction to the thesis and outlines the relevant research and methodological issues as well as framing the thesis in the broader dialogue on bundling. This is followed by two chapters aiming at reviewing the literature on bundling and on the liner shipping industry. In doing so, the chapters not only provide a new synthesis of these research areas, but also highlight those aspects that are most relevant for the application of bundling to the liner and logistics sectors.

Chapter 4 adds the shipper dimension to the analysis. Since one of the most relevant reasons for developing bundling propositions is shippers demand, the thesis integrates shippers' perspective by reporting the results of two questionnaires on shippers preferences on outsourcing and bundling. Specularly to chapter 4, chapter 5 is an account of current business practices and the carrier's perspective on bundling. It emerges on chapter 5 that the decision of providing bundles is connected to the make or buy decision and whether bundles are better provided by a carrier that has acquired the full control of the capabilities necessary to assemble the bundle. Whether to organise the provision of a bundle through the market (outsourcing) or through hierarchies (integration) depends on the nature of the transactions involved, and is the subject of chapter 6.

This open the discussion on what approach carriers should use in order to develop optimal bundles. The thesis will suggest conjoint analysis and liner programming as the most appropriate techniques. One of the important conclusions of the thesis, as already mentioned, is the necessity of setting adequate measures that monitor the creation of supply chain value and help identify bundling opportunities. For this reason chapter 8 is dedicated to measurement and performance, with a particular focus on the interface between ocean transportation and hinterland (terminals) and a discussion on the performance measurement practices in the liner industry.

Chapter 9 and 10 are devoted to the analysis of the potential and implication of bundling as a strategic device aiming at providing carriers with better control of the market. From the two models developed and the analysis of the regulatory framework that governs the liner and logistics industry, it emerges that bundling is beneficial for society and carriers and represents an incentive for improving supply chain efficiency. Chapter 11 concludes and provides directions for further research.

NEDERLANDSE SAMENVATTING (SUMMARY IN DUTCH)

Dit proefschrift is gericht op het bestuderen van de haalbaarheid en de voordelen van de verkoop van meerdere diensten in een pakket (een praktijk algemeen aangeduid als *bundling*) in de container-industrie, en in het bijzonder met betrekking tot het gezamenlijke aanbod van vervoer over zee en andere logistieke diensten. De praktijk van het bundelen van producten is binnen de meeste industrieën wijdverbreid, maar onderzoek over de toepassing hiervan in de containersector is vrij beperkt, deels als gevolg van de zeer speciale regelgeving die vervoer over zee door de jaren heen heeft gekarakteriseerd en deels als gevolg van de tamelijk conservatieve aard van de lijnvaart industrie. De betrokkenheid van lijnvaartbedrijven in de logistieke sector heeft de sector sinds de late jaren tachtig bepaald en is een aanhoudende trend. Veranderingen in de regelgeving en de marktomstandigheden hebben lijnvaartbedrijven de mogelijkheid geboden om nieuwe en meer flexibele vormen van non-lineaire prijszetting zoals *bundling* te ontwerpen, welke een betere dienstverlening aan klanten en de ontwikkeling van synergieën mogelijk maken.

Een van de meest belangrijke conclusies van dit onderzoek komt voort uit de studie van de effecten van *bundling* op verladers en de samenleving als geheel. Verladers waarderen de voordelen van deze praktijk in termen van vereenvoudiging van de tarieven; het gemak om offerten van verschillende lijnvaartmaatschappijen te vergelijken; en de toename van het aantal en de aard van logistieke oplossingen die aangeboden kunnen worden. Maar in de maritieme sector wordt deze praktijk nog steeds met argwaan bekeken. Ogenschijnlijk wordt dit veroorzaakt door de nogal confronterende relaties die bestaat tussen lijnvaartbedrijven en verladers en de perceptie dat gebundelde tarieven verborgen prijsverhogingen kunnen omvatten.

Er dient tevens te worden opgemerkt dat als de verkoop van gebundelde aanbiedingen wordt gecombineerd met de verkoop van afzonderlijke componenten (over het algemeen aangeduid als *mixed bundling*) dit resulteert in een toename van keuzes voor consumenten. Beschouwingen over het maatschappelijk nut moet dan worden afgewogen tegen de waarde van de toegenomen keuzevrijheid en diversiteit. Vooral in het geval van geïntegreerde toevoerketens kunnen deze voordelen aanzienlijk zijn. De resultaten voor de samenleving zijn positief, hoewel toezicht op deze praktijk van essentieel belang is en verder onderzoek noodzakelijk is.

Een tweede onderzoeksgebied was gericht op het beoordelen van de waarde van *bundling* voor vervoerders in het verbeteren van hun concurrentievoordeel. De belangrijkste bevindingen van dit proefschrift zijn, dat *bundling* in de praktijk wordt ingegeven door: kostenbesparende voordelen; vraaggestuurde factoren; differentiatiestrategieën; de mogelijkheid tot het verkrijgen van hogere marges door het gezamenlijk aanbieden van vervoer over zee en naar het achterland; en de noodzaak voor een betere controle van de coördinatie kosten met betrekking tot de achterlandverbindingen. Op lange termijn lijkt integratie de strategie die binnen de rederijen zal overwinnen. *Bundling* is een nuttig hulpmiddel om deze strategie met succes uit te voeren. Maar niet alle vormen van bundels worden echter aanbevolen. Afhankelijk van de verdeling van de reserveringsprijzen tussen de verschillende klantensegmenten bediend door elke vervoerder, zijn optimale bundels die bundels die voortvloeien uit een combinatie van diensten met asymmetrische voorwaardelijke reserveringsprijzen.

Eén van de belangrijke waarnemingen van dit proefschrift heeft betrekking op de superioriteit van bundels die het mogelijk maken complementair af te stemmen op de klant en of kosten voordelen aan te bieden die voortvloeien uit bijvoorbeeld *economies of scope* of de route dichtheid. Een succesvolle implementatie van *bundling*, vereist in feite aandacht voor de aard van de transacties tussen verladers, lijnvaartbedrijven, en logistieke dienstverleners. Enkel op deze manier kunnen rederijen bundels ontwikkelen, die de winstgevendheid van *bundling* en de wenselijkheid ervan voor de samenleving vergroten.

Het gebruik van *Transaction Cost Economics* kan bijzonder waardevol zijn in het kader van het vervoer over zee en de logistieke uitbesteding en vormt een solide basis waarop lijnvaartmaatschappijen hun bereidheid tot bundelstrategieën kunnen beoordelen. Hoewel *bundling* niet per se verticale integratie nodig heeft, zullen rederijen in een betere positie zijn om bundels aan te bieden, als de transacties tussen de rederijen en de logistieke dienstverleners niet langer deel uitmaken van de waardeketen. Op deze manier zijn zij beter in staat om transactiekosten te beheersen en de impact van informatie asymmetrie te verminderen. Dergelijke bundels van producten, zoals uitgelegd in hoofdstuk 7, brengen altijd betere resultaten dan losse producten (stelling 3).

Om ten volle de mogelijkheden van het bundelen van logistieke diensten te waarderen, moeten rederijen zich openstellen voor de voordelen van verticale integratie. Het proefschrift betoogt dat om dit te laten gebeuren, rederijen verder moeten kijken dan hun traditionele bedrijfsgrenzen, door nadruk te leggen op intersectorale prestaties kenmerkend voor toevoerketens. Deze benadering vereist dat binnen de traditionele prestatie-indicatoren ook intersectorale prestatie-indicatoren worden opgenomen. Dit, zo wordt gesteld, moet niet alleen plaatsvinden op het niveau van de vervoerder, maar ook op het niveau van de andere leden van de container waardeketens, zoals terminals, havens, achterlandvervoerders, distributeurs, magazijnen en logistieke dienstverleners.

Een ander onderzoeksgebied richtte zich op het potentieel van *bundling* om rederijen een strategisch voordeel te verschaffen. Hoewel onderzoek op dit gebied nog beperkt is, kan de toepasbaarheid van *bundling* in een concurrerende markt interessante conclusies opleveren. Uit de twee modellen besproken in dit proefschrift is in het bijzonder voortgekomen dat *bundling* gemengde effecten heeft op het consumentensurplus en de totale welvaart. Het model heeft toegevoegde waarde voor de discussie over de strategische dimensies van *bundling*-besluiten. Dit wordt bereikt door de evaluatie van de resultaten van concurrentie in een duopolie, waar vervoerders op prijs concurreren; waar vervoerders afzonderlijke componenten of bundels kunnen verkopen, en waar zowel de lijnvaartmaatschappijen als de verzender kosten maken bij het samenstellen van een bundel. De meest interessante conclusie van het proefschrift is dat *bundling* het mogelijk maakt dat efficiëntiewinst wordt doorgegeven aan de verladers en de samenleving; iets wat niet kan plaatsvinden wanneer koppelverkoop verboden is.

Dit wenselijke effect van *bundling* brengt echter een risico met zich mee, aangezien lijnvaartmaatschappijen niet noodzakelijkerwijs het hoogste niveau van efficiëntie hebben bij het verstrekken van een bundel. Wanneer dit het geval is, neigt *bundling* het surplus van de consument en zelfs het sociaal welzijn te verminderen. Een belangrijke kwestie die open blijft staan voor verder onderzoek is de vraag of lijnvaartmaatschappijen intrinsiek beter zijn dan andere partijen in de toevoerketen om bundels te leveren. Als dit inderdaad het geval is, zorgt concurrentie ervoor dat, zelfs in het geval van een beperkende duopolie, efficiëntie aan de consumenten en de maatschappij wordt doorgegeven.

Aan de basis van het proefschrift ligt de ontwikkeling van het supply chain denken welke de vervoersindustrie de laatste drie decennia heeft gekenmerkt en de opkomst van logistieke uitbesteding als een belangrijke business praktijk. De bijdrage van deze scriptie aan dit gebied is tweeledig: het toepassen van *yield management* technieken in de waardeketen biedt veel potentie en de selectie van prestatie indicatoren is een beslissende factor in het succes van verticale integratie strategieen binnen de keten. Het gebied van *supply chain* prijsstelling is nog steeds relatief onderontwikkeld en het proefschrift suggereert dat de toepassing van de uitgebreide toolbox van *non-liner* prijsstellingen, reeds ontwikkeld in de industriële organisatie literatuur, kan wijzen in de richting van nieuwe en interessante onderzoeksrichtingen.

Wat de tweede bijdrage betreft, is het uitgangspunt van dit proefschrift de constatering dat vervoer over zee een subsysteem is binnen de waardeketen en als zodanig moet het rendement hiervan niet beperkt worden tot een evaluatie van de interne processen. Het is de prestatie van de gehele keten die er echt toe doet. Als de keten goed presteert, dat wil zeggen waarde creëert, dan zal voor deze keten gekozen worden en daarmee dus ook voor de vervoerder over zee. Aangezien de waardeketen zo sterk is als zijn zwakste schakel, kan een vervoerder zeer efficiënt zijn, maar als terminals of aanbieders van vervoer naar het achterland geen adequaat niveau van dienstverlening bieden, of de toegangswegen tot de haven overvol zijn, zal dit het vermogen van de keten om waarde te creëren beïnvloeden en in wezen ook de concurrentiepositie van de vervoerder.

Deze nadruk op de waardeketen is ook noodzakelijk vanwege het feit dat de prestaties van elke schakel beïnvloed worden door de prestaties van de andere schakels. De resultaten van de rederij worden beïnvloed door de resultaten van de containerterminal en die resultaten worden weer beïnvloed door bijvoorbeeld inefficiënte wegtransporteurs of havendiensten. De noodzaak tot samenwerking binnen de keten maakt een andere benadering van prestatie beoordeling noodzakelijk, waar naast de traditionele maatstaven binnen de onderneming, ook indicatoren voor de keten als geheel moeten worden gecontroleerd en geanalyseerd.

Dit werpt natuurlijk specifieke uitdagingen op voor de actoren in waardeketen: samenwerking tussen de verschillende belanghebbenden wordt op deze manier een fundamentele voorwaarde voor de implementatie van efficiënte toevoerketen strategieën. Van de kant van de rederijen, en in het bijzonder van degenen die ervoor kiezen om meerdere logistieke diensten aan te bieden, dienen investeringen in ICT en de verbetering van de zichtbaarheid van de waardeketen *in* de top van hun ontwikkelingsstrategieën te staan. Maar dit kan natuurlijk niet en moet niet los van elkaar gedaan worden.

Het laatste onderzoeksgebied heeft betrekking op de tussenkomst van de overheid in de regulering van *bundling* in de container-industrie. Hoewel gemengde *bundling* een praktijk is die altijd is toegestaan op grond van antitrust regelgeving voor bedrijven met weinig of geen macht op de markt, is er geen volledige juridische overeenstemming over de kwestie.

Het proefschrift onderzocht de regulering in de Verenigde Staten en Europa en merkte op dat de praktijk van bundeling niet illegaal is in bevoegd zolang (i) diensten zijn verleend als deel van vertrouwelijke *service contracten*, dus niet als onderdeel van de *conference* prijsafspraken, (ii) een dienstenbundel niet exclusief wordt aangeboden, dat wil zeggen dat de verlader altijd de mogelijkheid heeft tot aankoop van de verschillende componenten afzonderlijk, (iii) binnenlandse prijzen en specificaties niet gezamenlijk onderhandeld worden door vervoerders als een consortium, (iv) de "niet onder de kostprijs"-regel wordt gerespecteerd voor de vaargebieden waar de tarieven van de conferences van toepassing zijn (v) op routes van en naar de EU, geen gebruik wordt gemaakt van *discussion agreements*.

Deze bepalingen zorgen ervoor dat het gebruik van bundeling strategieën in alle andere omstandigheden is toegestaan en dus wordt de ontwikkeling van deze strategieën sterk aangeraden. Het proefschrift stelt ook dat de intrekking van de Europese Raad Verordening nr. 4056/86 de ontwikkeling van bundelingsstrategieën zal bevorderen en dat rederijen verder onderzoek moeten uitvoeren naar de voordelen van deze strategie. Het proefschrift betoogt voorts dat de toezichthouder zich moet richten op het ondersteunen van de ontwikkeling van bundeling praktijken tussen de partners in de toeleveringsketen, aangezien dit samenwerking binnen de keten zal stimuleren.

Het proefschrift bestaat uit elf hoofdstukken, die de verschillende kwesties analyseren zoals hiervoor genoemd. Hoofdstuk 1 is de introductie van het proefschrift en schetst het relevante onderzoek en de methodologische zaken en geeft tevens aan waar in de bredere discussie rond *bundling* dit proefschrift zich bevindt. Dit wordt gevolgd door twee hoofdstukken die gericht zijn op het belichten van de beschikbare relevante literatuur op het gebied van *bundling* en de lijnvaart industrie. Deze hoofdstukken bieden niet alleen een nieuwe synthese van deze onderzoeksgebieden, maar markeren ook de aspecten die het meest relevant zijn voor de toepassing van *bundling* op de lijnvaart en logistieke sectoren.

Hoofdstuk 4 voegt de dimensie van de verlader toe aan de analyse. Aangezien één van de belangrijkste redenen voor de ontwikkeling van *bundling* producten de vraag van verladers is, integreert dit proefschrift het verladers perspectief, door verslag te doen van de uitkomsten van twee vragenlijsten over verladersvoorkeuren met betrekking tot outsourcing en *bundling*. Hoofdstuk 5 is een verslag van de huidige zakenpraktijk en de kijk van de rederijen op *bundling*. Uit hoofdstuk 5 komt naar voren dat de beslissing om *bundling* aan te bieden samenhangt met de "maak of koop" afweging en of het beter is om pas bundels aan te bieden als je als reder alle vaardigheden in huis hebt om alle onderdelen van de bundel zelf te maken. De afweging of het aanbod van bundels plaats dient te vinden via marktwerking (outsourcing) of door hiërarchische krachten (integratie) is afhankelijk van de aard van de transacties die nodig zijn en is het onderwerp van hoofdstuk 6.

Dit opent de discussie over welke aanpak reders dienen te gebruiken om optimale bundels te ontwikkelen. Het proefschrift beveelt conjunctanalyse en linear programming aan als de best bruikbare technieken. Eén van de belangrijke conclusies van het proefschrift is, zoals reeds opgemerkt, de noodzaak van het opstellen van geschikte instrumenten die de waardecreatie in de toevoerketen kunnen vaststellen en zo bundelingsmogelijkheden identificeren. Hoofdstuk 8 is gewijd aan prestatiemeting met een nadruk op de interactie tussen zeetransport en achterlandverbindingen (terminals) en een discussie van de prestatiemetingspraktijk in de lijnvaart industrie.

Hoofdstuk 9 en 10 zijn gewijd aan de analyse van de potentie en de implicatie van bundling als strategisch middel voor rederijen om grotere macht in de markt te krijgen. Uit de twee modellen die hiertoe ontwikkeld zijn en de analyse van het regelgevende kader dat betrekking heeft op de lijnvaart en logistieke industrie blijkt dat *bundling* voordelen heeft voor de samenleving en de rederijen. Tevens biedt het een impuls voor het verbeteren van de efficiëntie binnen de waardeketen. Hoofdstuk 11 bevat de conclusies en aanbevelingen voor verder onderzoek.

SINTESI IN ITALIANO (SUMMARY IN ITALIAN)

Questa tesi si propone di studiare l'applicabilità e i vantaggi derivanti della vendita di servizi logistici in un unico pacchetto o *bundle* nel settore del trasporto contenitori, e in particolare con riferimento alla fornitura congiunta di trasporto marittimo e di altri servizi logistici. La pratica della vendita a pacchetto, spesso indicata con il termine inglese *bundling*, è una pratica diffusa in molte industrie, sebbene la sua applicazione nel settore contenitori sia piuttosto limitata. L'uso sporadico delle vendite a pacchetto in questo settore è attribuibile in parte al particolare regime normativo che ha caratterizzato il trasporto transoceanico ed è conseguenza dell'approccio piuttosto tradizionalista delle aziende di linea nei confronti di nuove pratiche di tariffazione. Il coinvolgimento delle aziende di trasporto transoceanico, gli *ocean carriers,* nella logistica ha caratterizzato il settore sin dalla fine degli anni Ottanta ed è una tendenza in continua crescita. I cambiamenti delle condizioni di mercato e del regime antitrust derivanti dall'abolizione della normativa 4056/86, hanno offerto nuove opportunità per lo sviluppo di forme di tariffazione più flessibili, come il *bundling*, che consentono di offrire migliori servizi e sviluppare sinergie tra vari segmenti della catena logistica.

Uno degli aspetti più interessanti dell'analisi effettuata nella tesi fa riferimento agli effetti dell'utilizzo delle tecniche di *bundling* sui clienti delle aziende di trasporto contenitori e in generale sui consumatori. I clienti delle aziende sembrano apprezzare i vantaggi di questa pratica commerciale in termini di semplificazione tariffaria, facilità di confronto tra le offerte dei vari vettori e l'aumento del numero e tipo di soluzioni logistiche disponibili. Tuttavia, la pratica nel settore marittimo è ancora guardata con diffidenza, probabilmente a causa delle relazioni piuttosto conflittuali tra le aziende di trasporto e i loro clienti e del timore che nel *bundling* passano celarsi margini aggiuntivi.

Va osservato che la vendita in un *bundle* combinata con la vendita dei singoli componenti separatamente, nella forma che viene chiamata di *bundling* misto, comporta sempre un aumento della scelta per i consumatori. La valutazione della desiderabilità di tale pratica pertanto va sempre commisurata ai vantaggi derivanti dalla disponibilità di maggiore scelta e varietà. Specialmente nel caso delle catene logistiche integrate, questi vantaggi possono essere notevoli. Non esistono ragioni per ritenere che lo sviluppo delle pratiche di *bundling* possa avere risvolti negativi per la società. Tuttavia, l'utilizzo di questa forma di tariffazione richiede ancora per il momento attenta considerazione e ulteriore ricerca in quest'area è indispensabile.

Un altro insieme di considerazioni importanti derivanti dalla tesi fa riferimento al ruolo che le pratiche di *bundling* avrebbero nel migliorare il vantaggio competitivo delle aziende di trasporto contenitori. Questo vantaggio deriverebbe dalla riduzione dei costi ottenibile col *bundling*, dalla migliore aderenza tra domanda e offerta, dalla capacità di differenziazione dell'offerta, dalla possibilità di ottenere margini più elevati combinando l'offerta di trasporto marittimo e trasporto terrestre, e dalla necessità di ridurre i costi di coordinamento con l'hinterland. L'integrazione verticale nel trasporto marittimo di linea sembra essere la strategia di business che prevarrà a lungo termine, e l'uso di pratiche di *bundling* favorirebbe l'attuazione di questa strategia.

La tesi fornisce anche indicazioni sul processo di selezione dei servizi da includere in un *bundle*. Una delle osservazioni importanti desumibili dalla tesi fa riferimento alla superiorità di proposte di *bundle* che permettono di sfruttare le complementarità tra i servizi e le riduzioni di costo derivanti, ad esempio, dalle economie di scopo o di densità di rotta. Il successo di una proposta di *bundle*, infatti, è legato al coordinamento tra le attività degli spedizionieri, degli operatori terminalisti, delle compagnie di linea, e dei fornitori di servizi logistici, tra cui gli autotrasportatori e le linee ferroviarie. Solo in questo modo è possibile sviluppare proposte di *bundle* redditizie per le aziende di trasporto marittimo e allo stesso tempo vantaggiose per i consumatori.

I paradigmi offerti dall'Economia dei Costi di Transazione sono particolarmente utili nel contesto dell'outsourcing, a cui alla fine lo sviluppo della logistica integrata fa riferimento, e costituiscono una solida base su cui le aziende di trasporto contenitori integrate possono misurare il valore delle strategie di *bundling*. Quando le transazioni tra l'azienda di trasporto transoceanico e il fornitore di servizi logistici sono portate fuori dal mercato, l'azienda di trasporto transoceanico diviene un operatore logistico integrato. Sebbene lo sviluppo di proposte di *bundle* non richieda necessariamente integrazione verticale, gli operatori logistici integrati si trovano in una posizione migliore per offrire un *bundle*. Questa è una diretta conseguenza del maggiore controllo sui costi di transazione e della riduzione delle asimmetrie informative. I *bundle* di servizi offerti in queste condizioni non sono mai proposte di valore peggiori di quelle associate all'offerta separata dei servizi logistici che li compongono.

Per apprezzare appieno le potenzialità offerte dalle vendite a pacchetto è necessario che le aziende di trasporto contenitori si aprano ai vantaggi offerti dall'integrazione verticale. La tesi sostiene che perché questo accada le aziende di trasporto contenitori debbano guardare oltre i loro confini aziendali tradizionali, concentrandosi sulle relazioni transaziendali caratteristiche delle catene logistiche. Quest'approccio richiede la modifica delle misure di prestazione aziendale tradizionali così da includere anche indicatori di performance transaziendali. Questo non deve avvenire solo a livello delle aziende di trasporto contenitori, ma anche tra gli altri membri della catena logistica, come ad esempio le imprese terminaliste, i porti, i trasportatori terrestri, i distributori, gli spedizionieri, i centri logistici e i fornitori di logistica integrata.

Un'altra area di ricerca esplorata nella tesi, è incentrata sul potenziale strategico offerto dallo sviluppo di proposte di *bundling*. Sebbene la ricerca in questo settore sia ancora limitata, l'uso delle vendite a pacchetto in un mercato altamente competitivo come quello del trasporto transoceanico può portare a conclusioni interessanti. In particolare emerge dalle formalizzazioni discusse nella tesi che gli effetti dell'uso delle pratiche di *bundling* sul surplus del consumatore e sul welfare totale risulterebbero essere ambigui. In particolare è interessante notare che le proposte di vendita in *bundle* comporterebbero aumenti di efficienza che possono essere trasferiti ai consumatori sotto forma di una riduzione dei prezzi o miglioramento dell'offerta, un'eventualità, questa, che non può avvenire quando la pratica è vietata.

Quanto detto sopra dipende però dall'efficienza delle aziende di trasporto contenitori. Se l'industria fosse caratterizzata da elevati livelli di inefficienza, lo sviluppo di vendite a pacchetto risulterebbe in una riduzione del surplus dei consumatori, e addirittura anche del welfare totale. La questione se i vettori siano intrinsecamente migliori di altri operatori all'interno della catena logistica nella creazione di *bundle* di servizi richiede ulteriore analisi. Se questo fosse il caso, la concorrenza, anche nel caso di duopolio, garantirebbe che tali efficienze siano trasferite ai consumatori.

Alla base di gran parte dei concetti presentati nella tesi vi è l'idea che il trasporto transoceanico di contenitori sia solo una delle componenti della catena logistica. In questo senso la valutazione del trasporto transoceanico in sé non è sufficiente per determinare l'efficacia dell'intero sistema di trasporto. Questo perché ciò che costituisce gran parte del vantaggio competitivo di un operatore logistico è l'abilità della catena logistica in cui esso opera di creare valore. Il successo di una catena logistica dipende dalla sua capacità di creare valore, e dipende in modo critico dall'efficacia del suo anello più debole. Un'azienda di trasporto contenitori può essere estremamente efficiente nelle sue operazioni, ma se gli operatori terminalistici, o i trasportatori, o gli uffici doganali, non forniscono un livello di servizi adeguato, o le strade di accesso al porto, o altre infrastrutture sono congestionate, questo avrà un impatto determinante sulla capacità della catena di creare valore e, alla fine, anche sulla competitività dell'azienda di trasporto.

Questo ovviamente rappresenta una sfida importante per tutti gli operatori logistici, e richiede lo sviluppo di forme di cooperazione per migliorare l'efficienza complessiva della catena logistica. Per quanto riguarda le aziende di trasporto contenitori, e in particolare per quelle che offrono servizi integrati, è importante investire in nuove tecnologie di informazione e migliorare la visibilità della catena logistica. Questo naturalmente non può e non deve essere effettuato senza la cooperazione degli altri operatori coinvolti nella catena logistica e delle istituzioni.

Un'altra area di ricerca sviluppata nella tesi fa riferimento al ruolo del regolatore nella promozione di pratiche di *bundling* nel settore contenitori. La tesi analizza il regime antitrust in Europa e negli Stati Uniti e offre un criterio di analisi per determinare in quali circostanze le pratiche di *bundling* possono ritenersi in linea con la normativa per la tutela della concorrenza. In generale le forme di *bundling* conosciute come *bundling* misto non contravvengono mai alla normativa antitrust per aziende senza o con limitato potere di mercato. Tali disposizioni consentono l'uso di strategie di *bundling* per gran parte delle aziende contenitori e delle rotte e quindi lo sviluppo di tali strategie è fortemente consigliato. La tesi sostiene inoltre che l'abrogazione della normativa del Consiglio Europeo n. 4056/86 favorirà lo sviluppo di strategie di *bundling*.

Lo studio delle strategie di prezzo nel settore della logistica integrata, e in particolare l'applicazione di tecniche di prezzo non lineari, offrono molteplici direzioni di ricerca che solo in parte possono essere esplorate nella tesi. La tesi rappresenta un contributo nella direzione dell'applicazione di tecniche di prezzo non lineari al settore logistico e offre un'analisi esplorativa degli aspetti più rilevanti per la comprensione di quest'area di ricerca.

Questi temi sono discussi negli undici capitoli della tesi. Il primo capitolo introduce la tesi e gli aspetti di carattere metodologico oltre ad offrire una panoramica sulla pratica del *bundling*. L'introduzione è seguita da due capitoli che mirano ad offrire una sintesi della letteratura esistente sul *bundling* e sull'economia del trasporto marittimo. Il capitolo 4 contribuisce all'analisi la prospettiva dei clienti delle aziende di trasporto, e riporta i risultati di due studi sulle preferenze di outsourcing delle aziende in vari settori. Il capitolo 5 espone come le strategie di *bundling* vengono attuate in pratica, e spiega come un operatore logistico integrato sia in una posizione di vantaggio nell'offrire un *bundle*. Il tema dell'integrazione verticale è ulteriormente approfondito nel capitolo 6, che ne discute i vantaggi e le implicazioni in termini di costi di transazione.

Il capitolo 7 si apre col tema delle strategie che le aziende di trasporto contenitori possono impiegare per sviluppare *bundle* ottimi. La tesi suggerisce l'uso di tecniche di analisi congiunta e di programmazione lineare per la determinazione di *bundle* ottimi. Una delle conclusioni importanti della tesi fa riferimento alla necessità di approntare misure adeguate all'identificazione del valore all'interno della catena logistica come presupposto alla creazione di *bundle* ottimi. Per questa ragione il capitolo 8 è dedicato alla misurazione e alla performance con particolare attenzione alle interfacce tra il trasporto transoceanico, i terminali e l'hinterland. Il capitolo 9 e 10 sono dedicati all'analisi del potenziale e delle implicazioni delle pratiche di *bundling* come strumento per acquisire vantaggio strategico e miglior controllo dl mercato. Dai modelli presentati e dall'analisi della normativa relativa all'industria del trasporto marittimo e della logistica risulta che la pratica di *bundling* non sia dannosa per i consumatori e per le aziende. Essa al contrario costituisce un incentivo per il miglioramento dell'efficienza delle catene logistiche. Il capitolo 11 conclude ed offre indicazioni per ulteriori ricerche.

About the Author

Michele Acciaro was born in June 1979 in Sassari, Italy, on the beautiful island of Sardinia, where he completed his secondary education top of his class. In 1998 Michele moved to Rome, to study at the Faculty of Statistics, University of Rome *La Sapienza.* In 2001 he participated in the European Exchange Programme *Erasmus*, and studied at Erasmus University for six months. During this period he followed his first course in Maritime Economics. In 2003 Michele graduated (*cum Laude*) in Statistics and Economics from the University of Rome *La Sapienza*, with a thesis on Port Economics.

In 2003 he was employed at PriceWaterhouse Coopers in Rome as junior consultant, where he worked on the European Commission's study on Scenarios, Traffic Forecasts, and Analyses of Corridors on the Trans-European Transport Networks (TEN-STAC) among other projects. In 2004 he joined the Center for Maritime Economics and Logistics (MEL) of Erasmus University as research associate, after the successful completion of his MSc in Maritime Economics and Logistics for which he was awarded the *NOL/APL Prize for Student Excellence*.

In November 2004, he was granted a four-year scholarship from the Sardinian Region to carry out PhD research at Erasmus University on Maritime and Port Economics. In 2005 Michele was awarded the Young Researcher Best Paper Prize at the IAME Annual Conference in Cyprus and in the same year he took the position of Assistant Academic Director at MEL. Since 2008 he has been working as MEL Deputy Director.

Since 2004 Michele has been associated with MEL as researcher and lecturer and he teaches at graduate and postgraduate level a number of economics, logistics and transport related course. In 2005 he was visiting fellow at the National University of Singapore, and in 2005 and 2006 at Singapore Management University. He is regularly invited as a speaker or chairman at various conferences, and he spoke at Intermodal, the TOC Europe, the Port Finance and Investment Conference, the Global Ports conference among other industry events.

Next to his research and education activities, Michele worked on several consultancy projects, including, the project Port Financing and Pricing Practices in the Seaports of the European Union, where he was lead researcher for the Baltic States, the Netherlands and Cyprus, and in the research project on Bundling of Liner and Logistics Services supported by the NOL Foundation. Between 2005 and 2008 he served as Member of the Board and Treasurer of the Erasmus PhD Association Rotterdam (EPAR).

He has published on various academic journals and his research interests range from port finance and investment, to terminal management and operations' optimisation, to supply chain integration and pricing for terminals, ocean transportation and other logistics services.

Michele likes swimming, movies and a good night out with friends. He has a passion for travelling and foreign languages, the arts and music. He is single and lives in Rotterdam.

ERASMUS RESEARCH INSTITUTE OF MANAGEMENT (ERIM)

ERIM PH.D. SERIES
RESEARCH IN MANAGEMENT

ERIM Electronic Series Portal: http://hdl.handle.net/1765/1

Agatz, N.A.H., *Demand Management in E-Fulfillment*, Promotor: Prof.dr.ir. J.A.E.E. van Nunen, EPS-2009-163-LIS, ISBN: 978-90-5892-200-7, http://hdl.handle.net/1765/15425

Althuizen, N.A.P., *Analogical Reasoning as a Decision Support Principle for Weakly Structured Marketing Problems*, Promotor: Prof.dr.ir. B. Wierenga, EPS-2006-095-MKT, ISBN: 90-5892-129-8, http://hdl.handle.net/1765/8190

Alvarez, H.L., *Distributed Collaborative Learning Communities Enabled by Information Communication Technology*, Promotor: Prof.dr. K. Kumar, EPS-2006-080-LIS, ISBN: 90-5892-112-3, http://hdl.handle.net/1765/7830

Appelman, J.H., *Governance of Global Interorganizational Tourism Networks: Changing Forms of Co-ordination between the Travel Agency and Aviation Sector*, Promotors: Prof.dr. F.M. Go & Prof.dr. B. Nooteboom, EPS-2004-036-MKT, ISBN: 90-5892-060-7, http://hdl.handle.net/1765/1199

Asperen, E. van, *Essays on Port, Container, and Bulk Chemical Logistics Optimization*, Promotor: Prof.dr.ir. R. Dekker, EPS-2009-181-LIS, ISBN: 978-90-5892-222-9, http://hdl.handle.net/1765/1

Assem, M.J. van den, *Deal or No Deal? Decision Making under Risk in a Large-Stake TV Game Show and Related Experiments*, Promotor: Prof.dr. J. Spronk, EPS-2008-138-F&A, ISBN: 978-90-5892-173-4, http://hdl.handle.net/1765/13566

Baquero, G, *On Hedge Fund Performance, Capital Flows and Investor Psychology*, Promotor: Prof.dr. M.J.C.M. Verbeek, EPS-2006-094-F&A, ISBN: 90-5892-131-X, http://hdl.handle.net/1765/8192

Berens, G., *Corporate Branding: The Development of Corporate Associations and their Influence on Stakeholder Reactions*, Promotor: Prof.dr. C.B.M. van Riel, EPS-2004-039-ORG, ISBN: 90-5892-065-8, http://hdl.handle.net/1765/1273

Berghe, D.A.F. van den, *Working Across Borders: Multinational Enterprises and the Internationalization of Employment*, Promotors: Prof.dr. R.J.M. van Tulder & Prof.dr. E.J.J. Schenk, EPS-2003-029-ORG, ISBN: 90-5892-05-34, http://hdl.handle.net/1765/1041

Berghman, L.A., Strategic Innovation Capacity: A Mixed Method Study on Deliberate Strategic Learning Mechanisms, Promotor: Prof.dr. P. Mattyssens, EPS-2006-087-MKT, ISBN: 90-5892-120-4, http://hdl.handle.net/1765/7991

Bezemer, P.J., Diffusion of Corporate Governance Beliefs: Board Independence and the Emergence of a Shareholder Value Orientation in the Netherlands, Promotors: Prof.dr.ing. F.A.J. van den Bosch & Prof.dr. H.W. Volberda, EPS-2009-192-STR, ISBN: 978-90-5892-232-8, http://hdl.handle.net/1765/1

Bijman, W.J.J., *Essays on Agricultural Co-operatives: Governance Structure in Fruit and Vegetable Chains*, Promotor: Prof.dr. G.W.J. Hendrikse, EPS-2002-015-ORG, ISBN: 90-5892-024-0, http://hdl.handle.net/1765/867

Bispo, A., *Labour Market Segmentation: An investigation into the Dutch hospitality industry*, Promotors: Prof.dr. G.H.M. Evers & Prof.dr. A.R. Thurik, EPS-2007-108-ORG, ISBN: 90-5892-136-9, http://hdl.handle.net/1765/10283

Blindenbach-Driessen, F., *Innovation Management in Project-Based Firms*, Promotor: Prof.dr. S.L. van de Velde, EPS-2006-082-LIS, ISBN: 90-5892-110-7, http://hdl.handle.net/1765/7828

Boer, C.A., *Distributed Simulation in Industry,* Promotors: Prof.dr. A. de Bruin & Prof.dr.ir. A. Verbraeck, EPS-2005-065-LIS, ISBN: 90-5892-093-3, http://hdl.handle.net/1765/6925

Boer, N.I., *Knowledge Sharing within Organizations: A situated and Relational Perspective,* Promotor: Prof.dr. K. Kumar, EPS-2005-060-LIS, ISBN: 90-5892-086-0, http://hdl.handle.net/1765/6770

Boer-Sorbán, K., *Agent-Based Simulation of Financial Markets: A modular, Continuous-Time Approach,* Promotor: Prof.dr. A. de Bruin, EPS-2008-119-LIS, ISBN: 90-5892-155-0, http://hdl.handle.net/1765/10870

Boon, C.T., *HRM and Fit: Survival of the Fittest!?,* Promotors: Prof.dr. J. Paauwe & Prof.dr. D.N. den Hartog, EPS-2008-129-ORG, ISBN: 978-90-5892-162-8, http://hdl.handle.net/1765/12606

Braun, E., *City Marketing: Towards an Integrated Approach,* Promotor: Prof.dr. L. van den Berg, EPS-2008-142-MKT, ISBN: 978-90-5892-180-2, http://hdl.handle.net/1765/13694

Brito, M.P. de, *Managing Reverse Logistics or Reversing Logistics Management?* Promotors: Prof.dr.ir. R. Dekker & Prof.dr. M. B. M. de Koster, EPS-2004-035-LIS, ISBN: 90-5892-058-5, http://hdl.handle.net/1765/1132

Brohm, R., *Polycentric Order in Organizations: A Dialogue between Michael Polanyi and IT-Consultants on Knowledge, Morality, and Organization,* Promotors: Prof.dr. G. W. J. Hendrikse & Prof.dr. H. K. Letiche, EPS-2005-063-ORG, ISBN: 90-5892-095-X, http://hdl.handle.net/1765/6911

Brumme, W.-H., *Manufacturing Capability Switching in the High-Tech Electronics Technology Life Cycle,* Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr.ir. L.N. Van Wassenhove, EPS-2008-126-LIS, ISBN: 978-90-5892-150-5, http://hdl.handle.net/1765/12103

Budiono, D.P., The Analysis of Mutual Fund Performance: Evidence from U.S. Equity Mutual Funds*,* Promotor: Prof.dr.ir. M.J.C.M. Verbeek, EPS-2010-185-F&A, ISBN: 978-90-5892-224-3, http://hdl.handle.net/1765/1

Burgers, J.H., *Managing Corporate Venturing: Multilevel Studies on Project Autonomy, Integration, Knowledge Relatedness, and Phases in the New Business Development Process,* Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2008-136-STR, ISBN: 978-90-5892-174-1, http://hdl.handle.net/1765/13484

Campbell, R.A.J., *Rethinking Risk in International Financial Markets*, Promotor: Prof.dr. C.G. Koedijk, EPS-2001-005-F&A, ISBN: 90-5892-008-9, http://hdl.handle.net/1765/306

Chen, C.-M., *Evaluation and Design of Supply Chain Operations Using DEA*, Promotor: Prof.dr. J.A.E.E. van Nunen, EPS-2009-172-LIS, ISBN: 978-90-5892-209-0, http://hdl.handle.net/1765/1

Chen, H., *Individual Mobile Communication Services and Tariffs*, Promotor: Prof.dr. L.F.J.M. Pau, EPS-2008-123-LIS, ISBN: 90-5892-158-1, http://hdl.handle.net/1765/11141

Chen, Y., *Labour Flexibility in China's Companies: An Empirical Study*, Promotors: Prof.dr. A. Buitendam & Prof.dr. B. Krug, EPS-2001-006-ORG, ISBN: 90-5892-012-7, http://hdl.handle.net/1765/307

Damen, F.J.A., *Taking the Lead: The Role of Affect in Leadership Effectiveness*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2007-107-ORG, http://hdl.handle.net/1765/10282

Daniševská, P., *Empirical Studies on Financial Intermediation and Corporate Policies*, Promotor: Prof.dr. C.G. Koedijk, EPS-2004-044-F&A, ISBN: 90-5892-070-4, http://hdl.handle.net/1765/1518

Delporte-Vermeiren, D.J.E., *Improving the Flexibility and Profitability of ICT-enabled Business Networks: An Assessment Method and Tool*, Promotors: Prof. mr. dr. P.H.M. Vervest & Prof.dr.ir. H.W.G.M. van Heck, EPS-2003-020-LIS, ISBN: 90-5892-040-2, http://hdl.handle.net/1765/359

Derwall, J.M.M., *The Economic Virtues of SRI and CSR*, Promotor: Prof.dr. C.G. Koedijk, EPS-2007-101-F&A, ISBN: 90-5892-132-8, http://hdl.handle.net/1765/8986

Diepen, M. van, *Dynamics and Competition in Charitable Giving*, Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2009-159-MKT, ISBN: 978-90-5892-188-8, http://hdl.handle.net/1765/14526

Dietz, H.M.S., *Managing (Sales)People towards Perfomance: HR Strategy, Leadership & Teamwork*, Promotor: Prof.dr. G.W.J. Hendrikse, EPS-2009-168-ORG, ISBN: 978-90-5892-210-6, http://hdl.handle.net/1765/1

Dijksterhuis, M., *Organizational Dynamics of Cognition and Action in the Changing Dutch and US Banking Industries*, Promotors: Prof.dr.ir. F.A.J. van den Bosch & Prof.dr. H.W. Volberda, EPS-2003-026-STR, ISBN: 90-5892-048-8, http://hdl.handle.net/1765/1037

Eijk, A.R. van der, *Behind Networks: Knowledge Transfer, Favor Exchange and Performance*, Promotors: Prof.dr. S.L. van de Velde & Prof.dr.drs. W.A. Dolfsma, EPS-2009-161-LIS, ISBN: 978-90-5892-190-1, http://hdl.handle.net/1765/14613

Elstak, M.N., *Flipping the Identity Coin: The Comparative Effect of Perceived, Projected and Desired Organizational Identity on Organizational Identification and Desired Behavior*, Promotor: Prof.dr. C.B.M. van Riel, EPS-2008-117-ORG, ISBN: 90-5892-148-2, http://hdl.handle.net/1765/10723

Erken, H.P.G., *Productivity, R&D and Entrepreneurship*, Promotor: Prof.dr. A.R. Thurik, EPS-2008-147-ORG, ISBN: 978-90-5892-179-6, http://hdl.handle.net/1765/14004

Fenema, P.C. van, *Coordination and Control of Globally Distributed Software Projects*, Promotor: Prof.dr. K. Kumar, EPS-2002-019-LIS, ISBN: 90-5892-030-5, http://hdl.handle.net/1765/360

Fleischmann, M., *Quantitative Models for Reverse Logistics*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr.ir. R. Dekker, EPS-2000-002-LIS, ISBN: 35-4041-711-7, http://hdl.handle.net/1765/1044

Flier, B., *Strategic Renewal of European Financial Incumbents: Coevolution of Environmental Selection, Institutional Effects, and Managerial Intentionality*, Promotors: Prof.dr.ir. F.A.J. van den Bosch & Prof.dr. H.W. Volberda, EPS-2003-033-STR, ISBN: 90-5892-055-0, http://hdl.handle.net/1765/1071

Fok, D., *Advanced Econometric Marketing Models*, Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2003-027-MKT, ISBN: 90-5892-049-6, http://hdl.handle.net/1765/1035

Ganzaroli, A., *Creating Trust between Local and Global Systems*, Promotors: Prof.dr. K. Kumar & Prof.dr. R.M. Lee, EPS-2002-018-LIS, ISBN: 90-5892-031-3, http://hdl.handle.net/1765/361

Gertsen, H.F.M., *Riding a Tiger without Being Eaten: How Companies and Analysts Tame Financial Restatements and Influence Corporate Reputation*, Promotor: Prof.dr. C.B.M. van Riel, EPS-2009-171-ORG, ISBN: 90-5892-214-4, http://hdl.handle.net/1765/1

Gilsing, V.A., *Exploration, Exploitation and Co-evolution in Innovation Networks*, Promotors: Prof.dr. B. Nooteboom & Prof.dr. J.P.M. Groenewegen, EPS-2003-032-ORG, ISBN: 90-5892-054-2, http://hdl.handle.net/1765/1040

Gijsbers, G.W., *Agricultural Innovation in Asia: Drivers, Paradigms and Performance,* Promotor: Prof.dr. R.J.M. van Tulder, EPS-2009-156-ORG, ISBN: 978-90-5892-191-8, http://hdl.handle.net/1765/14524

Gong, Y., *Stochastic Modelling and Analysis of Warehouse Operations*, Promotors: Prof.dr. M.B.M. de Koster & Prof.dr. S.L. van de Velde, EPS-2009-180-LIS, ISBN: 978-90-5892-219-9, http://hdl.handle.net/1765/1

Govers, R., *Virtual Tourism Destination Image: Glocal Identities Constructed, Perceived and Experienced*, Promotors: Prof.dr. F.M. Go & Prof.dr. K. Kumar, EPS-2005-069-MKT, ISBN: 90-5892-107-7, http://hdl.handle.net/1765/6981

Graaf, G. de, *Tractable Morality: Customer Discourses of Bankers, Veterinarians and Charity Workers*, Promotors: Prof.dr. F. Leijnse & Prof.dr. T. van Willigenburg, EPS-2003-031-ORG, ISBN: 90-5892-051-8, http://hdl.handle.net/1765/1038

Greeven, M.J., *Innovation in an Uncertain Institutional Environment: Private Software Entrepreneurs in Hangzhou, China*, Promotor: Prof.dr. B. Krug, EPS-2009-164-ORG, ISBN: 978-90-5892-202-1, http://hdl.handle.net/1765/15426

Groot, E.A. de, *Essays on Economic Cycles*, Promotors: Prof.dr. Ph.H.B.F. Franses & Prof.dr. H.R. Commandeur, EPS-2006-091-MKT, ISBN: 90-5892-123-9, http://hdl.handle.net/1765/8216

Guenster, N.K., *Investment Strategies Based on Social Responsibility and Bubbles*, Promotor: Prof.dr. C.G. Koedijk, EPS-2008-175-F&A, ISBN: 978-90-5892-206-9, http://hdl.handle.net/1765/1

Gutkowska, A.B., *Essays on the Dynamic Portfolio Choice*, Promotor: Prof.dr. A.C.F. Vorst, EPS-2006-085-F&A, ISBN: 90-5892-118-2, http://hdl.handle.net/1765/7994

Hagemeijer, R.E., *The Unmasking of the Other*, Promotors: Prof.dr. S.J. Magala & Prof.dr. H.K. Letiche, EPS-2005-068-ORG, ISBN: 90-5892-097-6, http://hdl.handle.net/1765/6963

Hakimi, N.A, *Leader Empowering Behaviour: The Leader's Perspective: Understanding the Motivation behind Leader Empowering Behaviour*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2010-184-ORG, http://hdl.handle.net/1765/1

Halderen, M.D. van, *Organizational Identity Expressiveness and Perception Management: Principles for Expressing the Organizational Identity in Order to Manage the Perceptions and Behavioral Reactions of External Stakeholders*, Promotor: Prof.dr. S.B.M. van Riel, EPS-2008-122-ORG, ISBN: 90-5892-153-6, http://hdl.handle.net/1765/10872

Hartigh, E. den, *Increasing Returns and Firm Performance: An Empirical Study*, Promotor: Prof.dr. H.R. Commandeur, EPS-2005-067-STR, ISBN: 90-5892-098-4, http://hdl.handle.net/1765/6939

Hermans. J.M., *ICT in Information Services; Use and Deployment of the Dutch Securities Trade, 1860-1970,* Promotor: Prof.dr. drs. F.H.A. Janszen, EPS-2004-046-ORG, ISBN 90-5892-072-0, http://hdl.handle.net/1765/1793

Hessels, S.J.A., *International Entrepreneurship: Value Creation Across National Borders*, Promotor: Prof.dr. A.R. Thurik, EPS-2008-144-ORG, ISBN: 978-90-5892-181-9, http://hdl.handle.net/1765/13942

Heugens, P.P.M.A.R., *Strategic Issues Management: Implications for Corporate Performance*, Promotors: Prof.dr.ir. F.A.J. van den Bosch & Prof.dr. C.B.M. van Riel, EPS-2001-007-STR, ISBN: 90-5892-009-9, http://hdl.handle.net/1765/358

Heuvel, W. van den, *The Economic Lot-Sizing Problem: New Results and Extensions*, Promotor: Prof.dr. A.P.L. Wagelmans, EPS-2006-093-LIS, ISBN: 90-5892-124-7, http://hdl.handle.net/1765/1805

Hoedemaekers, C.M.W., *Performance, Pinned down: A Lacanian Analysis of Subjectivity at Work*, Promotors: Prof.dr. S. Magala & Prof.dr. D.H. den Hartog, EPS-2008-121-ORG, ISBN: 90-5892-156-7, http://hdl.handle.net/1765/10871

Hooghiemstra, R., *The Construction of Reality: Cultural Differences in Self-serving Behaviour in Accounting Narratives*, Promotors: Prof.dr. L.G. van der Tas RA & Prof.dr. A.Th.H. Pruyn, EPS-2003-025-F&A, ISBN: 90-5892-047-X, http://hdl.handle.net/1765/871

Hu, Y., *Essays on the Governance of Agricultural Products: Cooperatives and Contract Farming*, Promotors: Prof.dr. G.W.J. Hendrkse & Prof.dr. B. Krug, EPS-2007-113-ORG, ISBN: 90-5892-145-1, http://hdl.handle.net/1765/10535

Huij, J.J., *New Insights into Mutual Funds: Performance and Family Strategies*, Promotor: Prof.dr. M.C.J.M. Verbeek, EPS-2007-099-F&A, ISBN: 90-5892-134-4, http://hdl.handle.net/1765/9398

Huurman, C.I., *Dealing with Electricity Prices*, Promotor: Prof.dr. C.D. Koedijk, EPS-2007-098-F&A, ISBN: 90-5892-130-1, http://hdl.handle.net/1765/9399

Iastrebova, K, *Manager's Information Overload: The Impact of Coping Strategies on Decision-Making Performance*, Promotor: Prof.dr. H.G. van Dissel, EPS-2006-077-LIS, ISBN: 90-5892-111-5, http://hdl.handle.net/1765/7329

Iwaarden, J.D. van, *Changing Quality Controls: The Effects of Increasing Product Variety and Shortening Product Life Cycles,* Promotors: Prof.dr. B.G. Dale & Prof.dr. A.R.T. Williams, EPS-2006-084-ORG, ISBN: 90-5892-117-4, http://hdl.handle.net/1765/7992

Jansen, J.J.P., *Ambidextrous Organizations*, Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2005-055-STR, ISBN: 90-5892-081-X, http://hdl.handle.net/1765/6774

Jaspers, F.P.H., *Organizing Systemic Innovation*, Promotor: Prof.dr.ir. J.C.M. van den Ende, EPS-2009-160-ORG, ISBN: 978-90-5892-197-), http://hdl.handle.net/1765/14974

Jennen, M.G.J., *Empirical Essays on Office Market Dynamics*, Promotors: Prof.dr. C.G. Koedijk & Prof.dr. D. Brounen, EPS-2008-140-F&A, ISBN: 978-90-5892-176-5, http://hdl.handle.net/1765/13692

Jiang, T., *Capital Structure Determinants and Governance Structure Variety in Franchising*, Promotors: Prof.dr. G. Hendrikse & Prof.dr. A. de Jong, EPS-2009-158-F&A, ISBN: 978-90-5892-199-4, http://hdl.handle.net/1765/14975

Jiao, T., *Essays in Financial Accounting*, Promotor: Prof.dr. G.M.H. Mertens, EPS-2009-176-F&A, ISBN: 978-90-5892-211-3, http://hdl.handle.net/1765/1

Jong, C. de, *Dealing with Derivatives: Studies on the Role, Informational Content and Pricing of Financial Derivatives*, Promotor: Prof.dr. C.G. Koedijk, EPS-2003-023-F&A, ISBN: 90-5892-043-7, http://hdl.handle.net/1765/1043

Kaa, G. van, *Standard Battles for Complex Systems: Empirical Research on the Home Network,* Promotors: Prof.dr.ir. J. van den Ende & Prof.dr.ir. H.W.G.M. van Heck, EPS-2009-166-ORG, ISBN: 978-90-5892-205-2, http://hdl.handle.net/1765/1

Kagie, M., *Advances in Online Shopping Interfaces: Product Catalog Maps and Recommender Systems,* Promotor: Prof.dr. P.J.F. Groenen, EPS-2010-195-MKT, ISBN: 978-90-5892-233-5, http://hdl.handle.net/1765/1

Keizer, A.B., *The Changing Logic of Japanese Employment Practices: A Firm-Level Analysis of Four Industries,* Promotors: Prof.dr. J.A. Stam & Prof.dr. J.P.M. Groenewegen, EPS-2005-057-ORG, ISBN: 90-5892-087-9, http://hdl.handle.net/1765/6667

Kijkuit, R.C., *Social Networks in the Front End: The Organizational Life of an Idea,* Promotor: Prof.dr. B. Nooteboom, EPS-2007-104-ORG, ISBN: 90-5892-137-6, http://hdl.handle.net/1765/10074

Kippers, J., *Empirical Studies on Cash Payments,* Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2004-043-F&A, ISBN: 90-5892-069-0, http://hdl.handle.net/1765/1520

Klein, M.H., *Poverty Alleviation through Sustainable Strategic Business Models: Essays on Poverty Alleviation as a Business Strategy,* Promotor: Prof.dr. H.R. Commandeur, EPS-2008-135-STR, ISBN: 978-90-5892-168-0, http://hdl.handle.net/1765/13482

Knapp, S., *The Econometrics of Maritime Safety: Recommendations to Enhance Safety at Sea*, Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2007-096-ORG, ISBN: 90-5892-127-1, http://hdl.handle.net/1765/7913

Kole, E., *On Crises, Crashes and Comovements*, Promotors: Prof.dr. C.G. Koedijk & Prof.dr. M.J.C.M. Verbeek, EPS-2006-083-F&A, ISBN: 90-5892-114-X, http://hdl.handle.net/1765/7829

Kooij-de Bode, J.M., *Distributed Information and Group Decision-Making: Effects of Diversity and Affect*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2007-115-ORG, http://hdl.handle.net/1765/10722

Koppius, O.R., *Information Architecture and Electronic Market Performance*, Promotors: Prof.dr. P.H.M. Vervest & Prof.dr.ir. H.W.G.M. van Heck, EPS-2002-013-LIS, ISBN: 90-5892-023-2, http://hdl.handle.net/1765/921

Kotlarsky, J., *Management of Globally Distributed Component-Based Software Development Projects,* Promotor: Prof.dr. K. Kumar, EPS-2005-059-LIS, ISBN: 90-5892-088-7, http://hdl.handle.net/1765/6772

Krauth, E.I., *Real-Time Planning Support: A Task-Technology Fit Perspective,* Promotors: Prof.dr. S.L. van de Velde & Prof.dr. J. van Hillegersberg, EPS-2008-155-LIS, ISBN: 978-90-5892-193-2, http://hdl.handle.net/1765/14521

Kuilman, J., *The Re-Emergence of Foreign Banks in Shanghai: An Ecological Analysis,* Promotor: Prof.dr. B. Krug, EPS-2005-066-ORG, ISBN: 90-5892-096-8, http://hdl.handle.net/1765/6926

Kwee, Z., *Investigating Three Key Principles of Sustained Strategic Renewal: A Longitudinal Study of Long-Lived Firms,* Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2009-174-STR, ISBN: 90-5892-212-0, http://hdl.handle.net/1765/1

Langen, P.W. de, *The Performance of Seaport Clusters: A Framework to Analyze Cluster Performance and an Application to the Seaport Clusters of Durban, Rotterdam and the Lower Mississippi*, Promotors: Prof.dr. B. Nooteboom & Prof. drs. H.W.H. Welters, EPS-2004-034-LIS, ISBN: 90-5892-056-9, http://hdl.handle.net/1765/1133

Le Anh, T., *Intelligent Control of Vehicle-Based Internal Transport Systems*, Promotors: Prof.dr. M.B.M. de Koster & Prof.dr.ir. R. Dekker, EPS-2005-051-LIS, ISBN: 90-5892-079-8, http://hdl.handle.net/1765/6554

Le-Duc, T., *Design and Control of Efficient Order Picking Processes*, Promotor: Prof.dr. M.B.M. de Koster, EPS-2005-064-LIS, ISBN: 90-5892-094-1, http://hdl.handle.net/1765/6910

Leeuwen, E.P. van, *Recovered-Resource Dependent Industries and the Strategic Renewal of Incumbent Firm: A Multi-Level Study of Recovered Resource Dependence Management and Strategic Renewal in the European Paper and Board Industry*, Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2007-109-STR, ISBN: 90-5892-140-6, http://hdl.handle.net/1765/10183

Lentink, R.M., *Algorithmic Decision Support for Shunt Planning*, Promotors: Prof.dr. L.G. Kroon & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2006-073-LIS, ISBN: 90-5892-104-2, http://hdl.handle.net/1765/7328

Li, T., *Informedness and Customer-Centric Revenue Management,* Promotors: Prof.dr. P.H.M. Vervest & Prof.dr.ir. H.W.G.M. van Heck, EPS-2009-146-LIS, ISBN: 978-90-5892-195-6, http://hdl.handle.net/1765/14525

Liang, G., *New Competition: Foreign Direct Investment and Industrial Development in China,* Promotor: Prof.dr. R.J.M. van Tulder, EPS-2004-047-ORG, ISBN: 90-5892-073-9, http://hdl.handle.net/1765/1795

Liere, D.W. van, *Network Horizon and the Dynamics of Network Positions: A Multi-Method Multi-Level Longitudinal Study of Interfirm Networks,* Promotor: Prof.dr. P.H.M. Vervest, EPS-2007-105-LIS, ISBN: 90-5892-139-0, http://hdl.handle.net/1765/10181

Loef, J., *Incongruity between Ads and Consumer Expectations of Advertising*, Promotors: Prof.dr. W.F. van Raaij & Prof.dr. G. Antonides, EPS-2002-017-MKT, ISBN: 90-5892-028-3, http://hdl.handle.net/1765/869

Maeseneire, W., de, *Essays on Firm Valuation and Value Appropriation,* Promotor: Prof.dr. J.T.J. Smit, EPS-2005-053-F&A, ISBN: 90-5892-082-8, http://hdl.handle.net/1765/6768

Londoño, M. del Pilar, *Institutional Arrangements that Affect Free Trade Agreements: Economic Rationality Versus Interest Groups*, Promotors: Prof.dr. H.E. Haralambides & Prof.dr. J.F. Francois, EPS-2006-078-LIS, ISBN: 90-5892-108-5, http://hdl.handle.net/1765/7578

Maas, A.A., van der, *Strategy Implementation in a Small Island Context: An Integrative Framework,* Promotor: Prof.dr. H.G. van Dissel, EPS-2008-127-LIS, ISBN: 978-90-5892-160-4, http://hdl.handle.net/1765/12278

Maas, K.E.G., *Corporate Social Performance: From Output Measurement to Impact Measurement,* Promotor: Prof.dr. H.R. Commandeur, EPS-2009-182-STR, ISBN: 978-90-5892-225-0, http://hdl.handle.net/1765/1

Maeseneire, W., de, *Essays on Firm Valuation and Value Appropriation,* Promotor: Prof.dr. J.T.J. Smit, EPS-2005-053-F&A, ISBN: 90-5892-082-8, http://hdl.handle.net/1765/6768

Mandele, L.M., van der, *Leadership and the Inflection Point: A Longitudinal Perspective*, Promotors: Prof.dr. H.W. Volberda & Prof.dr. H.R. Commandeur, EPS-2004-042-STR, ISBN: 90-5892-067-4, http://hdl.handle.net/1765/1302

Meer, J.R. van der, *Operational Control of Internal Transport*, Promotors: Prof.dr. M.B.M. de Koster & Prof.dr.ir. R. Dekker, EPS-2000-001-LIS, ISBN: 90-5892-004-6, http://hdl.handle.net/1765/859

Mentink, A., *Essays on Corporate Bonds*, Promotor: Prof.dr. A.C.F. Vorst, EPS-2005-070-F&A, ISBN: 90-5892-100-X, http://hdl.handle.net/1765/7121

Meyer, R.J.H., *Mapping the Mind of the Strategist: A Quantitative Methodology for Measuring the Strategic Beliefs of Executives*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2007-106-ORG, ISBN: 978-90-5892-141-3, http://hdl.handle.net/1765/10182

Miltenburg, P.R., *Effects of Modular Sourcing on Manufacturing Flexibility in the Automotive Industry: A Study among German OEMs*, Promotors: Prof.dr. J. Paauwe & Prof.dr. H.R. Commandeur, EPS-2003-030-ORG, ISBN: 90-5892-052-6, http://hdl.handle.net/1765/1039

Moerman, G.A., *Empirical Studies on Asset Pricing and Banking in the Euro Area,* Promotor: Prof.dr. C.G. Koedijk, EPS-2005-058-F&A, ISBN: 90-5892-090-9, http://hdl.handle.net/1765/6666

Moitra, D., *Globalization of R&D: Leveraging Offshoring for Innovative Capability and Organizational Flexibility,* Promotor: Prof.dr. K. Kumar, EPS-2008-150-LIS, ISBN: 978-90-5892-184-0, http://hdl.handle.net/1765/14081

Mol, M.M., *Outsourcing, Supplier-relations and Internationalisation: Global Source Strategy as a Chinese Puzzle*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2001-010-ORG, ISBN: 90-5892-014-3, http://hdl.handle.net/1765/355

Mom, T.J.M., *Managers' Exploration and Exploitation Activities: The Influence of Organizational Factors and Knowledge Inflows*, Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2006-079-STR, ISBN: 90-5892-116-6, http://hdl.handle.net/1765

Moonen, J.M., *Multi-Agent Systems for Transportation Planning and Coordination*, Promotors: Prof.dr. J. van Hillegersberg & Prof.dr. S.L. van de Velde, EPS-2009-177-LIS, ISBN: 978-90-5892-216-8, http://hdl.handle.net/1

Mulder, A., *Government Dilemmas in the Private Provision of Public Goods*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2004-045-ORG, ISBN: 90-5892-071-2, http://hdl.handle.net/1765/1790

Muller, A.R., *The Rise of Regionalism: Core Company Strategies Under The Second Wave of Integration*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2004-038-ORG, ISBN: 90-5892-062-3, http://hdl.handle.net/1765/1272

Nalbantov G.I., *Essays on Some Recent Penalization Methods with Applications in Finance and Marketing*, Promotor: Prof. dr P.J.F. Groenen, EPS-2008-132-F&A, ISBN: 978-90-5892-166-6, http://hdl.handle.net/1765/13319

Nederveen Pieterse, A., *Goal Orientation in Teams: The Role of Diversity*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2009-162-ORG, http://hdl.handle.net/1765/15240

Nguyen, T.T., *Capital Structure, Strategic Competition, and Governance*, Promotor: Prof.dr. A. de Jong, EPS-2008-148-F&A, ISBN: 90-5892-178-9, http://hdl.handle.net/1765/14005

Niesten, E.M.M.I., *Regulation, Governance and Adaptation: Governance Transformations in the Dutch and French Liberalizing Electricity Industries*, Promotors: Prof.dr. A. Jolink & Prof.dr. J.P.M. Groenewegen, EPS-2009-170-ORG, ISBN: 978-90-5892-208-3, http://hdl.handle.net/1765/1

Nieuwenboer, N.A. den, *Seeing the Shadow of the Self*, Promotor: Prof.dr. S.P. Kaptein, EPS-2008-151-ORG, ISBN: 978-90-5892-182-6, http://hdl.handle.net/1765/14223

Ning, H., *Hierarchical Portfolio Management: Theory and Applications*, Promotor: Prof.dr. J. Spronk, EPS-2007-118-F&A, ISBN: 90-5892-152-9, http://hdl.handle.net/1765/10868

Noeverman, J., *Management Control Systems, Evaluative Style, and Behaviour: Exploring the Concept and Behavioural Consequences of Evaluative Style*, Promotors: Prof.dr. E.G.J. Vosselman & Prof.dr. A.R.T. Williams, EPS-2007-120-F&A, ISBN: 90-5892-151-2, http://hdl.handle.net/1765/10869

Nuijten, I., *Servant Leadership: Paradox or Diamond in the Rough? A Multidimensional Measure and Empirical Evidence*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2009-183-ORG, http://hdl.handle.net/1765/1

Oosterhout, J., van, *The Quest for Legitimacy: On Authority and Responsibility in Governance*, Promotors: Prof.dr. T. van Willigenburg & Prof.mr. H.R. van Gunsteren, EPS-2002-012-ORG, ISBN: 90-5892-022-4, http://hdl.handle.net/1765/362

Oostrum, J.M., van, *Applying Mathematical Models to Surgical Patient Planning*, Promotor: Prof.dr. A.P.M. Wagelmans, EPS-2009-179-LIS, ISBN: 978-90-5892-217-5, http://hdl.handle.net/1765/1

Paape, L., *Corporate Governance: The Impact on the Role, Position, and Scope of Services of the Internal Audit Function*, Promotors: Prof.dr. G.J. van der Pijl & Prof.dr. H. Commandeur, EPS-2007-111-MKT, ISBN: 90-5892-143-7, http://hdl.handle.net/1765/10417

Pak, K., *Revenue Management: New Features and Models*, Promotor: Prof.dr.ir. R. Dekker, EPS-2005-061-LIS, ISBN: 90-5892-092-5, http://hdl.handle.net/1765/362/6771

Pattikawa, L.H, *Innovation in the Pharmaceutical Industry: Evidence from Drug Introduction in the U.S.*, Promotors: Prof.dr. H.R.Commandeur, EPS-2007-102-MKT, ISBN: 90-5892-135-2, http://hdl.handle.net/1765/9626

Peeters, L.W.P., *Cyclic Railway Timetable Optimization*, Promotors: Prof.dr. L.G. Kroon & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2003-022-LIS, ISBN: 90-5892-042-9, http://hdl.handle.net/1765/429

Pietersz, R., *Pricing Models for Bermudan-style Interest Rate Derivatives*, Promotors: Prof.dr. A.A.J. Pelsser & Prof.dr. A.C.F. Vorst, EPS-2005-071-F&A, ISBN: 90-5892-099-2, http://hdl.handle.net/1765/7122

Poel, A.M. van der, *Empirical Essays in Corporate Finance and Financial Reporting*, Promotors: Prof.dr. A. de Jong & Prof.dr. G.M.H. Mertens, EPS-2007-133-F&A, ISBN: 978-90-5892-165-9, http://hdl.handle.net/1765/13320

Popova, V., *Knowledge Discovery and Monotonicity*, Promotor: Prof.dr. A. de Bruin, EPS-2004-037-LIS, ISBN: 90-5892-061-5, http://hdl.handle.net/1765/1201

Pouchkarev, I., *Performance Evaluation of Constrained Portfolios*, Promotors: Prof.dr. J. Spronk & Dr. W.G.P.M. Hallerbach, EPS-2005-052-F&A, ISBN: 90-5892-083-6, http://hdl.handle.net/1765/6731

Prins, R., *Modeling Consumer Adoption and Usage of Value-Added Mobile Services*, Promotors: Prof.dr. Ph.H.B.F. Franses & Prof.dr. P.C. Verhoef, EPS-2008-128-MKT, ISBN: 978/90-5892-161-1, http://hdl.handle.net/1765/12461

Puvanasvari Ratnasingam, P., *Interorganizational Trust in Business to Business E-Commerce*, Promotors: Prof.dr. K. Kumar & Prof.dr. H.G. van Dissel, EPS-2001-009-LIS, ISBN: 90-5892-017-8, http://hdl.handle.net/1765/356

Quak, H.J., *Sustainability of Urban Freight Transport: Retail Distribution and Local Regulation in Cities*, Promotor: Prof.dr. M.B.M. de Koster, EPS-2008-124-LIS, ISBN: 978-90-5892-154-3, http://hdl.handle.net/1765/11990

Quariguasi Frota Neto, J., *Eco-efficient Supply Chains for Electrical and Electronic Products*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr.ir. H.W.G.M. van Heck, EPS-2008-152-LIS, ISBN: 978-90-5892-192-5, http://hdl.handle.net/1765/14785

Radkevitch, U.L, *Online Reverse Auction for Procurement of Services*, Promotor: Prof.dr.ir. H.W.G.M. van Heck, EPS-2008-137-LIS, ISBN: 978-90-5892-171-0, http://hdl.handle.net/1765/13497

Rinsum, M. van, *Performance Measurement and Managerial Time Orientation*, Promotor: Prof.dr. F.G.H. Hartmann, EPS-2006-088-F&A, ISBN: 90-5892-121-2, http://hdl.handle.net/1765/7993

Roelofsen, E.M., *The Role of Analyst Conference Calls in Capital Markets*, Promotors: Prof.dr. G.M.H. Mertens & Prof.dr. L.G. van der Tas RA, EPS-2010-190-F&A, ISBN: 978-90-5892-228-1, http://hdl.handle.net/1765/1

Romero Morales, D., *Optimization Problems in Supply Chain Management*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Dr. H.E. Romeijn, EPS-2000-003-LIS, ISBN: 90-9014078-6, http://hdl.handle.net/1765/865

Roodbergen, K.J., *Layout and Routing Methods for Warehouses*, Promotors: Prof.dr. M.B.M. de Koster & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2001-004-LIS, ISBN: 90-5892-005-4, http://hdl.handle.net/1765/861

Rook, L., *Imitation in Creative Task Performance*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2008-125-ORG, http://hdl.handle.net/1765/11555

Rosmalen, J. van, *Segmentation and Dimension Reduction: Exploratory and Model-Based Approaches*, Promotor: Prof.dr. P.J.F. Groenen, EPS-2009-165-MKT, ISBN: 978-90-5892-201-4, http://hdl.handle.net/1765/15536

Rus, D., *The Dark Side of Leadership: Exploring the Psychology of Leader Self-serving Behavior*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2009-178-ORG, http://hdl.handle.net/1765/1

Samii, R., *Leveraging Logistics Partnerships: Lessons from Humanitarian Organizations,* Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr.ir. L.N. Van Wassenhove, EPS-2008-153-LIS, ISBN: 978-90-5892-186-4, http://hdl.handle.net/1765/14519

Schaik, D. van, *M&A in Japan: An Analysis of Merger Waves and Hostile Takeovers,* Promotors: Prof.dr. J. Spronk & Prof.dr. J.P.M. Groenewegen, EPS-2008-141-F&A, ISBN: 978-90-5892-169-7, http://hdl.handle.net/1765/13693

Schauten, M.B.J., *Valuation, Capital Structure Decisions and the Cost of Capital,* Promotors: Prof.dr. J. Spronk & Prof.dr. D. van Dijk, EPS-2008-134-F&A, ISBN: 978-90-5892-172-7, http://hdl.handle.net/1765/13480

Schramade, W.L.J., *Corporate Bonds Issuers,* Promotor: Prof.dr. A. De Jong, EPS-2006-092-F&A, ISBN: 90-5892-125-5, http://hdl.handle.net/1765/8191

Schweizer, T.S., *An Individual Psychology of Novelty-Seeking, Creativity and Innovation,* Promotor: Prof.dr. R.J.M. van Tulder, EPS-2004-048-ORG, ISBN: 90-5892-077-1, http://hdl.handle.net/1765/1818

Six, F.E., *Trust and Trouble: Building Interpersonal Trust Within Organizations*, Promotors: Prof.dr. B. Nooteboom & Prof.dr. A.M. Sorge, EPS-2004-040-ORG, ISBN: 90-5892-064-X, http://hdl.handle.net/1765/1271

Slager, A.M.H., *Banking across Borders*, Promotors: Prof.dr. R.J.M. van Tulder & Prof.dr. D.M.N. van Wensveen, EPS-2004-041-ORG, ISBN: 90-5892-066–6, http://hdl.handle.net/1765/1301

Sloot, L., *Understanding Consumer Reactions to Assortment Unavailability*, Promotors: Prof.dr. H.R. Commandeur, Prof.dr. E. Peelen & Prof.dr. P.C. Verhoef, EPS-2006-074-MKT, ISBN: 90-5892-102-6, http://hdl.handle.net/1765/7438

Smit, W., *Market Information Sharing in Channel Relationships: Its Nature, Antecedents and Consequences*, Promotors: Prof.dr.ir. G.H. van Bruggen & Prof.dr.ir. B. Wierenga, EPS-2006-076-MKT, ISBN: 90-5892-106-9, http://hdl.handle.net/1765/7327

Sonnenberg, M., *The Signalling Effect of HRM on Psychological Contracts of Employees: A Multi-level Perspective*, Promotor: Prof.dr. J. Paauwe, EPS-2006-086-ORG, ISBN: 90-5892-119-0, http://hdl.handle.net/1765/7995

Speklé, R.F., *Beyond Generics: A closer Look at Hybrid and Hierarchical Governance*, Promotor: Prof.dr. M.A. van Hoepen RA, EPS-2001-008-F&A, ISBN: 90-5892-011-9, http://hdl.handle.net/1765/357

Srour, F.J., *Dissecting Drayage: An Examination of Structure, Information, and Control in Drayage Operations*, Promotor: Prof.dr. S.L. van de Velde, EPS-2010-186-LIS, http://hdl.handle.net/1765/1

Stam, D.A., *Managing Dreams and Ambitions: A Psychological Analysis of Vision Communication*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2008-149-ORG, http://hdl.handle.net/1765/14080

Stienstra, M., *Strategic Renewal in Regulatory Environments: How Inter- and Intra-organisational Institutional Forces Influence European Energy Incumbent Firms,* Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2008-145-STR, ISBN: 978-90-5892-184-0, http://hdl.handle.net/1765/13943

Sweldens, S.T.L.R., *Evaluative Conditioning 2.0: Direct versus Associative Transfer of Affect to Brands,* Promotor: Prof.dr. S.M.J. van Osselaer, EPS-2009-167-MKT, ISBN: 978-90-5892-204-5, http://hdl.handle.net/1765/1

Szkudlarek, B.A*., Spinning the Web of Reentry: [Re]connecting reentry training theory and practice*, Promotor: Prof.dr. S.J. Magala, EPS-2008-143-ORG, ISBN: 978-90-5892-177-2, http://hdl.handle.net/1765/13695

Tempelaar, M.P., *Organizing for Ambidexterity: Studies on the Pursuit of Exploration and Exploitation through Differentiation, Integration, Contextual and Individual Attributes,* Promotors: Prof.dr.ing. F.A.J. van den Bosch & Prof.dr. H.W. Volberda, EPS-2010-191-STR, ISBN: 978-90-5892-231-1, http://hdl.handle.net/1765/1

Teunter, L.H., *Analysis of Sales Promotion Effects on Household Purchase Behavior*, Promotors: Prof.dr.ir. B. Wierenga & Prof.dr. T. Kloek, EPS-2002-016-MKT, ISBN: 90-5892-029-1, http://hdl.handle.net/1765/868

Tims, B., Empirical Studies on Exchange Rate Puzzles and Volatility, Promotor: Prof.dr. C.G. Koedijk, EPS-2006-089-F&A, ISBN: 90-5892-113-1, http://hdl.handle.net/1765/8066

Tuk, M.A., Is Friendship Silent When Money Talks? How Consumers Respond to Word-of-Mouth Marketing, Promotors: Prof.dr.ir. A. Smidts & Prof.dr. D.H.J. Wigboldus, EPS-2008-130-MKT, ISBN: 978-90-5892-164-2, http://hdl.handle.net/1765/12702

Valck, K. de, *Virtual Communities of Consumption: Networks of Consumer Knowledge and Companionship*, Promotors: Prof.dr.ir. G.H. van Bruggen & Prof.dr.ir. B. Wierenga, EPS-2005-050-MKT, ISBN: 90-5892-078-X, http://hdl.handle.net/1765/6663

Valk, W. van der, *Buyer-Seller Interaction Patterns During Ongoing Service Exchange*, Promotors: Prof.dr. J.Y.F. Wynstra & Prof.dr.ir. B. Axelsson, EPS-2007-116-MKT, ISBN: 90-5892-146-8, http://hdl.handle.net/1765/10856

Verheul, I., *Is There a (Fe)male Approach? Understanding Gender Differences in Entrepreneurship*, Prof.dr. A.R. Thurik, EPS-2005-054-ORG, ISBN: 90-5892-080-1, http://hdl.handle.net/1765/2005

Verwijmeren, P., *Empirical Essays on Debt, Equity, and Convertible Securities*, Promotors: Prof.dr. A. de Jong & Prof.dr. M.J.C.M. Verbeek, EPS-2009-154-F&A, ISBN: 978-90-5892-187-1, http://hdl.handle.net/1765/14312

Vis, I.F.A., *Planning and Control Concepts for Material Handling Systems*, Promotors: Prof.dr. M.B.M. de Koster & Prof.dr.ir. R. Dekker, EPS-2002-014-LIS, ISBN: 90-5892-021-6, http://hdl.handle.net/1765/866

Vlaar, P.W.L., *Making Sense of Formalization in Interorganizational Relationships: Beyond Coordination and Control,* Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2006-075-STR, ISBN 90-5892-103-4, http://hdl.handle.net/1765/7326

Vliet, P. van, *Downside Risk and Empirical Asset Pricing*, Promotor: Prof.dr. G.T. Post, EPS-2004-049-F&A, ISBN: 90-5892-07-55, http://hdl.handle.net/1765/1819

Vlist, P. van der, *Synchronizing the Retail Supply Chain*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr. A.G. de Kok, EPS-2007-110-LIS, ISBN: 90-5892-142-0, http://hdl.handle.net/1765/10418

Vries-van Ketel E. de, *How Assortment Variety Affects Assortment Attractiveness: A Consumer Perspective*, Promotors: Prof.dr. G.H. van Bruggen & Prof.dr.ir. A. Smidts, EPS-2006-072-MKT, ISBN: 90-5892-101-8, http://hdl.handle.net/1765/7193

Vromans, M.J.C.M., *Reliability of Railway Systems*, Promotors: Prof.dr. L.G. Kroon, Prof.dr.ir. R. Dekker & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2005-062-LIS, ISBN: 90-5892-089-5, http://hdl.handle.net/1765/6773

Vroomen, B.L.K., *The Effects of the Internet, Recommendation Quality and Decision Strategies on Consumer Choice*, Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2006-090-MKT, ISBN: 90-5892-122-0, http://hdl.handle.net/1765/8067

Waal, T. de, *Processing of Erroneous and Unsafe Data*, Promotor: Prof.dr.ir. R. Dekker, EPS-2003-024-LIS, ISBN: 90-5892-045-3, http://hdl.handle.net/1765/870

Waard, E.J. de, *Engaging Environmental Turbulence: Organizational Determinants for Repetitive Quick and Adequate Responses*, Promotors: Prof.dr. H.W. Volberda & Prof.dr. J. Soeters, EPS-2010-189-STR, ISBN: 978-90-5892-229-8, http://hdl.handle.net/1765/1

Wall, R.S., *Netscape: Cities and Global Corporate Networks,* Promotor: Prof.dr. G.A. van der Knaap, EPS-2009-169-ORG, ISBN: 978-90-5892-207-6, http://hdl.handle.net/1765/1

Watkins Fassler, K., *Macroeconomic Crisis and Firm Performance,* Promotors: Prof.dr. J. Spronk & Prof.dr. D.J. van Dijk, EPS-2007-103-F&A, ISBN: 90-5892-138-3, http://hdl.handle.net/1765/10065

Weerdt, N.P. van der, *Organizational Flexibility for Hypercompetitive Markets: Empirical Evidence of the Composition and Context Specificity of Dynamic Capabilities and Organization Design Parameters,* Promotor: Prof.dr. H.W. Volberda, EPS-2009-173-STR, ISBN: 978-90-5892-215-1, http://hdl.handle.net/1765/1

Wennekers, A.R.M., *Entrepreneurship at Country Level: Economic and Non-Economic Determinants,* Promotor: Prof.dr. A.R. Thurik, EPS-2006-81-ORG, ISBN: 90-5892-115-8, http://hdl.handle.net/1765/7982

Wielemaker, M.W., *Managing Initiatives: A Synthesis of the Conditioning and Knowledge-Creating View*, Promotors: Prof.dr. H.W. Volberda & Prof.dr. C.W.F. Baden-Fuller, EPS-2003-28-STR, ISBN: 90-5892-050-X, http://hdl.handle.net/1765/1042

Wijk, R.A.J.L. van, *Organizing Knowledge in Internal Networks: A Multilevel Study*, Promotor: Prof.dr.ir. F.A.J. van den Bosch, EPS-2003-021-STR, ISBN: 90-5892-039-9, http://hdl.handle.net/1765/347

Wolters, M.J.J., *The Business of Modularity and the Modularity of Business*, Promotors: Prof. mr. dr. P.H.M. Vervest & Prof.dr.ir. H.W.G.M. van Heck, EPS-2002-011-LIS, ISBN: 90-5892-020-8, http://hdl.handle.net/1765/920

Wubben, M.J.J., *Social Functions of Emotions in Social Dilemmas*, Promotors: Prof.dr. D. De Cremer & Prof.dr. E. van Dijk, EPS-2009-187-ORG, http://hdl.handle.net/1765/1

Xu, Y., *Empirical Essays on the Stock Returns, Risk Management, and Liquidity Creation of Banks*, Promotor: Prof.dr. M.J.C.M. Verbeek, EPS-2010-188-F&A, http://hdl.handle.net/1765/1

Yang, J., *Towards the Restructuring and Co-ordination Mechanisms for the Architecture of Chinese Transport Logistics*, Promotor: Prof.dr. H.E. Haralambides, EPS-2009-157-LIS, ISBN: 978-90-5892-198-7, http://hdl.handle.net/1765/14527

Yu, M., *Enhancing Warehouse Perfromance by Efficient Order Picking*, Promotor: Prof.dr. M.B.M. de Koster, EPS-2008-139-LIS, ISBN: 978-90-5892-167-3, http://hdl.handle.net/1765/13691

Zhang, X., *Strategizing of Foreign Firms in China: An Institution-based Perspective*, Promotor: Prof.dr. B. Krug, EPS-2007-114-ORG, ISBN: 90-5892-147-5, http://hdl.handle.net/1765/10721

Zhu, Z., *Essays on China's Tax System*, Promotors: Prof.dr. B. Krug & Prof.dr. G.W.J. Hendrikse, EPS-2007-112-ORG, ISBN: 90-5892-144-4, http://hdl.handle.net/1765/10502

Zwart, G.J. de, *Empirical Studies on Financial Markets: Private Equity, Corporate Bonds and Emerging Markets*, Promotors: Prof.dr. M.J.C.M. Verbeek & Prof.dr. D.J.C. van Dijk, EPS-2008-131-F&A, ISBN: 978-90-5892-163-5, http://hdl.handle.net/1765/12703

BUNDLING STRATEGIES IN GLOBAL SUPPLY CHAINS

The development of logistics has offered a wide range of new business opportunities for transport operators. Shipping lines have been taking advantage of these opportunities and have expanded their business scope beyond the movement of cargo to include, for example, coordination among transport modes, route rationalisation and even value added logistics services. Carriers offer today transportation as part of integrated global supply chain solutions in an attempt to provide a better service to their customers as well as improve their bottom lines. This appears to be a winning strategy since an increasing number of industry players are investing in logistics operations and infrastructure.

The offering of products and services jointly as a package or bundle is a common marketing strategy in a variety of industries and also appears to be a successful strategy for enhancing shipping lines' competitiveness and profitability. Only limited research is available though to better understand under what conditions such bundled sales are possible; what attitude shippers show towards this industry trend; how bundling strategies could be developed optimally; and how they could be priced. This thesis is a contribution to research in this area and provides an analysis of the viability and the benefits of bundling strategies in the container industry, and specifically with reference to the joint provision of ocean transportation and other logistics services.

ERIM

The Erasmus Research Institute of Management (ERIM) is the Research School (Onderzoekschool) in the field of management of the Erasmus University Rotterdam. The founding participants of ERIM are Rotterdam School of Management (RSM), and the Erasmus School of Economics (ESE). ERIM was founded in 1999 and is officially accredited by the Royal Netherlands Academy of Arts and Sciences (KNAW). The research undertaken by ERIM is focused on the management of the firm in its environment, its intra- and interfirm relations, and its business processes in their interdependent connections.

The objective of ERIM is to carry out first rate research in management, and to offer an advanced doctoral programme in Research in Management. Within ERIM, over three hundred senior researchers and PhD candidates are active in the different research programmes. From a variety of academic backgrounds and expertises, the ERIM community is united in striving for excellence and working at the forefront of creating new business knowledge.

Erasmus Research Institute of Management - ERIM

ERIM PhD Series
Research in Management

Erasmus Research Institute of Management - **ERIM**
Rotterdam School of Management (RSM)
Erasmus School of Economics (ESE)
P.O. Box 1738, 3000 DR Rotterdam
The Netherlands

Tel. +31 10 408 11 82
Fax +31 10 408 96 40
E-mail info@erim.eur.nl
Internet www.erim.eur.nl

Design & layout: B&T Ontwerp en advies (www.b-en-t.nl) Print: Haveka (www.haveka.nl)