WOUTER DE MAESENEIRE

Essays on Firm Valuation and Value Appropriation

ESSAYS ON FIRM VALUATION AND VALUE APPROPRIATION

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Promotor:
Prof.dr. J.T.J. Smit

Overige leden:
Prof.dr.ing. S. Manigart
Prof.dr. J. Spronk
Prof.dr. D.M. Wright

Preface

While traditional valuation methods such as discounted cash flow (DCF) are widely being used in real life, more sophisticated techniques such as adjusted present value (APV) and real options (RO) attract ever-increasing attention from theory and practice. A wide range of papers covering very diverse areas of application for these advanced tools have been published over the recent years. However, in contrast to their extensive knowledge about techniques that can be applied for valuing acquisitions, academics have an incomplete understanding of how the value created in acquisitions is split up between the target's and acquirer's shareholders. Strategic literature points to the importance of possessing unique capabilities and both the strategic and financial literature emphasize the role of information asymmetry in determining the acquirer value appropriation.

This PhD thesis discusses both simple and more complex valuation models of acquisitions. Our valuation and value appropriation models consider the specific capabilities of the evaluator. We propose an innovative application of an option-game model that takes rival bidders' resources into account. The analysis provided in the thesis aims to further bridge the gap between finance and strategic management.

This dissertation consists of the following chapters: '*The Valuation of IPOs by Underwriting Investment Banks and the Stock Market*', '*The Role of Investor Capabilities in Public-to-Private Transactions*', and '*Acquisitions as a Real Options Bidding Game*'. Each chapter is based on a paper. The first chapter is empirical work, the second is of a more conceptual nature and the third one is based on theoretical modeling.

All three papers from which the chapters draw are under submission at high-quality journals, and have been presented at several international conferences (e.g., the EIASM International Workshop on Capital Market Research, Valencia, 2001; the Financial Management Association European Meeting, Copenhague, 2002; the European Financial Management Association Conference, Londen, 2002; the Strategic Management Society Conference, San Juan, 2004). This research has also been presented at several Belgian and Dutch universities.

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Wouter De Maeseneire
Deinze, May 2005

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Introduction to the dissertation

1. Introduction

Though valuation methods such as discounted cash flow (DCF) are broadly applied in practice, more sophisticated techniques such as adjusted present value (APV) are receiving increasing attention. However, the new valuation paradigm that is really on the forefront, both at an academic and practitioner level, is real options. In a survey of US firms, Graham & Harvey (2001) found that about 27% of the CFOs already use real options for project evaluation. Valuation experts like Tom Copeland also expect a rapid growth in the acceptance and application of the real option technique, and even predict real options to replace the DCF methodology, as the latter method is only a specific case of a real options valuation.

Myers (1977) introduced 'real options' by extending the idea of financial options to real assets. Since then, several types of real options have been developed in the financial strand of literature. In the early real options literature, competitive effects were ignored or assumed to be exogenous. However, if there is a competitive threat, whereby a firm's payoff is affected by its rivals' actions, competitive interactions have an impact on the value of real options and their optimal exercise strategies. Only recently have strategic considerations, particularly with regard to imperfect competition, been treated in a formal way in the finance and more general economic literature. Kester (1984) discusses concepts of the strategic and competitive aspects of growth opportunities. Baldwin (1987) and Trigeorgis (1991) show that a firm anticipating future competitive entry at a specified time will invest earlier for pre-emptive reasons. Kogut (1991), Williams (1993), Dixit & Pindyck (1994), McGahan (1993), Nichols (1994), Kulatilaka & Perotti (1998), Smit & Trigeorgis (1998, 2004), Huisman & Kort (1999), Grenadier (2000 a,b), Lambrecht (2000), Huisman (2001), Perotti & Rossetto (2002), Weeds (2002), Kranenburg, Perotti, & Rossetto (2004) and others provide various treatments of the intersection between real options and game theory with applications in R&D, joint research ventures, real estate, consumer electronics and pharmaceuticals. Real options have also penetrated the strategic literature (Bowman & Hurry, 1993; McGrath, 1997; Chi, 2000). Research on the combined field of real options and game theory is rapidly growing; for an overview, we refer to Smit & Trigeorgis (2004).

In contrast to their extensive knowledge about traditional and real option techniques that can be applied for valuing acquisitions, academics still need to further develop theories

(and empirical evidence supporting them) about the distribution of the value creation between the target and acquirer. In other words, what part of the value creation can the acquirer appropriate? Strategic management literature points to the importance of possessing unique capabilities, and both the strategic and financial literature emphasize the role of information asymmetry. In this dissertation both simple and more complex valuation models are discussed, and in the last chapter we apply an integrated real option-game model to analyze the value appropriated by acquiring firms. In our valuation and value appropriation models, the specific resources and capabilities of the evaluator are considered. By taking the acquirer resources into account and by proposing an innovative application of a combined option-game model, this dissertation aims to further bridge the gap between finance and strategic management theory.

This dissertation consists of the collection of the following three papers: '*The Valuation of IPOs by Underwriting Investment Banks and the Stock Market*' (joint work with Marc Deloof and Koen Inghelbrecht), '*The Role of Investor Capabilities in Public-to-Private Transactions*', and '*Acquisitions as a Real Options Bidding Game*' (joint work with Han Smit and Ward van den Berg). The first paper is empirical work, the second is a conceptual synthesis and the third one is based on a theoretical model. The common topic covered is valuation (all three papers) and value appropriation (second and third paper). The dissertation discusses the real option perspective next to the traditional valuation methodologies.

The first chapter examines the valuation methods used by underwriting investment banks for initial public offerings (IPOs). It investigates how the offer price is set and analyzes to what extent the investment banks' valuation results deviate from the stock market price shortly after the first listing. Traditional valuation models such as discounted cash flow are widely used whereas novel developments like real option methods, in contrast to the US, have currently not yet been applied or even discussed for any of the IPOs in our sample. This is probably due to its more complex character and the fact that real-life real option applications are still in their infancy. The second chapter describes a valuation model for the various sources of value creation in a public-to-private transaction and links the investor's value appropriation to its idiosyncratic capabilities. One of the unique resources and value components within our framework is the opportunity (real option) provided by the initial acquisition of a public-to-private target to lever the investor's core competences by pursuing follow-on investments, for instance within a buy-and-build strategy. The third chapter examines how the value creation in acquisitions is distributed between the target's and the acquirer's shareholders within a setting of asymmetric and costly information. A real option

model that explicitly incorporates a rival bidder's reactions is used to analyze bidding contests, the level of the bidding premium and the expected acquirer value appropriation.

2. Overview of the dissertation

The first chapter examines the accuracy of the various valuation models as used by the underwriting investment banks, for a sample of 49 IPOs that were listed on Euronext Brussels in the 1993-2001 period. A number of papers in both the accounting and finance literature look into the accuracy of valuation methods and a mass of research has been published about IPOs. However, there is almost no literature about the valuation of IPOs and the accuracy of that valuation. In Belgium, pre-IPO valuation estimates by the underwriting investment bank are published in the IPO prospectus. This enables us to examine the accuracy of the ex-ante valuation models as used by the underwriter, whereas other papers in the field analyze the ex-post value estimates of academics. We furthermore investigate how the offer price is set and whether investment banks use additional information next to their value estimates when setting the issue price. Our analysis provides insights in both valuation and the broader IPO context.

The second chapter investigates the value of a public-to-private leveraged management buyout (PTP), considered from the perspective of a private equity investor. Its main contribution is the fact that it provides an integration of finance and strategic management to explain the actual developments and overall evolution taking place within the buyout market. Next to the traditional factors (reducing agency problems and information-asymmetry, tax shields, value added services provided by the private equity investor) we discuss the levering of the private investor's capabilities. These may result in synergetic benefits that might exist between the target and the current portfolio companies, and in intertemporal synergies, i.e., the real option or opportunity to realize synergetic effects by making follow-on investments which build on the initial PTP. All the sources of value are integrated within an expanded adjusted present value criterion, which incorporates both the operational and financial value, as well as the real option value of a public-to-private. We link the private investor's value appropriation to its unique capabilities and propose that buyout firms will further specialize and pursue more innovative investment strategies such as buy-and-build.

The third chapter analyses the value appropriation of the acquiring firm in a takeover. It presents an integrated real options-game model that examines the bidding process, the likelihood of a bidding contest and the expected value appropriation for the acquirer from a resource-based perspective. We consider the opportunity to bid on a potential target as a real option on the target's resources in a competitive setting with imperfect and costly information. Performing due diligence can be considered as the purchase of a real option on the target. Potential buyers need to incur due diligence costs (option premium) in order to become informed about their specific target value (underlying value) before making a bid (exercise price). In a bidding contest the exercise price is affected by the competitor's target valuation, requiring an option-game model with imperfect information. A higher value of this real option and a lower option premium induce rivals to enter a bidding contest and reduce the acquirer's expected value appropriation. The contribution of our model is that when considering acquisitions as options games, new -and less obvious- parameters related to uncertainty, such as volatility and correlation between bidders, affect value appropriation.

The final chapter summarizes this dissertation, its main findings and implications. It outlines how the dissertation aims to contribute to our knowledge on valuation and value appropriation, and how it has taken a step further in bridging the gap between strategic management and finance. Furthermore, it provides a number of directions for future research.

Chapter 1

The Valuation of IPOs by Underwriting Investment Banks and the Stock Market

Chapter 1: The Valuation of IPOs by Underwriting Investment Banks and the Stock Market[1]

Abstract

We analyze the underwriting investment banks' valuation of 49 IPOs on Euronext Brussels in the 1993-2001 period. We find that for each IPO several valuation methods are used, of which Discounted Free Cash Flow (DFCF) is the most popular, but the offer price seems to be mainly driven by the Dividend Discount Model (DDM) if applied. Our results suggest that DDM tends to underestimate value, while DFCF produces unbiased value estimates. When multiples valuation is used, investment banks rely mostly on future earnings and cash flows. Moreover, multiples valuation based on post-IPO forecasted earnings and cash flows leads to more accurate valuations than multiples valuation based on earnings and cash flows in the IPO-year. Consistent with the hypothesis that lead underwriters use other valuable information besides value estimates to set the final offer price, our results indicate that the final offer price is closer to the post-IPO stock market price than individual value estimates.

1.1. Introduction

A firm conducting an initial public offering (IPO) needs to have its stock valued before the IPO, in order to determine a price range within which the stock will be offered to the public. There are several methods available for stock valuation. The most widely used valuation approaches are the dividend discount model (DDM), the discounted free cash flow (DFCF) method, and valuation approaches that rely on multiples of firms in similar industries and firms involved in similar transactions.

[1] This chapter is based on the paper 'The Valuation of IPOs by Underwriting Investment Banks and the Stock Market: Empirical Evidence', Marc Deloof, Koen Inghelbrecht, & Wouter De Maeseneire, Working Paper Ghent University 02/136, 2002. I am grateful to An Buysschaert, Marc De Ceuster, Nancy Huyghebaert, Marc Jegers, Rez Kabir, Sophie Manigart, Ilse Verschueren and two anonymous referees for helpful comments and suggestions. This paper has also benefited from presentations at the 2001 EIASM International Workshop on Capital Market Research (Valencia), the 2001 meeting of the Flemish Economic Association (Diepenbeek), the 2002 FMA European meeting (Copenhagen), the 2002 EFMA meeting (London), and a research seminar at the Katholieke Universiteit Leuven.

While there are many papers on the accuracy of valuation methods, and there is a very extensive literature on IPOs, few papers focus on the valuation of IPOs. Two studies investigate the accuracy of IPO valuation.[2] Kim & Ritter (1999) value a sample of IPOs in the US using P/E and price-to-book comparables, and find that these methods lead to very imprecise valuations when historical accounting numbers are used. However, when forecasted earnings are used, the accuracy of the valuation improves substantially. Berkman, Bradbury, & Ferguson (2000), who value 45 newly listed firms in New Zealand, conclude that the best discounted cash flow and P/E valuations have similar accuracy.

An important feature of these and other studies on the accuracy of valuation methods is that they use ex post value estimations by the researcher(s). In Belgium, pre-IPO value estimates by the lead underwriting investment bank are often published in the IPO-prospectus, which is made available at the start of the public offering. This allows us to examine the accuracy of the valuation models *as used by investment banks*. It can be expected that the accuracy of *ex ante* valuation by investment banks will differ from the valuation accuracy measured by academics, for several reasons. Value estimates by investment banks may be *less* accurate because academics are more objective than investment banks, who may be tempted to report valuations that justify a high price, for instance by choosing comparables with high multiples, or a low price, in order to reduce marketing efforts. On the other hand, value estimates by investment banks may be *more* accurate than value estimates by academics because investment banks have more information for valuation available. Moreover, as the stock market is pricing *perceptions* of the future and not the future itself, the value estimates by lead underwriters and the offer price, which to some extent will be based on these value estimates, may influence these perceptions and therefore the stock price. However, in an efficient market mispricing by underwriters should not affect market valuation.

In this chapter, we investigate the valuation by the underwriters of 49 IPOs on Euronext Brussels (formerly the Brussels Stock Exchange) in the 1993-2001 period. We address two research questions. First, we want to know how IPOs are valued. What valuation models do underwriters use, and how do they set the offer price, given the value estimates? Second, we investigate which of the valuation models, as used by underwriters, provides the best estimation of the stock market price. Do these valuation methods produce unbiased results, and what is the accuracy of the valuations?

[2] A number of papers investigate determinants of IPO valuation, but do not consider valuation accuracy (e.g., Krinsky & Rotenberg, 1989; Clarkson, Dontoh, Richardson, & Sefcik, 1992; McGuinness, 1993; Klein, 1996; Roosenboom & Van der Goot, 2003).

We find that for each IPO several valuation methods are used, of which DFCF is the most popular method: the DFCF model is used to value all IPOs in the sample. However, the offer price is set closer to DDM estimates if DDM is applied. This is remarkable, as a comparison of pre-IPO valuations to the average stock price in the first month of listing and to the stock price on post-IPO days +1, +10, +20 and +30 suggests that the dividend discount model tends to underestimate value, while discounted free cash flow produces unbiased results. Interviews with investment bankers indicate that underwriters consciously underprice IPOs, by applying a deliberate discount to DFCF value estimates. DFCF is considered to be the most reliable method. DDM estimates are on average closer to the preliminary offer price than other value estimates, because DDM tends to underestimate value.

We also find that P/E and price/cash flow (P/CF) multiples using earnings and cash flows in the IPO-year lead to less accurate valuations than multiples using forecasted earnings and cash flows in the year after the IPO, which is consistent with results of Kim & Ritter (1999). Finally, our results indicate that the final offer price is closer to the stock market price than pre-IPO value estimates. This is consistent with the expectation that the final offer price incorporates valuable information about investor demand, obtained by the underwriter during the public offering.

This study uses 'real world' estimations to investigate the different valuation approaches. DeAngelo (1990) describes the use of different valuation techniques by a limited number of investment bankers to evaluate the fairness of management buyouts, but does not investigate the accuracy of these valuations. Other studies examine the accuracy of earnings forecasts in IPO prospectuses, but do not focus on valuation accuracy (e.g., Firth & Smith, 1992; Jaggi, 1997; Jelic, Saaudouni, & Briston, 1998, Gonoupolis, 2003). This chapter adds to the IPO valuation literature as it uses the actual value estimates of the underwriters. It provides insights in both valuation and the broader IPO context. Our results indicate that investment banks can fairly accurately estimate the intrinsic value; high initial returns (often referred to as underpricing) are partly due to the underwriters deliberately applying a discount when setting the offer price. DFCF, the method most commonly used by valuation experts and widely taught in business schools, produces the best estimate of the future IPO stock price.

The remainder of the chapter is organized as follows. In the next section we briefly discuss the accuracy of valuation models and the IPO process. Section 1.3. describes the sample along with some statistics and discusses the methodology. In Section 1.4. valuations

are analyzed and compared to the IPO offer price and the average stock market price in the first month of listing. Section 1.5. presents some conclusions.

1.2. The accuracy of valuation models and the IPO process

1.2.1. The accuracy of valuation models

Several studies examine the accuracy of valuation models. A number of these focus on multiples valuation, and provide mixed results on which multiples have the highest valuation accuracy (e.g., Beatty, Riffe, & Thompson, 1999; Kim & Ritter, 1999; Cheng & McNamara, 2000; Liu, Nissim, & Thomas, 2002; Lie & Lie, 2002). Other papers investigate how the choice of comparable firms affects accuracy of multiples. Profitability, growth and risk are important variables in peer group selection, and the use of harmonic means generates the best results (e.g., Boatsman & Baskin, 1981; Alford, 1992; Cheng & McNamara, 2000; Bhojraj & Lee, 2002). A consistent result from studies on multiples is that multiples based on forecasted earnings leads to higher valuation accuracy than multiples using trailing earnings (see Kim & Ritter, 1999; Liu, Nissim, & Thomas, 2002; Lie & Lie, 2002). This is not unexpected, as a number of studies suggest that earnings forecasts capture information on value that is not reflected by historical earnings (e.g., Tse & Yaansah, 1999; Liu & Thomas, 2000). Yee (2004) shows that in a setting of unobserved information, forward earnings are better valuation attributes than trailing earnings.

Some studies compare the accuracy of multiples valuation and discounted cash flow valuation. Kaplan & Ruback (1995) examine the discounted cash flow and comparable firm approaches in the context of highly leveraged transactions, and conclude that both approaches are useful and reliable. According to Kaplan & Ruback, discounted cash flow valuation methods perform at least as well as valuation approaches using companies in similar industries and companies involved in similar transactions. Gilson, Hotchkiss, & Ruback (2000) find that, for firms that reorganize in bankruptcy, the discounted cash flow and comparable firm approaches have about the same degree of accuracy and lead to estimates that are generally unbiased but not very precise. Berkman, Bradbury, & Ferguson (2000), value 45 newly listed firms in New Zealand, and also conclude that the best discounted cash flow and multiples valuations have similar accuracy.

Penman & Sougiannis (1998) and Francis, Olsson, & Oswald (2000) compare accrual earnings valuation to discounted cash flow valuation. Interestingly, both studies find that

accrual earnings techniques produce lower valuation errors than discounted cash flows and dividends. However, Lundholm & O'Keefe (2001) claim that the superiority of accrual earnings valuation found by these papers is misguided, and is only due to the researchers' actual implementation containing inconsistencies, as accrual earnings valuation and discounted cash flow valuation are theoretically equivalent.

Another part of the literature concentrates on the valuation of high-tech and internet stocks, examining whether traditional value fundamentals are relevant for these stocks as well (e.g., Hand, 1999; Hand, 2000; Schwartz & Moon, 2000; Trueman, Wong, & Zhan, 2000; Demers & Lev, 2001; Bartov, Mohanram, & Seethamraju, 2002). The results of these studies are mixed: some find that the valuation departs from traditional wisdom, while others find that traditional value drivers play a key role.

1.2.2. The IPO process

As our analysis focuses on the valuation of IPOs, it is useful to briefly describe the IPO process in Belgium. This process is very similar to IPO procedures in other countries, such as the US and the UK. Once the board of directors of a company has decided to go public, the company will hire an investment bank to underwrite the offering. Usually, a group of co-underwriters is formed to help sell the issue to the public. A prospectus is drafted which contains, amongst other things, financial information about the company and the terms of the offer. It is the only document the company can use to communicate with potential investors during the IPO. In Belgium, it will very often contain estimates of the company value by the lead underwriter. Before the shares can be offered to the public, the prospectus has to be approved by the Belgian Banking and Finance Commission.

During the offering period, which lasts one or two weeks, investors can place bids for shares, usually within a range of potential offer prices, and sometimes at a unique offer price. Most IPOs in Belgium make use of the bookbuilding method, in which the underwriter builds a book of likely orders and uses this information to set the final offer price. The underwriter organizes road shows during which the new issue is marketed to investors. A few days after the public offering period, the final offer price is set within the offer price range (if applicable), shares are allocated to investors, and the share starts trading on the stock market. The final offer price is therefore set after the underwriter has obtained information about investor demand, which is not available at the time when the underwriter sets the preliminary offer price range on the basis of the value estimates.

1.3. Sample and methodology

1.3.1. Sample

Our sample includes 49 IPOs on Euronext Brussels from 1993 to 2001, excluding IPOs of mutual funds and holding companies. For IPOs before 1993, there is insufficient information available on value estimates. 15 of the 49 firms included in our sample were listed on the New Market (also called the Euro.NM Belgium), which was set up in 1997 for young, high growth firms. Table 1.1. shows that the IPOs in the sample are active in a wide range of industries, including both 'high tech' industries and industries that do not rely on sophisticated technologies.

Table 1.1.
Distribution across Industries

49 IPOs on Euronext Brussels between 1993 and 2001 by industry (Source: Datastream)

Industry	Number of IPOs
Software	6
Food processors	4
Computer services	3
Clothing and footwear	2
Commercial vehicles	2
Diversified industry	2
Environmental control	2
Leisure facilities	2
Media agencies	2
Medical equipment and supplies	2
Pharmaceuticals	2
Restaurants and pubs	2
Textiles and leather goods	2
Brewers	1
Chemicals – advanced materials	1
Computer hardware	1
Construction materials	1
Consumer electronics	1
Electrical equipment	1
Electronic equipment	1
Gas distribution	1
Insurance non-life	1
Non-ferrous materials	1
Paper	1
Personal products	1
Publishing and printing	1
Retailers	1
Soft goods	1
Telecom equipment	1

Table 1.2. presents some descriptive statistics. The median firm introduced at Euronext Brussels offered 858,678 shares at a preliminary offer price of 28.8 EURO. The preliminary offer price is the midpoint of the minimum and maximum offer prices, or, if the shares are not offered within a price range, the unique offer price (see Kim & Ritter, 1999).[3] The initial returns, which are calculated as [average price in the first month of listing / offer price] – 1, were generally substantial on Euronext Brussels: the median initial return is + 10.6%, and the mean initial return is + 20.2%.[4]

Table 1.2.
Descriptive Statistics

Descriptive statistics on (1) the number of shares offered to the public, (2) the preliminary offer price (in EURO), which is the midpoint of the minimum and maximum offer prices, or, if the shares are not offered within a price range, the pre-specified offer price, (3) the average price in the first month of listing (in EURO), (4) the initial return (in %), which is defined as [average price in the first month of listing / preliminary offer price] – 1, and (5) the number of firms offering existing shares and/or new shares, for 49 IPOs on Euronext between 1993 and 2001. For three observations there is no information available on the average price in the first month of listing, and therefore the initial return could not be calculated. For one observation there is no information available on the type of shares offered.

	Mean	St. dev.	Minimum	Median	Maximum
Number of shares offered to the public	1,132,361	1,066,284	116,809	858,678	6,250,000
Preliminary offer price (EURO)	40.4	96.4	1.7	28.8	694.1
Average price in the first month of listing (EURO)	49.6	100.8	2.09	33.6	695.8
Initial return (%)	20.2	38.0	-22.3	10.6	190.5

	Number of firms offering
Only existing shares	8
Existing and new shares	25
Only new shares	15

For most IPOs, at least a part of the shares are sold by existing shareholders: 8 firms offer only existing shares; 25 firms offer both existing and new shares; only 15 firms offer only new shares (not surprisingly, all firms introduced on the New Market, which aims at young high growth firms, offer new shares)[5]. These findings are consistent with evidence from other European countries that a major motivation for European firms to go public is to allow the controlling shareholder to divest from the firm (see Rydqvist & Högholm, 1995; Pagano, Panetta, & Zingales, 1998; Giudici & Roosenboom, 2002; Ritter, 2003).

[3] 33 out of 49 IPOs in our sample made use of bookbuilding, the remaining IPOs involved fixed price mechanisms.
[4] Stock prices were taken from Datastream.
[5] For 1 observation we did not have sufficient information on the type of shares offered.

All lead underwriters are Belgian banks, with the exception of ABN Amro Rothschild, which is co-lead underwriter of 2 IPOs, and Indosuez, which is co-lead underwriter of 1 IPO.[6] How do these lead underwriters value the firm? Table 1.3. contains the valuation methods used to value the 49 IPOs, and the number of cases in which they are applied.[7] All lead underwriters mention only the use of generally accepted valuation methods and seem to avoid eccentric multiple valuation methods as the ones described by Fernandez (2001).[8] DFCF is the most popular method: it is used to value all IPOs. DDM is used for 24 IPOs, and a multiples approach is used to value 40 IPOs. All underwriters use at least two different valuation methods. Although multiple valuation is flawed from a theoretical perspective, it is often used in practice as in contrast to DCF, it does not require the though work of adequately estimating cash flows and appropriate discount rates (cf. Lie & Lie, 2002). P/E and P/CF are the most popular multiples approaches: P/E is applied for 37 IPOs and P/CF is applied for 17 IPOs. Other multiple approaches used are EnterpriseValue/EBITDA (8x), EnterpriseValue/Sales (3x), Price/Book (1x), Dividend yield (2x) and P/E-to-Growth (1x).

A number of empirical studies (e.g., Carter & Manaster, 1990, and Carter, Dark, & Singh, 1998) have found that IPOs managed by high prestige investment bankers have a smaller initial return than do IPOs handled by low reputation underwriters. According to Carter & Manaster (1990), low risk firms signal their low risk by selecting prestigious underwriters, and prestigious underwriters, to maintain their reputation, only market IPOs of low risk firms. In line with this argument, it could be argued that underwriter reputation will also affect the accuracy of valuation. Underwriters that are more prestigious, can be expected to have more incentives to certify that the offer price incorporates all available information. More prestigious underwriters may therefore be associated with higher valuation accuracy. However, we do not investigate this relation here, for several reasons. First, we do not have a reliable measure of investment bank reputation in Belgium. The Belgian market for underwriting services is very small, the number of banks offering these services is limited, and there do not appear to be big differences in reputation across Belgian investment banks.

[6] Other (co-)lead underwriters are Generale Bank/Fortis Bank (14 IPOs), Smeets Securities/Delta Lloyd Securities (12 IPOs), Bank Brussel Lambert (9 IPOs), KBC Securities (7 IPOs), Petercam (7 IPOs), Paribas/Artesia Bank/Dexia (5 IPOs), Bank De Groof (4 IPOs), Lessius (1 IPO), Delen & Co (1 IPO), Van Moer Santerre (1 IPO) and Nedee (1 IPO).

[7] Some IPO prospectuses mention the use of a valuation method for which no estimation result is given. These are not included in Table 1.3.

[8] Fernandez discusses the valuation of internet provider Terra-Lycos in 2000 by a number of banks, which use weighted averages of a curious mix of multiples, based on e.g., GNP per capital, number of habitants, capitalization per subscriber, enterprise value per page view, and capitalization per page view.

Moreover, Engelen (2000) finds an insignificant relation between proxies for underwriter reputation and underpricing of Belgian IPOs.

Table 1.3.
Valuation Methods Used by
Lead Underwriters

The number of IPOs for which the IPO-prospectus, which is made available at the start of the public offering, provides a value estimation based on a particular valuation method, for 49 IPOs on Euronext Brussels between 1993 and 2001.

Valuation method	Number of IPOs
Discounted free cash flow	49
Dividend discount model	24
Multiples	40
▪ Price/earnings	37
Peer group	34
Stock market	14
Growth shares	2
▪ Price/cash flow	17
Peer group	15
Stock market	8
Growth shares	3
▪ EnterpriseValue/EBITDA (peer group)	8
▪ EnterpriseValue/sales	3
Peer group	3
Stock market	1
▪ Price/book (peer group)	1
▪ Dividend yield (peer group)	2
▪ P/E-to-growth (peer group)	1

A problem with using multiples to value Belgian IPOs is that the number of firms listed on Euronext Brussels is limited. At the end of 1999 only 144 firms were listed, many of which are financial institutions and holding companies. It is therefore often difficult to find a sufficient number of comparable firms. In several cases, the underwriter compares the IPO to the Euronext Brussels stock market, as well as to a peer group of firms, in order to estimate value. In some cases, value is also estimated using the average P/E or P/CF of growth shares on Euronext Brussels. Table 1.3. shows that the stock market P/E is used to value 14 IPOs, while the stock market P/CF is used for 8 IPOs. In one case, valuation is based on the stock market Enterprise Value/Sales ratio. The P/E (2x) and the P/CF (3x) of Euronext Brussels growth shares is used in only a very limited number of cases.

Multiples can be based on historical earnings or cash flows, but also on forecasted earnings and cash flows. Most multiples used in our sample are based on current year's

forecasted earnings and cash flow (year 0) or next year's forecasted earnings or cash flow (year +1). In a limited number of cases the underwriter also uses historical earnings and cash flow in the year before the IPO (year –1) and/or the forecasted earnings and cash flow for the second post-IPO year (year +2). This leads to a wide range of multiples used by investment banks, along three dimensions: [1] type of multiple (P/E, P/CF, Price/book ..), [2] the firms to which the IPO is compared (peer group, stock market, growth shares), and [3] the timing of the multiple (years –1, 0, +1, +2). In the remainder of the chapter, we will investigate the estimations of the most frequently used multiples: P/E and P/CF, for a peer group and for the stock market, in years 0 and +1.

1.3.2. Methodology

For each valuation method, the proximity of the estimated value to the offer price is measured by the natural log of the ratio of the estimated value to the offer price. Likewise, the proximity of estimated value to the market value is computed as the natural log of the estimated value over market value. We will refer to these measures as 'valuation errors'. However, the natural log of the ratio of the estimated value to the offer price should not be interpreted as an error in the strict sense, but only as a measure of the proximity of value estimate and offer price. As in other studies of valuation methods, we use mean and median valuation errors to indicate the extent to which value estimates are *biased*: do the value estimates tend to be on average higher or lower than the offer price or the market value? We focus on median errors, which are less affected by outliers than mean errors (although the difference in our sample is limited). The *accuracy* of valuation is measured by the percentage of valuation errors within 15% and the mean absolute error, both indicating the dispersion of the valuation errors.[9]

Our measure of valuation accuracy, which is commonly used in the literature, is based on a comparison of value estimates with stock market prices. This measure assumes that (1) values estimates reported in the prospectus are the actual value estimates of the underwriter, and (2) stock market prices reflect fair value. Regarding the first assumption, it cannot be ruled out that the reported values estimates are lower than the actual estimations of the

[9] See for instance Kaplan & Ruback (1995), Kim & Ritter (1998) and Gilson et al. (2000). Kaplan & Ruback also use the mean quadratic error as a measure of valuation accuracy. The mean squared error assumes that the 'cost' of valuation errors for the user of the valuation method, such as costs arising from mispricing, increase quadraticly, while the mean absolute error assumes that the cost increases are linear. We measured the mean squared error for all the analyses presented in this paper. The results (not reported) fully confirm those of the mean absolute error.

underwriter. It is widely acknowledged that IPOs are underpriced. If underwriters consciously underprice IPOs, they may have an incentive to report value estimates that are lower than their "true" value estimates. If this is the case for the IPOs in our sample, we expect to find that the reported value estimates for different methods tend to underestimate stock market prices. However, it can be argued that even if the reported value estimates are lower than the actual value estimates of the underwriter, a comparison of valuation errors will yield consistent results, as long as reported value estimates are underpriced to the same degree.

The assumption that stock market prices reflect fair value, implies that the stock market is efficient and that any underpricing is corrected for very fast when trading starts. Most studies on underpricing indeed find abnormal initial returns on the first day of trading, but not afterwards, which suggests that underpricing is corrected at the first trading day (e.g., Ritter, 1998). Investors may also *overreact* when trading starts, thereby driving stock prices *above* fair values. Some studies on the long-run underperformance of IPOs find support for this theory (e.g., Aggarwal & Rivoli, 1990; Ritter, 1991; Loughran & Ritter, 1995; Ritter & Welch, 2002; Purnanandam & Swaminathan, 2004). Stocks can also become overvalued because underwriters tend to support prices in the after-market (e.g., Aggarwal & Rivoli, 1990; Schultz & Rivoli, 1994). Stock market prices might therefore not reflect fair value. However, it can be argued that if the underwriter bases his valuations upon the same expectations as the stock market, a comparison of valuation errors will yield consistent results, regardless of overvaluation in the stock market.

Another potential problem when examining the valuation accuracy is that the information set changes when trading of the IPO begins, and investors are not restricted to the investment bank's information set (Berger, 2002). This would mean that even though the value estimates of underwriters may be right at the time they were made (ex ante), they may be wrong afterwards (ex post), potentially distorting our results. However, given the very short period of time between the publication of the IPO prospectus and the first day of trading, we estimate this effect to be limited.

1.4. Results

1.4.1. On which method(s) do lead underwriters rely most to set the preliminary offer price?

We first investigate the relation between the preliminary offer price and the results of the different value estimates by the lead underwriter. We want to find out on which valuation

method(s) lead underwriters rely most to set the preliminary offer price. Table 1.4. presents results for DFCF, DDM and the most commonly used multiple approaches: P/E and P/CF based on a peer group or stock market, calculated for year 0 and year +1.[10]

The median valuation error for DFCF is +14.1%: lead underwriters set the preliminary offer price significantly lower than the value estimates based on DFCF (p-value of the Wilcoxon signed rank test is less than 0.001). The median error for DDM is +3.4% and only significant at the 10% level (p-value = 0.094). The median errors for estimates based on multiples vary widely: they range from -9.8% to +21.7%. These results suggest that the lead underwriters rely primarily on DDM to determine the preliminary offer price.

We measure the degree of central tendency of value estimates towards the preliminary offer price by the percentage of differences within 15% and the mean absolute error. For only 27 out of 49 IPOs (55.1% of the sample), the estimates based on DFCF are within 15% of the preliminary offer price. On the other hand, the DDM estimate is within 15% of the preliminary offer price for 22 out of 24 IPOs (91.7%) for which a DDM value is estimated.

For the multiples estimates, the percentages within 15% are also much lower than for DDM. A comparison of the mean absolute error for the different valuation methods leads to the same conclusions as the comparison based on the percentage within 15%. A t-test of differences in the mean absolute error reveals that the mean absolute error for DDM estimates is significantly smaller than the mean absolute error of DFCF estimates (p-value = 0.002), and smaller than the mean absolute error for P/E peer group estimates in year +1 (p-value = 0.003), the most frequently used multiple estimation method. The mean absolute error for DFCF and P/E peer group (year +1) estimates are not significantly different (p-value = 0.40). Again these results seem to suggest that the preliminary offer price is driven by DDM if applied (we will further elaborate upon these results in Section 1.4.3.).

Another interesting finding in Table 1.4. is that the multiples valuations for year +1 are consistently closer to the preliminary offer price than the multiples valuations for the IPO year 0: underwriters seem to rely more on forecasted future multiples than on current multiples. The p-value of a t-test of differences in the mean absolute error between P/E peer group (year 0) and P/E peer group (year +1) is 0.002.

Some valuation methods will be more appropriate to use than others. The underwriter has to choose which methods are appropriate and which are not. The results in Table 1.4. may be influenced by this choice. For example, the difference between DFCF and DDM might be

[10] These multiples are consistently closer to the preliminary offer price than the multiples for which no results are presented.

caused by the 15 IPOs for which DFCF was used but DDM was not. For the 24 IPOs for which both methods were used, the DFCF estimates might then be much closer to the preliminary offer price than the results in Table 1.4. suggest. We therefore also investigate the relation between the IPO preliminary offer price and different value estimates by a pairwise comparison of valuation methods, for those IPOs that are valued with both methods. The results are presented in Table 1.5. DFCF, DDM and P/E based on a peer group for year +1 are compared pairwise. We concentrate on the P/E based on a peer group for year +1 because our performance measures indicate that this multiple is the one closest to the preliminary offer price. Moreover, P/E based on a peer group is the most commonly used multiple. We also compare P/E based on a peer group in year 0 and year +1. All results in Table 1.5. confirm those in Table 1.4..

So far, we have relied on univariate analysis to investigate the relation between pre-IPO value estimates and preliminary offer price. For the IPOs in our sample, underwriters always use at least two valuation approaches. It therefore seems likely that the preliminary offer price is based on more than one value estimate. Table 1.6. reports the results of OLS-regressions of the natural logarithm of the preliminary offer price, on the natural logarithm of value estimates by the lead underwriter. All variables are expressed as a natural logarithm because of large size differences. The coefficients of the explanatory variables should provide an estimate of the weight underwriters attach to a particular valuation method. However, the results in Table 1.6. have to be interpreted with caution: the number of observations for each combination of valuation methods is limited, and the value estimates are strongly correlated.

The first column of Table 1.6. reports results for 13 IPOs which were valued with DFCF, DDM and P/E Peer Group Year +1 (the most commonly used multiple). The DDM coefficient is 0.68 and significant at the 1% level; the P/E Peer Group Year +1 is 0.31 and significant at the 5% level; the DFCF-coefficient is not significant. This again suggests that the preliminary offer price of IPOs which are valued with DFCF, DDM and P/E Peer Group Year +1, is primarily determined by DDM, and to a lesser extent by P/E Peer Group Year +1.

Table 1.4.
Pre-IPO Value Estimates and Preliminary Offer Price: a Comparison of Different Valuation Methods

A comparison of the most commonly used methods to value 49 IPOs on Euronext Brussels between 1993 and 2001. Valuation errors are computed as the natural log of the ratio of the estimated value to the preliminary offer price. The preliminary offer price is the midpoint of the minimum and maximum offer prices, or, if the shares are not offered within a price range, the pre-specified offer price. The pre-IPO value estimates are published in the IPO-prospectus, which is made available at the start of the public offering. The first four rows report median, mean, standard deviation and interquartile range of errors. Two measures of valuation accuracy are reported: the percentage of errors within 15 %, and the mean absolute error. For each valuation method, the number of observations depends on the number of IPOs for which the method is applied.

Valuation method:	Discounted Free Cash Flow	Dividend Discount Model	P/E Peer Group (year 0)	P/E Peer Group (year +1)	P/E Stock Market (year 0)	P/E Stock Market (year +1)	P/CF Peer Group (year 0)	P/CF Peer Group (year +1)	P/CF Stock Market (year 0)	P/CF Stock Market (year +1)
Median	14.1%	3.4%	-1.0%	11.2%	-7.2%	7.6%	21.7%	20.1%	-9.8%	7.7%
Mean	14.4%	3.2%	-25.8%	7.4%	-16.8%	9.5%	24.9%	24.2%	-3.8%	5.8%
Standard deviation	13.2%	8.7%	121.5%	14.1%	30.8%	23.5%	34.1%	32.5%	21.6%	14.4%
Interquartile range	15.0%	12.0%	34.0%	16.8%	26.8%	6.6%	32.4%	31.8%	18.5%	13.4%
Percentage within 15%	55.1%	91.7%	42.9%	63.0%	50.0%	66.7%	33.3%	27.3%	62.5%	50.0%
Mean absolute error	15.8%	7.9%	47.0%	13.9%	23.2%	16.6%	30.4%	30.1%	17.6%	13.5%
Number of observations	49	24	21	27	12	12	12	11	8	6

Column (2) of Table 1.6. reports regression results for 24 IPOs which were valued with DFCF and DDM. The preliminary offer price of these IPOs seems to be primarily determined by DDM, and to a lesser extent by DFCF. For 27 IPOs which were valued with DFCF and P/E Peer Group Year +1 (see column (3)), the underwriter seems to rely primarily on DFCF, but also on P/E Peer Group Year +1. The results in column (4), based on 17 IPOs, suggest that when P/E Peer Group year 0 and year +1 are used, underwriters rely only on P/E Peer Group in year +1.[11] Taken together, the regression results confirm those of the univariate analysis: the preliminary offer price seems to be primarily determined by DDM, and underwriters rely more on forecasted multiples than on current multiples.

1.4.2. What is the bias and accuracy of the valuation methods used?

Next, we investigate the bias and accuracy of the valuation methods by comparing the estimated values to the average stock price in the first month of listing. Results are presented in Table 1.7.. Results based on the stock price on post-IPO days +1, +10, +20 and +30 are very similar and are therefore not reported here.

DFCF seems to be an unbiased value estimator: the median valuation error is only 4.1% and not significant (Wilcoxon signed rank test p = 0.681). DDM on the other hand produces biased estimates of value: the median valuation error is – 10.6% and is significant (p = 0.006). If the stock market prices IPOs correctly, then DDM tends to underestimate value. For most multiple valuation methods, we also find a negative median valuation error, but this error is significant at the 10% level or higher for only three methods: P/E Peer Group (year 0) (p-value = 0.082), P/E Stock Market (year 0) (p-value = 0.009) and P/CF Stock Market (year +1) (p-value = 0.031). Of course, for most multiples the sample is very small, which affects the quality of statistical testing.

Again, we use the percentage within 15% and the mean absolute error to measure the accuracy of the valuation methods. The results suggest that DFCF, DDM and the most commonly used multiples (P/E Peer Group year 0 and year +1) have similar accuracy. For each of these methods, about half of the valuations is within 15% of the average stock price in the first month of listing. The mean absolute errors are also very similar: they are not significantly different from each other, except the mean absolute error of P/E Peer Group year 0, which is significantly larger than DFCF mean absolute error (p-value = 0.043).

[11] We did not estimate a separate regression for DDM and P/E Peer Group year +1, because the 13 IPOs which were valued with DDM and P/E Peer Group year +1, were also valued with DFCF: see column (1).

Table 1.5.
Pre-IPO Value Estimates and Preliminary Offer Price: a Pairwise Comparison of Different Valuation Methods

A pairwise comparison of the most commonly used methods to value 49 IPOs on Euronext Brussels between 1993 and 2001. Valuation errors are computed as the natural log of the ratio of the estimated value to the preliminary offer price. The preliminary offer price is the midpoint of the minimum and maximum offer prices, or, if the shares are not offered within a price range, the pre-specified offer price. The pre-IPO value estimates are published in the IPO-prospectus, which is made available at the start of the public offering. The first four rows report median, mean, standard deviation and interquartile range of errors. Two measures of valuation accuracy are reported: the percentage of errors within 15 %, and the mean absolute error. For each pair of valuation methods, the number of observations depends on the number of IPOs for which both methods are applied.

Valuation method:	Discounted Free Cash Flow	Dividend Discount Model	Discounted Free Cash Flow	P/E Peer Group (year +1)	Dividend Discount Model	P/E Peer Group (year +1)	P/E Peer Group (year 0)	P/E Peer Group (year +1)
Median	13.8%	3.4%	15.6%	11.2%	7.7%	11.2%	-5.8%	8.4%
Mean	12.9%	3.2%	15.0%	7.4%	4.8%	7.4%	-38.4%	5.7%
Standard deviation	9.3%	8.7%	11.6%	14.1%	9.2%	14.1%	131.7%	13.3%
Interquartile range	12.0%	12.0%	18.5%	16.8%	9.8%	13.6%	41.3%	13.5%
Percentage within 15%	62.5%	91.7%	48.1%	63.0%	84.6%	61.5%	41.2%	70.6%
Mean absolute error	13.7%	7.9%	15.9%	13.9%	9.1%	13.9%	51.6%	12.6%
Number of observations	24	24	27	27	13	13	17	17

Table 1.6.
Relation of the Preliminary Offer Price to Pre-IPO Value Estimates

OLS-regressions of the natural logarithm of the preliminary offer price on the natural logarithm of value estimates by the lead underwriter, for 49 IPOs on Euronext Brussels between 1993 and 2001. The preliminary offer price is the midpoint of the minimum and maximum offer prices, or, if the shares are not offered within a price range, the pre-specified offer price. The pre-IPO value estimates are published in the IPO-prospectus, which is made available at the start of the public offering. For each regression, the number of observations depends on the number of IPOs for which the value estimates included in the regression are used. *, ** and *** denote significant difference from zero at the 10% level, the 5% level and the 1% level, respectively.

Explanatory variables	(1)	(2)	(3)	(4)
C	-0.37 (-1.27)	-0.20 (-2.02)*	-0.12 (-1.58)	0.50 (1.46)
Ln (DFCF estimate)	0.09 (0.46)	0.38 (2.36)**	0.62 (4.94)***	-
Ln (DDM estimate)	0.68 (3.15)***	0.66 (3.82)***	-	-
Ln (P/E Peer Group Year +1 estimate)	0.31 (2.93)**	-	0.38 (3.21)***	0.82 (6.24)***
Ln (P/E Peer Group Year 0 estimate)	-	-	-	0.03 (0.59)
Adjusted R^2	0.95	0.99	0.99	0.96
Number of observations:	13	24	27	17

It is interesting to compare our results on value accuracy with the valuation accuracies obtained by Kim & Ritter (1999), who investigate the value accuracy of multiples using a sample of 190 US IPOs from 1992 to 1993. They use recent IPOs as comparables, which are chosen with a mechanical algorithm, and comparables chosen by a firm specializing in IPO research. Comparing IPO multiples to the median comparables multiple and a predicted multiple using regressions, they find much lower valuation accuracy than we do. It may seem surprising that objective valuations by academics are less accurate than valuations by lead underwriters. As we have noted in the introduction, value estimates by lead underwriters may be more accurate because they often have better access to information that is useful for valuation. Moreover, the valuation does not take place in a vacuum: the lead underwriter may be affected by the market mood at the time of valuation (see Section 1.4.3.). On the other hand, the post-IPO stock price may be affected by the valuation of the lead underwriter, if the market is willing to be guided by the valuations made at the pre-IPO stage. In this case, the valuation influences the market, rather than the other way around. The Belgian IPOs in our sample are also often mature firms that are comparatively easy to value. Finally, it can be expected that lead underwriters choose to report only valuation results that are appropriate for

the type of firm that needs to be valued, while academics report all estimates of the valuation method(s) they investigate.

When we compare the valuation accuracy of the different multiples approaches in Table 1.7., it is striking that the valuations based on the forecasted earnings and cash flows in year +1 are consistently less biased and more accurate than the valuations based on the forecasted current year's earnings and cash flows: this result holds for both the P/E and the P/CF peer group multiples, and for the P/E and the P/CF stock market multiples, for all measures of valuation accuracy.[12] Again, we also make a pairwise comparison of valuation methods: DFCF, DDM and P/E based on a peer group for year +1 are mutually compared, as well as P/E based on a peer group in year 0 and year +1. The results, which are presented in Table 1.8., confirm those of Table 1.7..

1.4.3. Valuation and underpricing

Probably the most often researched anomaly in the IPO market concerns underpricing and high average initial returns. These are found over a wide range of time periods and countries. For an overview of evidence and underpricing theories, we refer to Ibbotson & Ritter (1995), Ritter & Welch (2002) and Ritter (2003). Ritter & Welch (2002) find an average initial return on the first trading day of 18.8% in their sample of US firms going public from 1980 to 2001. In our sample, the initial return averaged 20.2%, which is a strong indication of underpricing. Given this result, the results in Section 1.4.1. (preliminary offer price is on average closest to DDM estimates) and the results in Section 1.4.2. (DDM tends to underestimate value while DFCF is an unbiased value estimator) are consistent with three different explanations. First, underwriters may rely on DDM because they believe that DDM produces the most accurate value estimates, not realizing that DDM tends to underestimate value. Alternatively, underwriters may *consciously* underprice the IPO, by relying on DDM. Third, underwriters may also underprice the IPO by applying a discount to other value estimates (such as DFCF), or to a weighted average of valuations.

The hypothesis that underwriters consciously underprice IPOs is confirmed by the fact that for 21 out of 24 IPOs for which both DDM and DFCF were used, the DDM valuation, which is on average closest to the preliminary offer price, was lower than the DFCF valuation.

[12] This result is further confirmed if we take into account valuations based on the earnings and cash flows in years –1 and +2. We did not include these valuations in Table 1.7. because they are based on a very limited number of observations (1 to 5 observations).

For only one IPO, DDM and DFCF lead to the same value estimate. This is remarkable, as both valuation methods should yield the same value if consistent assumptions are made. Nevertheless, it is well recognized that dividend discounting techniques are subject to some practical issues. In Penman & Sougiannis (1998), DDM produces considerably lower valuation results than DFCF. Francis, Olsson, & Oswald (2000) find that all their models underestimate value, but DDM to the largest extent. They state that models which should give the same results in theory, differ in practice due to inconsistencies in forecasted attributes, growth rates and discount rates (e.g., clean surplus relationship violation, non-constant growth rates, discount rates inconsistent with no arbitrage principle). Lundholm & O'Keefe (2001) relate differences in the models to inconsistent forecast, inconsistent discount rate and missing cash flow errors. Damodaran (1994) explains the undervaluation of DDM because most practical valuation models do not allow (in an appropriate way) for the build-up in cash when firms pay out less than they are able to, which is often the case, and the use of inconsistent assumptions. He claims that in reality, DCF values often exceed DDM values.

Another indication that underwriters consciously underprice the IPO is that for 14 of the 49 IPOs, the preliminary offer price was set lower than *all* value estimates published in the prospectus. An example is the IPO of *Real Software*, a Belgian software company: DFCF, minimum multiple and maximum multiple estimates were respectively 21.8%, 48.1% and 50.0% higher than the preliminary offer price. The average stock price of Real Software in the first month of listing was 64.6% higher than the preliminary offer price.

Our data do not allow us to distinguish between the hypothesis that underwriters underprice by relying on biased DDM estimates, and the hypothesis that underwriters underprice by applying a discount to other value estimates, or to a weighted average of value estimates. In order to gain insight into the way underwriters value and price IPOs, four investment bankers were interviewed, who were the lead underwriter of 30 of the 49 IPOs in our sample. They provided a consistent story on how Belgian IPOs are valued and priced. All four investment bankers consider DFCF the most important valuation method. DDM is considered to be too 'conservative' and is less relied on. One banker described DDM-valuation as merely a control check on DFCF-valuation. Multiples on the other hand, are driven by market sentiment and may provide valuations that are 'too high' in a hot market. An offer price that is too high may damage the reputation of the underwriter. Interestingly, the investment bankers admit that in a hot issue market, they often have to make 'aggressive' assumptions about the parameters of the DFCF model, in order to obtain DFCF estimates that are in line with multiple estimates.

Table 1.7.
Pre-IPO Value Estimates and Stock Price: a Comparison of Different Valuation Methods

A comparison of the most commonly used methods to value 46 IPOs on Euronext Brussels between 1993 and 2001 (information on stock prices was not available for 3 IPOs). Valuation errors are computed as the natural log of the ratio of the estimated value to the average stock price in the first month of listing. The pre-IPO value estimates are published in the IPO-prospectus, which is made available at the start of the public offering. The first four rows report median, mean, standard deviation and interquartile range of errors. Two measures of valuation accuracy are reported: the percentage of errors within 15 %, and the mean absolute error. For each valuation method, the number of observations depends on the number of IPOs for which the method is applied.

Valuation method:	Discounted Free Cash Flow	Dividend Discount Model	P/E Peer Group (year 0)	P/E Peer Group (year +1)	P/E Stock Market (year 0)	P/E Stock Market (year +1)	P/CF Peer Group (year 0)	P/CF Peer Group (year +1)	P/CF Stock Market (year 0)	P/CF Stock Market (year +1)
Median	4.1%	-10.6%	-9.3%	-4.3%	-23.7%	-5.0%	4.6%	-1.3%	-27.3%	-20.4%
Mean	-1.8%	-16.0%	-45.0%	-13.2%	-33.4%	-11.4%	14.7%	8.0%	-24.9%	-20.5%
Standard deviation	29.1%	28.6%	123.5%	31.0%	34.8%	34.8%	36.1%	32.9%	30.8%	9.6%
Interquartile range	29.9%	22.2%	54.8%	35.7%	46.3%	35.4%	29.6%	27.6%	22.3%	11.1%
Percentage within 15%	47.8%	50.0%	38.1%	48.0%	33.3%	41.7%	50.0%	66.7%	0.0%	33.3%
Mean absolute error	20.7%	22.3%	58.1%	24.2%	36.7%	27.1%	25.4%	21.2%	35.9%	20.5%
Number of observations	46	24	21	25	12	12	12	12	8	6

Table 1.8.
Pre-IPO Value Estimates and Stock Price: a Pairwise Comparison of Different Valuation Methods

A pairwise comparison of the most commonly used methods to value 46 IPOs on Euronext Brussels between 1993 and 2001 (information on stock prices was not available for 3 IPOs). Valuation errors are computed as the natural log of the ratio of the estimated value to the average stock price in the first month of listing. The pre-IPO value estimates are published in the IPO-prospectus, which is made available at the start of the public offering. The first four rows report median, mean, standard deviation and interquartile range of errors. Two measures of valuation accuracy are reported: the percentage of errors within 15 %, and the mean absolute error. For each pair of valuation methods, the number of observations depends on the number of IPOs for which both methods are applied.

Valuation method:	Discounted Free Cash Flow	Dividend Discount Model	Discounted Free Cash Flow	P/E Peer Group (year +1)	Dividend Discount Model	P/E Peer Group (year +1)	P/E Peer Group (year 0)	P/E Peer Group (year +1)
Median	0.3%	-10.6%	-0.4%	-4.3%	-16.1%	-4.3%	-18.5%	-4.3%
Mean	-6.3%	-16.0%	-5.7%	-13.2%	-23.6%	-21.0%	-59.4%	-15.3%
Standard deviation	30.8%	28.6%	30.8%	31.0%	32.6%	38.2%	132.9%	31.5%
Interquartile range	31.1%	22.2%	25.7%	%35.7	35.2%	72.0%	67.8%	34.2%
Percentage within 15%	50.0%	50.0%	52.0%	48.0%	46.1%	46.1%	35.3%	52.9%
Mean absolute error	21.5%	22.3%	20.9%	24.2%	26.3%	32.2%	66.8%	24.1%
Number of observations	24	24	25	25	13	13	17	17

According to the investment bankers, the preliminary offer price and the offer price range are primarily determined by DFCF estimates, with DDM providing lower value estimates and multiples providing higher value estimates. The preliminary offer price is not actually based on a weighted sum of value estimates, but is set more loosely, taking into account the available value estimates (especially DFCF), and then applying a price discount. This implies that our finding that the preliminary offer price is closest to DDM is *not* a consequence of underwriters primarily relying on DDM, but rather coincidentally as it tends to produce low valuations. The preliminary offer price is closest to DDM because underwriters rely on valuation methods that produce higher value estimates, and apply a discount to these valuations.

1.4.4. Is the offer price a better predictor of the stock price than pre-IPO value estimates?

During the public offering period, the underwriter obtains information about investor demand and updates the price. In addition, the bank may incorporate any changes in general market conditions, industry or firm-specific outlooks. The final offer price should therefore be a more accurate predictor of the stock price than the estimates of individual valuation methods. To test whether this is indeed the case, we compare the relation between the final offer price and the stock price on the one hand, to the relation between the estimated value and the average stock price in the first month of listing on the other hand. For each valuation approach, the offer price should be closer to the stock price than the value estimate if the lead underwriter also uses other valuable information to determine the price at which the shares will be offered. Results for the most commonly used valuation methods are presented in Table 1.9.. The number of observations for each valuation method depends on the number of IPOs which were initially offered within a price range (not at a unique offer price), and which were valued with this estimation method.

For the 33 firms that are valued using DFCF, 15 firms (45.4%) have a DFCF estimated value within 15% of the stock price, while 19 firms (57.6%) have an offer price within 15% of the stock price. For the 21 firms that are valued using DDM, 10 firms (47.6%) have a DDM estimated value within 15% of the stock price, while 14 firms (66.7%) have an offer price within 15% of the stock price. A comparison of mean absolute errors also suggests that the offer price is closer to the stock price than the DFCF and/or DDM value estimates. However, the differences in the mean absolute errors are never statistically significant. Finally, the results for the most commonly used multiple estimates indicate that the offer price is closer to

Table 1.9.
Pre-IPO Value Estimates, Stock Price, and Final Offer Price: a Comparison of Different Valuation Methods

A comparison of the most commonly used methods to value 46 IPOs on Euronext Brussels between 1993 and 2001 (information on stock prices was not available for 3 IPOs). Valuation errors are computed as the natural log of the ratio of the estimated value to the average stock price in the first month of listing, and as the natural log of the ratio of the final offer price to the average stock price in the first month of listing. The pre-IPO value estimates are published in the IPO-prospectus, which is made available at the start of the public offering. The first four rows report median, mean, standard deviation and interquartile range of errors. Two measures of valuation accuracy are reported: the percentage of errors within 15 %, and the mean absolute error. For each valuation method, the number of observations depends on (a) the number of IPOs which were initially offered within a price range (not at a unique offer price), and (b) the number of IPOs which were valued with this estimation method.

Valuation method:	Discounted Free Cash Flow	Dividend Discount Model	P/E Peer Group (year 0)	P/E Peer Group (year +1)
Ln (estimated value / average stock price in the first month of listing)				
Percentage within 15%	45.4%	47.6%	38.9%	50.0%
Mean absolute error	22.1%	23.4%	34.4%	25.4%
Ln (offer price / average stock price in the first month of listing)				
Percentage within 15%	57.6%	66.7%	61.1%	55.0%
Mean absolute error	21.3%	20.4%	20.9%	22.1%
Number of observations	33	21	18	20

to the stock price than the multiple estimates, but again, the differences in the mean absolute errors are not statistically significant.[13]

1.5. Conclusions

There have been several studies that investigate the accuracy of valuation approaches using ex post value estimates, but this study investigates the accuracy of valuation by practitioners. We investigate the valuation by the lead underwriters of 49 IPOs on Euronext Brussels in the 1993-2001 period. We find that the lead underwriter always uses several valuation approaches, of which DFCF is the most popular. Our results show that DDM tends to underestimate value, while DFCF produces unbiased value estimates. Interviews with investment bankers suggest that underwriters consciously underprice IPOs, by applying a deliberate discount to DFCF value estimates. DFCF is considered to be the most reliable

[13] p-values are 0.89 for DFCF, 0.69 for DDM, 0.18 for P/E Peer Group (year 0), and 0.70 for P/CF Peer Group (year +1).

method. DDM estimates are on average closer to the preliminary offer price than other value estimates, because DDM tends to underestimate value.

When multiples valuation is used, investment banks rely mostly on forecasted *future* earnings and cash flows. We find that multiples valuation based on post-IPO forecasted earnings and cash flows indeed leads to more accurate valuations than multiples valuation based on earnings and cash flows in the IPO-year. Our results also indicate that the IPO final offer price is closer to the post-IPO stock price than pre-IPO value estimates, which is consistent with the lead underwriter using not only value estimates but also other valuable information to set the offer price.

Our work identifies some directions for future research. It would be interesting to examine what valuation methods investment banks use in a large sample study. For IPOs, how are offer prices set as compared to these value estimates, and how is the discount determined? How accurate are investment banks in predicting the stock market prices for the IPOs they manage? And what IPO-specific variables affect valuation accuracy? Answers to these questions would provide further insights in investment banks' incentives and in the IPO stock market characteristics. Another relevant question, is why investment banks do not use harmonic means in multiple valuation while academics find this methodology to produce the most accurate valuation results. It would also be interesting to know what the actual inconsistencies are applied by practitioners in DDM, which are responsible for its suggested undervaluation.

Chapter 2

The Role of Investor Capabilities in Public-to-Private Transactions

Chapter 2: The Role of Investor Capabilities in Public-to-Private Transactions[14]

Abstract

In a public-to-private (PTP) acquisition, the gained control and the capabilities of the private equity investor affect strategic management of the firm and its value. We examine the role of idiosyncratic investor capabilities in the value appropriation from PTPs and provide implications for the changing market for private equity. Next to the traditional sources of value, we incorporate and value entrepreneurial aspects, investor specialisation, path-dependency and levering the private investor's core competencies. Due to competition and replicability an increasing part of value creation in PTPs is reflected in the acquisition premium. As a result, we expect more specialization in private equity to lever idiosyncratic capabilities, as can be observed in buy-and-build strategies.

2.1. Introduction

Public-to-private transactions are an important means for restructuring underperforming businesses and may allow removing a capability gap that exists within inefficient public firms. In a public-to-private transaction (PTP)[15], a private equity investor, often in cooperation with the incumbent management, buys out the shareholders of a listed company. To a large extent, going-private transactions are financed by issuing new debt. Clearly, strategic management of and creating value in private investments are quite different from that of ordinary investments in public firms. A small shareholder of a public firm is not a true owner of the company in the sense of having an impact upon the operational cash flows or on the uncertainty surrounding them. By contrast, private equity is an alternative investment: the shareholder often gains control because its investment is substantial and involves a long-term commitment to the firm. This gives the private investor the opportunity

[14] This chapter is based on the paper 'The Role of Investor Capabilities in Public-to-Private Transactions', Wouter De Maeseneire, Working Paper Ghent University, 2004.

[15] The terms going private, public-to-private (PTP), leveraged buyout (LBO), management buyout (MBO) and leveraged management buyout (LMBO) are often used interchangeably in the literature to indicate a public-to-private transaction, although strictly speaking these are not synonyms. Public-to-privates belong to a special category of management buyouts, and their sources of value thus include those of a management buyout, but in addition there are the advantages (and disadvantages) of a delisting.

to influence management decisions, introduce better incentive mechanisms, renew firm governance, and enhance information flows.

PTPs occur when they generate economic value. Kaplan (1989a) reports that cash flows rise on average by 96% from the year before the buyout to three years after the transaction, and firm value increases by 235% (96% on a market-adjusted base) from two months before the buyout offer, to the exit. However, a large part of the value creation is reflected in the takeover price due to competition and flows to the target's shareholders.[16] The competitive landscape for private equity investors has changed over the last years as they encounter heavier competition, further driving their returns downwards. In addition, a large part of their once unique resources, such as their creative financial engineering skills and their privileged access to deals, have become commodities. Over time, the traditional idiosyncratic capabilities[17] and sources of value creation have lost their uniqueness. It has become increasingly difficult to appropriate value with a traditional buyout.

Only when rival private investors are unable to duplicate the value creation that derives from non-imitable assets or skills controlled by the buyout firm, bidding away the full value creation can be avoided. Examples of such idiosyncratic assets or capabilities include the private investor's organisation, culture, image and reputation, the firm's unique history, its experience in deal making and managing portfolio companies, and its network. If any of these organisational attributes are unique and when combined with the target generate more value than rivals can obtain, the investor will be able to appropriate part of the economic value created and generate abnormal returns. As a result of heavy competition, a private investor can only capture value creation by levering its own or its portfolio companies' unique core competences onto the target firm. In this chapter, we examine the process of replication and the role of renewing idiosyncratic investor capabilities in the value appropriation from PTPs. We value isolating mechanisms such as path dependencies and develop implications for the changing market for private equity.

This study adds to both the finance and the strategic management literature. In finance literature, restructuring and increasing efficiency by resolving agency and information problems and optimizing tax shields are the common grounds for PTPs. We also pay attention to entrepreneurial aspects, investor specialisation and levering the private investor's core competencies. To the finance literature we add the idiosyncratic and path-dependent nature of

[16] DeAngelo, DeAngelo, & Rice (1984a), Lowenstein (1985), Kaplan (1989a), Smith (1990) and others show that premiums paid to selling shareholders in public-to-privates in the 1970s and 1980s are 30 to 50% of the pre-buyout market value.

[17] We use the terms capabilities, (core) competencies and resources interchangeably.

the investor's resources. We emphasize that the strategic value of levering capabilities provides path-dependent follow-up investment opportunities that can be valued using real option theory. We contribute to the strategic management theory by providing an explicit application of the resource-based view, by linking the value appropriation to idiosyncratic resources and adding uncertainty to the knowledge-based view using a real options framework. This value-based framework is able to quantify the levering of core competencies and path dependencies.

Our holistic framework relies on techniques from finance and uses an expanded adjusted present value criterion that not only considers portfolio synergies but also intertemporal synergies of levering capabilities and creating growth opportunities (by organic growth or through acquisitions). A unique resource position can be built through the accumulation of resources by the sequential exercise of investment opportunities in a real options chain. As a result, private equity investors try to build and accumulate unique and difficult-to-replicate resource positions, and concentrate on deals in which their distinctive resources are most valuable. Building on our model, we propose the following implications for the buyout market.

In order to obtain a unique portfolio of accumulated resources, private investors will further specialize, in specific industries or technologies, and extend their networking and deal syndication. They differentiate themselves as they require unique core competencies that can be levered onto the target. The traditional sources of value like the financial and some of the operational effects have become non-idiosyncratic and are reflected in the takeover price; value appropriation stems from levering the investor's core capabilities onto the target and exploiting the follow-up investment opportunities the target provides. The private equity market will further move away from the traditional type of transactions based on financial considerations into more sector specialization, innovative approaches and hybrid deals, such as buy-and-build strategies, that really enable the private investor to take advantage of its unique competencies. To an increasing degree, a private investor's resources and previous portfolio investments determine the value of its current transactions (path dependency), resulting in specialisation. Moreover, this specialisation further reinforces the path-dependent character of its portfolio of investments. The path dependency of investments (under uncertainty) leads to unique investment opportunities that have a higher value to one specific investor than to the other, due to its idiosyncratic buyer value, its unique information and/or its idiosyncratic real option parameters.

Our framework allows explaining the dynamic evolution in the market for private equity. As the capabilities and sources of value creation in the ’80s (restructuring inefficient firms that suffered from agency problems) became commodities due to increasing levels of competition, buyout investors developed innovative investment strategies in the ‘90s enabling them to benefit from the idiosyncratic sources of value these strategies provide. However, rival private investors get more sophisticated as well, eroding the value from some of the current sources of value and inducing private investors to again develop new investment strategies, thereby producing a new set of idiosyncratic capabilities.

The remainder of the chapter is organised as follows. In Section 2.2., we present a resource-based framework for levering resources onto the PTP candidate of a specific private investor. In Section 2.3., we provide a comprehensive overview of the various shared and idiosyncratic sources of value creation associated with public-to-privates. Section 2.4. discusses the replication and renewal of the private equity investor’s idiosyncratic resources and the evolution of value creation and appropriation in PTPs. Section 2.5. summarizes the main implications of our framework.

2.2. A resource-based framework for levering capabilities in PTP transactions

In this section we develop a value-based theory for PTPs that incorporates strategic management theory in financial economics. We consider PTPs as the acquisition of a bundle of resources and incorporate the various potential value creating and destroying components of a going-private transaction.

2.2.1. Strategic management: replication and renewal of idiosyncratic capabilities

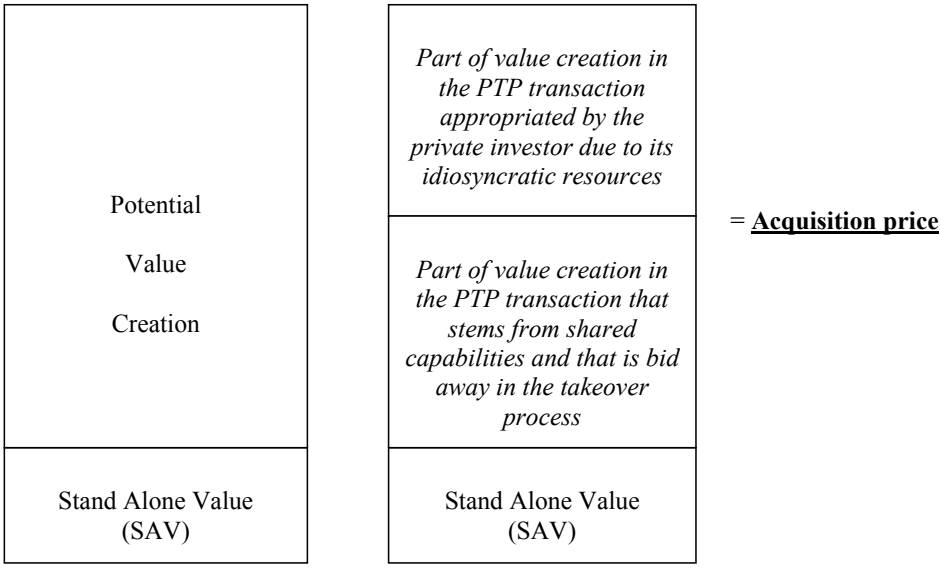
Unlike the public financial markets, the market for private acquisitions is characterized by illiquidity and imperfections. It is a market with few buyers and targets and with a low degree of transparency and high information asymmetry due to the heterogeneity of targets, sellers and potential buyers. We consider each PTP as a purchase of a bundle of resources by an investor that is also regarded as a combination of resources and capabilities. Thus, a PTP leads to capability bundling of the target and the private investor (Wernerfelt, 1984, 1995; Barney, 1991; Peteraf, 1993; Teece, Pisano, & Shuen, 1997).

The extent to which potential sources of value in PTPs are available and give rise to real value creation depends on the buyer’s resources and capabilities that can be levered onto

the acquisition, or the resources of the target that can be levered onto other portfolio companies or even future investment opportunities. Heterogeneity in buyer values can stem from both types of resources, but usually derives from those that the private investor can lever on the target. A firm's value is equal to the value of its current assets-in-place and the value of its growth opportunities (Myers, 1977). Obviously, dependent on the resources and skills of who owns and manages the company, the value of both components changes.

The total idiosyncratic value of the PTP firm is the upper price the private equity investor is prepared to pay. However, the actual price it will pay depends upon the competitive environment and the replicability of its resources. The non-idiosyncratic benefits of a PTP, such as the financial and most of the operational effects, are reflected in the transaction price; appropriating part of the value creation and obtaining abnormal returns stems from exploiting idiosyncratic capabilities which are levered onto the target (see Figure 2.1.). In order to appropriate part of the value creation, a private equity investor requires distinct valuable resources, and has to focus on deals in which its resources offer the most value creating opportunities.

Figure 2.1.
Buyer Value Creation in Public-to-Private Transaction



Following the resource-based perspective, the previous investments (other portfolio companies), the experience and the information advantage of a private equity investor will determine its current processes, accumulated resources and position. The key implication is that a given target will have different values for different buyers, with particularly a lot of variance among those buyers that can obtain a fit (synergy or complementarity) between their resources and the target's. For instance, an investor that can undertake the PTP at lower cost, or that is capable of financing the deal by raising a greater amount of debt at better terms, will value the target more highly. Similarly, the PTP target will be more valuable to investors that are best at optimizing management incentives and organizational efficiencies or that are better monitors as a result of their expertise, previous experience or inexpensive and efficient information processing. An information advantage or the ability to achieve one through quicker learning about the target may be a valuable resource. If a private investor possesses a portfolio company that offers potential synergies with the target, or a platform company in the target's industry, PTP targets may tie into a buy-and-build strategy and thus have a higher value to this investor. Another valuable resource might be the fact that an investor already has a substantial stake in the company. This will provide an important information advantage and a better starting position in a bidding contest, as the investor will not have to pay a bidding premium for the shares it has already acquired.

However, the rise in the number of private investors and the resulting increase in competition has resulted in a similar value creating potential for several investors that is bid away in a takeover contest. Competition from the typical rivals (strategic buyers) and new types of investors (PE funds that rely on innovative fund raising or investment strategies), or 'substitution' by new types of transactions (such as accelerated IPOs, in which the intermediate step of buyout fund ownership is skipped over) are ever increasing. Next to this, buyout firms used to have unique networks and relationships that provided them with access to buyout deals that their rivals did not have, thereby avoiding a competitive bidding process. Today however, most significant deals are subject to a visible and public auction process as sellers seek the best price (Harper & Schneider, 2004). Another unique resource for which buyout investors used to be (in)famous are their financial-engineering skills. Though still remaining important, this capability is now widely available and is a necessary competence in order to be in business, but does not provide a barrier that shields from competition as acquisition prices reflect the value inherent in leveraging up the target.

The majority of the sources of value creation in PTPs is replicable by and shared among various private investors; as a consequence, inimitable value creation can only be

obtained by levering unique core competencies onto the target. That is why private equity investors are pursuing innovative investment strategies such as buy-and-build, and are increasing their efforts to specialize and build networks, leading to a renewal of idiosyncratic capabilities. This knowledge-based perspective and the link with value appropriation can be observed in the actual behavior of venture capital and private equity firms. Bygrave (1987) and Barry, Peavy, Muscarella, & Vetsuypens (1990) point to the importance and the increasing level of specialization of venture capital firms in order to build valuable resources and capabilities (e.g., specialized knowledge about innovations, technology), and to distinguish themselves from competitors. Amongst others, Sahlman (1990) also finds that venture capital firms tend to specialize by industry, stage of investment, and geographic area.

Proposition 1: The private equity market will see a further move away from financial transactions into more innovative approaches, that require asset accumulation and specialization, and hybrid deals, which allow the private investor to lever its core competences and to fully exploit its unique capabilities.

Unique capabilities may lead to resource position barriers, meaning that a private investor's specific resources affect costs and/or revenues of rival acquirers, and allow the investor to obtain strong returns. Kaplan & Schoar (2003) show that there are large differences in private equity fund returns due to fund idiosyncratic resources and skills. New entrants cannot compete effectively due to the well performing funds' proprietary deal flow and unique ability to provide value added services, resulting in a strong persistency of fund returns. Furthermore, returns improve with partnership experience. Unique resources clearly allow generating abnormal returns.

Some barriers are self-reproducing: a private investor that is ahead of others may use these barriers to maintain and further extend this lead (Lieberman & Montgomery, 1998; Kaplan & Schoar, 2003). Examples of these resources are an information advantage, experience, reputation or the possession of a platform portfolio company in the industry. Strategic growth options open to a private investor depend therefore on its accumulation of specific resources and its portfolio of companies. Having a toehold in the target company, or having a platform in the target's industry, generates valuable real options. In this way, initial investments may create growth opportunities along the future path. Another way of obtaining an information advantage is through private investments in public equity (PIPE) which may allow to get ahead of rivals and may offer privileged access to potential disinvestments or buyout opportunities (Harper & Schneider, 2004). Thus, the private equity investor's resources give rise to a certain degree of path dependency (Teece et al., 1997). Competition

forces private investors to pursue acquisitions in which they can create most value, and will therefore be driven in the direction of specialisation. Once an investor has specialized, say in biotech, its accumulated resources in areas like information processing or monitoring will make new investments in biotech more attractive than to other investors.

Proposition 2: A private investor's resources and previous portfolio investments determine the value of its current transactions (path dependency) and lead to specialisation, and this specialisation further reinforces the path-dependent character of its investments.

Such investments in resources can be considered as a link in a chain of investment decisions under uncertainty or real options. Where the private investor is going in the future depends on the historical path it has traveled and its strategic plans. As soon as the buyout firm starts down a path it is faced with uncertainty about developments in the private equity market and the target's industry, and with competitive moves. The private investor needs to respond flexibly to those changes and it should not consider the current trajectory along the strategic path chosen as a static scenario but instead dynamically adjust it depending on uncertain developments in the business environment. Obviously, a resource-accumulating and capability-building strategy is history-dependent. The chosen path not only defines which buyout opportunities are available to the firm today but also constrains the future ones. The private equity investor is often able to appropriate part of the value from the path-dependent option to lever its core competences as its unique accumulated resource base results in a unique path towards the investment opportunity. Its idiosyncratic option parameters lead to inimitable value creation. Examples of unique option parameters may be a lower exercise price because of a foothold in the target company or a higher target value due to a unique fit between the target and acquirer's resource base. Alternatively, the private investor may have an exclusive option due to an information advantage that allows avoiding competition for the target.

Proposition 3: The path dependency of investment opportunities (under uncertainty) leads to a unique resource position in which the accumulated resources and the option to lever competences have a higher value to one specific investor than to the other, due to its idiosyncratic buyer value, its unique information and/or its idiosyncratic real option parameters.

2.2.2. The financial economics perspective: an expanded value-based model for the leverage of path-dependent resources

Private equity firms' willingness to commit funds determines the supply side of this market, whereas the companies who are seeking private equity rather than public equity financing define the demand side.[18] The markets for public and private equity investments are in balance when all the private investment opportunities are financed until the expected net benefit of the marginal private investment opportunity equals the return on a similar public investment in equilibrium. Private equity may provide a number of advantages and thus net benefits over public financing, thereby allowing buyout firms to make money by taking a public firm private while generating high returns for the target shareholders as well. However, the net benefits of PTPs are dynamic as a process of replication of value creation by competitors followed by a renewal of competencies takes place. The traditional net benefits derive from removing inefficiencies at the public target by reducing agency and information problems and levering up the firm.

We expand the traditional perspective on the net benefits by taking into account the potential real option value inherent in PTPs. Thus, our framework incorporates the value of operations, financial side effects and real option value of levering competences and resources. The value of operations is determined by the future free operating cash flows, discounted at the unlevered cost of capital, which purely reflects operational risk. The value of all the financing side effects of the transaction is captured by the (positive) value of interest tax shields and the (negative) value of financial distress costs. The value of learning and the real option value stem from levering capabilities and draws from strategic management theory. The net benefits of a going private are equal to the value of the target to this specific private investor minus the stand alone value on the financial markets:

$$Net\ benefits_i = PTP_i - Stand\ alone\ value \qquad (2.1.)$$

The value of the public-to-private target to a private investor i is given by PTP_i = value of operations + financial side effects + strategic value of levering capabilities (Equation 2.2.):

[18] A good description and overview of the private equity market can be found in Fenn, Liang, & Prowse (1997), Wright & Robbie (1998) and Denis (2004).

$$PTP_i = \sum_{n=1}^{\infty} \frac{FOCF_{i,n}}{(1+CA_i)^n} + \sum_{n=1}^{\infty} \frac{CFTS_{i,n}}{(1+RTS_i)^n} - ECFD_i - COST_i + ROV_i \qquad (2.2.)$$

where PTP_i = value of the public-to-private target to a specific private equity investor i, given its resources and capabilities

= SAV (standalone value of PTP target) + sources of value creation of private investor i – sources of value destruction of private investor i

$FOCF_{i,n}$ = expected free operating cash flow of target firm in year n, after PTP by private investor i

CA_i = cost of equity of target firm, after PTP by private investor i

$CFTS_{i,n}$ = expected cash flow of interest tax shields of target firm in year n, after PTP by private investor i

RTS_i = appropriate discount rate of interest tax shields cash flows of target firm, after PTP by private investor i

$ECFD_i$ = expected costs of financial distress of target firm, after PTP by private investor i

$COST_i$ = costs of the PTP operation for private investor i

ROV_i = real option value of the portfolio of growth opportunities and learning that the target offers to private investor i

All of these elements are equal to their value before the PTP, adjusted for the change brought about by the PTP by investor i. For example, $FOCF_{i,n} = FOCFsa_n + \Delta FOCF_{i,n}$ = expected free operating cash flow of standalone firm in year n + change in expected free operating cash flow of target firm in year n after PTP by private investor i.

The first component of the value and thus of the net benefits, "value of operations", is determined by the free operational cash flow and the cost of equity (=cost of assets). The overview of the various value components (discussed in detail in Section 2.3.), along with the supporting empirical evidence, shows that operational cash flow generally increases after PTP transactions, while investments in fixed assets and net working capital are reduced. At times, this has lead to a considerable rise in free operational cash flow and value. However, the impact of a PTP on the cost of equity (CA) is twofold. On the one hand, the cost of equity for new investors will be lower because business risk is often reduced; on the other hand, there is a lack of liquidity and diversification for these shareholders, resulting in a considerable rise in

the cost of equity. Empirical evidence makes no general statements about the overall change in the cost of equity.

The second component, "financial side effects", considers interest tax shields and potential costs of financial distress. As noted, public-to-private transactions are financed to a large extent with debt. Evidence shows that improved operational performance results in a further increase in interest tax shield cash flows (CFTS), as well as a lower risk associated with these cash flows (RTS). The other financial side effect, expected financial distress cash flows (ECFD), has a negative impact on the target's value. While the concentrated ownership presumably leads to improved firm performance after the PTP and a lower chance of financial distress, higher leverage increases the probability of distress. A final aspect is the transaction cost (COST) that is incurred in the PTP operation.

In this study, we add a third component, "strategic side effects". This new factor reflects cross-time growth options and synergies, which result from levering competencies and capabilities onto the buyout target. When the value of operations and financial side effects is fully incorporated in the acquisition price due to competitive forces, private investors need to search for unique capabilities that allow them to capture value creation. Recently, private equity investors have been more and more involved in hybrid transactions, and financial investors try to capture strategic benefits as well. The third component thus involves organizational change and the real option value (ROV) of the growth opportunities a buyout target provides in conjunction with other portfolio companies of the private investor, as well as the value of information learned by undertaking the buyout.[19]

For instance, the potential buyout candidate may be part of a buy-and-build strategy in which a private equity investor initially undertakes a platform acquisition and then leverages core competencies onto follow-on acquisitions in a broadened geographical base. The investor acts as an industry consolidator and aims to transform several smaller companies into an efficient large-scale network. The initial platform acquisition generates the real option for further acquisitions. The investor's leverage of its core capabilities onto the target may have two effects in Equation 2.2.. First, value adding services, reputation effects and synergies result in increased value of operations and financial side effects (interactive effect). Part of this value may be reflected in the acquisition premium. Second, if the PTP target offers

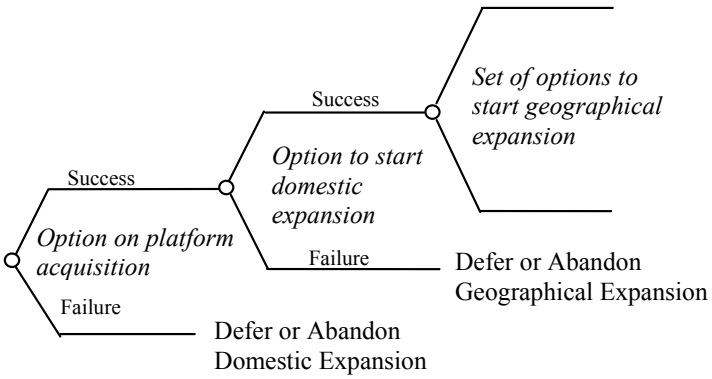
[19] We choose to present the various sources of value creation in an additive form which allows for a clear presentation of the various factors; however, we acknowledge that the leverage of core competencies and the capability bundling may result as well in interactive effects between our various value components.

growth opportunities or valuable information to the private equity investor, it contains real option value (ROV).

Asset accumulation strategies under uncertainty such as buy-and-builds should not be considered as static investment strategies but rather as (a path-dependent) series of options as presented in Figure 2.2.. Investors may always choose to forego planned follow-on investment opportunities if such a build strategy turns out worse than expected. To assess the flexibility value provided in a buy-and-build strategy, we have to look forward to how the industry might evolve and then reason back to when follow-on acquisitions are undertaken. This is equivalent to the backward induction principle of option valuation. The dynamics of the synergistic effect can be modeled with a binomial event tree over the estimated horizon of the buy-and-build strategy, according to favorable or unfavorable developments in the sector. The valuation is rather complex as the strategy may involve a collection of interacting and sequential real options. Further follow-on acquisitions in several geographic locations could increase cash flows as a result of cost and marketing efficiencies. Figure 2.2. presents a simplified structure of the value of synergistic opportunities (In Section 2.3.4.3. we provide a numerical valuation example of a path-dependent option). Future follow-on acquisitions can be undertaken, i.e., options can be exercised, after indications are received as to the likely potential speed of consolidation and as uncertainty about the success of the build-up is resolved over time. The opportunities that are available to a private investor in the later stages depend on the acquisitions taken earlier on (=accumulated resources), and thus one can observe a clear path dependency in the (value of) the further build-on acquisitions.

Figure 2.2.
Staged Decisions within a Buy-and-Build Strategy as a Set of Options

The PTP of the platform target can be regarded as providing a compound call option on the average synergestic effect with a time to maturity equal to the horizon of the build-up. The build-up will only be carried out if developments in the build-up process are more favourable than expected, and therefore the option on the synergetic effects has a higher value than the current expected synergies. The exact value can be computed by looking forward to how the industry might evolve and then performing a backward induction reasoning to see when follow-on acquisitions are undertaken. Acknowledging that the platform target generates the opportunity to make further build-up investments in the future captures the full value of the target, both the value provided by current actions and the value provided by future growth opportunities. An expanded adjusted present value is hence needed to refect all sources of value in a PTP transaction.



2.3. A categorization of capabilities and sources of value in going private

The high PTP takeover premiums averaging 30% to 50% on top of the share price, which is presumably close to the fair value of the standalone company in efficient markets, indicates that, at times, PTPs favourably affect firm value. This section reviews the various value-creating components in a public-to-private transaction, which all have to be evaluated in light of the distinct capabilities of the private investor. We distinguish between the sources of value that draw on common resources and that are available to many private investors, and those that are unique since they require idiosyncratic capabilities. However, we acknowledge that there is a dynamic evolution in the idiosyncratic nature of the capabilities. For instance, removing inefficiencies linked to agency problems and financial engineering used to be rather

unique skills in the '80s. Thus, our categorization is to some extent time-dependent and reflects the current state of the buyout market.

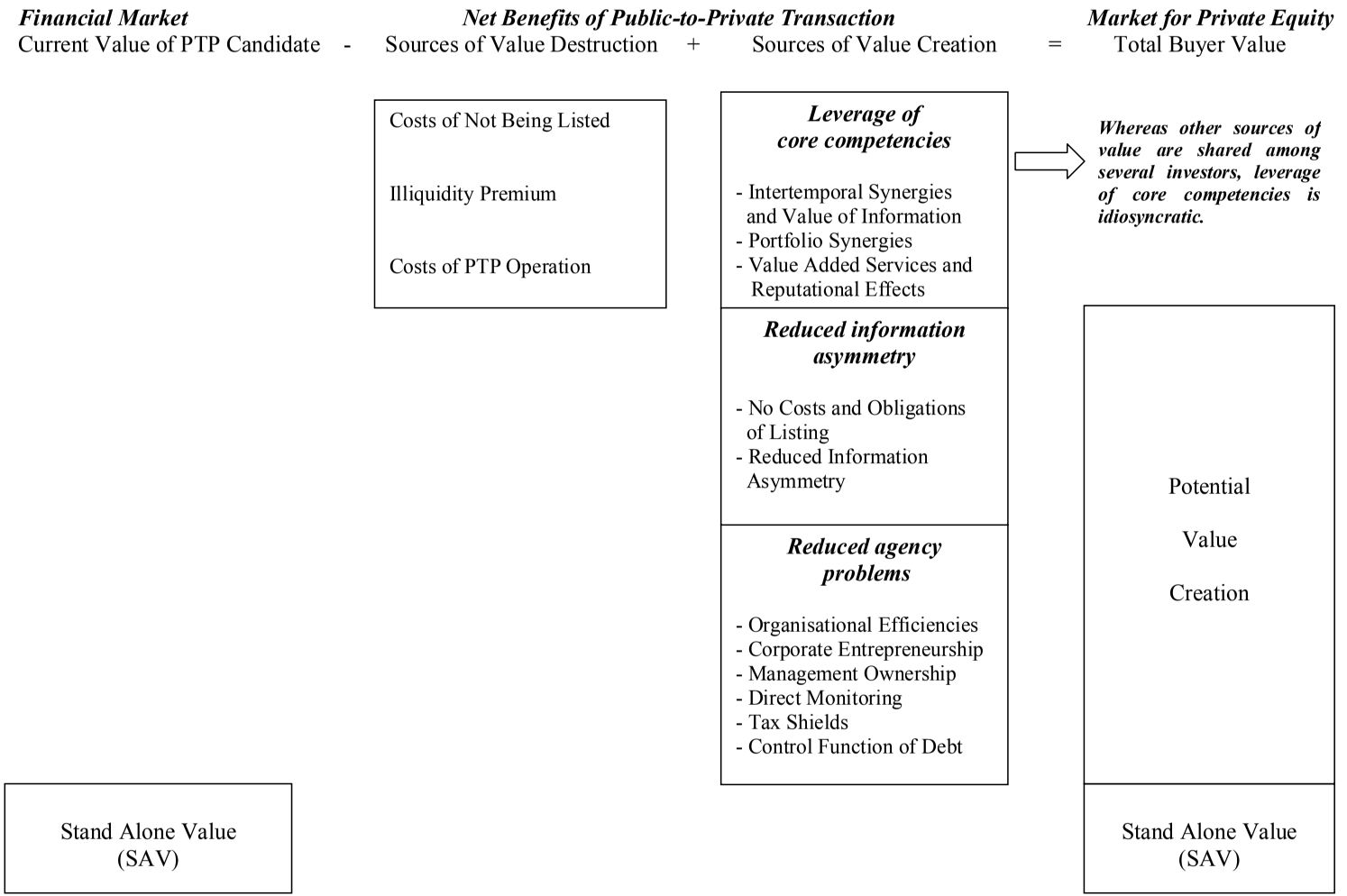
The starting point in our framework is the stand alone company (as is), whose value might be improved substantially by a going-private transaction. The standalone value[20] of the PTP target is the firm value when traded, given the current potentially suboptimal organisational, governance and incentive structures. The first category of value sources stems from resources and capabilities that are shared and have a rather similar value to several private investors. They often include the costs of the PTP transaction, reduced agency problems and reduced information asymmetry. The second category of sources of value consists of resources and capabilities that are rather unique to each private investor. The PTP firm may benefit from value added services by the private investor and from reputational effects. Furthermore, there might be potential synergies and growth opportunities generated in tandem with the private investor's current or future portfolio companies. In addition, undertaking the PTP might contain considerable learning value.[21]

Figure 2.3. presents an overview of the value creating and destroying factors, which together determine the total idiosyncratic buyer value of the buyout firm and the net benefits of the transaction. To value a specific PTP target, given the private equity investor's resources, all value creating and destroying components of the PTP should be estimated within the new organisational, governance and incentive structure, which will affect how these items are reflected in our framework. As a starting point, one can depart from the value components for the standalone firm, and take into account all changes due to the going private transaction.

[20] Usually firm value on the financial markets is equal to the standalone value of the firm; however, there might be reasons for deviations. For example, takeover speculation may lead to a higher stock market price.

[21] Next to the above sources of value, one can find two other frequently mentioned reasons in the literature for why public-to-privates exist: opportunistic behavior/private information of the firm's management, and wealth transfers to the shareholders. However, in contrast to the above sources, these do not represent real sources of value creation. In the best case, there is only a transfer of value from other parties to the new shareholders. Moreover, these transfers are non-existent or only minimal (a.o. DeAngelo et al., 1984a; Marais, Schipper, & Smith, 1989; Muscarella & Vetsuypens, 1990; Smith, 1990).

Figure 2.3.
The Net Benefits and Idiosyncratic Value of a Public-to-Private Target



2.3.1. Non-idiosyncratic sources of value destruction in a PTP

For some firms, a public-to-private may be worth considering, but it comes with a range of costs. A private firm suffers from an illiquidity discount. Amihud & Mendelson (1986a,b) show that the lower the liquidity of a financial asset, the higher is its required return, controlling for risk. By comparing the price of illiquid restricted and publicly traded stock, Amihud & Mendelson (1988) estimate this illiquidity discount to be 25% to 30%. The PTP transaction itself is expensive due to transaction costs and due diligence fees. Kaplan (1989a) reports median fees of 4.65% of the market value of equity two months before the buyout proposal. In Rappaport's (1990) view, a PTP transaction is a transitory stage by nature and cannot be a fully fledged alternative for public companies. Concentrated ownership and high leverage do not allow PTP firms to be flexible or to optimally adjust to changing economic and competitive environments. DeAngelo & DeAngelo (1987) suggest that private firms may face a higher cost of capital and that their investment is limited by the availability of senior claim financing at acceptable terms, the level of operational cash flow, and the ability and willingness of current shareholders to raise equity capital. A risk-averse manager whose wealth is entirely invested in his own PTP firm will generally bear a welfare loss due to a lack of diversification (Jensen & Meckling, 1976). Besides, this lack of diversification may induce managers to take suboptimal actions. The need for capital, a desire for higher liquidity and better diversification to spread risks may eventually lead to a public sale of the PTP firm. Another disadvantage is that the PTP abolishes the single best source of information about corporate value: the daily stock price. Furthermore, a delisted company cannot enjoy the advantages of being a public firm: the ability to raise new capital on public markets and to pay for takeovers with shares; the availability of cheaper financing sources; publicity and credibility; a better image and quality label; the opportunity for shareholders to diversify their holdings; reduced transaction costs and a lower cost of capital; employee and management motivation through share ownership and stock option schemes; and enhanced corporate professionalism because of organisational, control, and governance requirements for public companies (Roëll, 1996; Pagano, Panetta, & Zingales, 1996, 1998).

Although there are only a limited number of sources of value destruction, especially in comparison to the numerous sources of potential value creation, the importance of these disadvantages and costs are significant and are not offset by the benefits for most public firms.

2.3.2. Non-Idiosyncratic sources of value creation in a PTP: reduced agency problems

Reduced agency problems include the control function of debt, the associated tax shields, direct monitoring, management ownership and increased entrepreneurial spirit.

2.3.2.1. Control function of debt. When there are excess resources, management is particularly prone to making suboptimal decisions: this is the 'free cash flow' theory (Jensen & Meckling, 1976; Jensen, 1986). Higher leverage lowers free cash flow and the opportunities for waste and abuse of corporate resources. Furthermore, there is the pressure to perform well since failure of meeting debt services or interest payments can lead to financial distress. This is the control function of debt (Jensen, 1986). On the other hand, a leveraged buyout increases bankruptcy risk due to the higher debt load, but this is (partly) compensated by a reduction in business risk, due to increased management incentives, as well as organisational and strategic changes (Palepu, 1990). This business risk reduction allows for higher leverage. The private investor usually has long-term relationships with institutional lenders, and therefore has reduced incentives to transfer wealth from lenders. This again allows for greater borrowing (DeAngelo, DeAngelo, & Rice, 1984a). A significant positive relation exists between undistributed cash flow, the decision to go private, and the takeover premiums paid (Maupin, 1987; Singh, 1990). Moreover, this relation is very strong for companies in which management holds little stock. Competitive forces in the financial sector and the commoditizing of financial-engineering skills result in debt terms that are rather similar for different private investors.

2.3.2.2. Tax shields. The substantial reliance on debt financing results in an increase in tax-deductible interest payments. In some cases, there is also a tax advantage through a scale-up in the asset (and depreciation) base of the buyout firm for the acquirer. The tax advantage stems from the enlarged debt capacity resulting from the new incentives and better firm performance (Kaplan, 1988;1989b).[22] Increased monitoring of management by the buyout specialist also permits higher use of debt and increases the accompanying potential tax shields (Hite & Vetsuypens, 1989). Numerous researchers notice that the tax advantage in PTPs is an important source of value (a.o. Hayn, 1989; Kaplan, 1989b; Maupin, 1989; Smith, 1990; Newbould, Chatfield, & Anderson, 1992; Opler, 1992). PTP firms with higher operating

[22] Kim & Sorensen (1986) find that companies with greater insider stock ownership have more debt than firms with diffuse ownership, which is made possible by stronger management incentives to perform.

returns make use of higher leverage in order to optimize tax shields (Roden & Lewellen, 1995). Tax shields typically provide a non-idiosyncratic source of value.

2.3.2.3. Direct monitoring. In contrast to the fragmented ownership in financial markets concentrated firm ownership provides increased monitoring and disciplining incentives. Barry et al. (1990) find that venture capitalists specialize their investments to provide better and more intensive monitoring. The larger the participation, the more monitoring is performed by the private equity investor, and the larger the chance of having a seat on the board of directors (Lerner, 1995). Singh (1990) finds that the board of directors after a PTP is more focused, the board consists to a larger extent of institutional investors rather than reputed individuals or CEOs from other firms, and that directors now are larger shareholders with better monitoring incentives. In studying private equity financings, Wruck (1989) finds that an increase in ownership concentration has a positive impact on firm value. The private investor's monitoring incentives are further improved because its investment is illiquid and cannot be sold off when management fails to take value maximizing actions (Wright & Robbie, 1998).[23] Lichtenberg & Siegel (1990) find that after a PTP, total factor productivity increases and the number of supervisors is reduced, due to better monitoring incentives.

2.3.2.4. Management ownership. In public companies, the separation of ownership and control (stockholders and management) may have disadvantages if insufficient disciplining is imposed upon management. Management may strive for excessive corporate perquisites, power, status, prestige or visibility, and may try to grow or diversify the company so as to reduce risk and guarantee their own jobs, thereby destroying value (Berle & Means, 1932; Jensen & Meckling, 1976; Amihud & Lev, 1981; Jensen, 1989; Morck, Shleifer, & Vishny, 1990). In management buyouts, management becomes a (substantial) shareholder[24], agency costs are strongly reduced and management compensation is linked to firm performance, thereby providing managers with the right incentives (Berle & Means, 1932; Jensen &

[23] Furthermore, the high amount of debt financing, the high sensitivity of share value to firm performance induced by this substantial leverage, and the higher chance of facing liquidity problems all create additional monitoring incentives (Hite & Vetsuypens, 1989). Besides, management now is a major shareholder and will better monitor itself. In addition, there is generally a positive relationship between Tobin's q and the fraction of shares owned by institutional investors, who have better incentives, greater expertise and can perform lower-cost monitoring. This institutional ownership further increases the positive effect of insider ownership on corporate value (McConnell & Servaes, 1990).

[24] Jensen & Murphy (1990) find that the median CEO in a PTP firm has a 6.4% equity stake, as compared to 0.25% for the median CEO in a Forbes1000 company. Kaplan (1989b) and Smith (1990) estimate that top management in a PTP respectively holds 22.6 % and 16.7 % of the shares, which is much higher than in public companies.

Meckling, 1976). Moreover, the private equity investor makes use of sophisticated financial contracts, such as convertible preferred stock and redemption rights, that tie the distribution of cash flow, voting, control and liquidation rights to the firm's performance so as to optimize management incentives (Admati & Pfleiderer, 1994; Trester, 1998; Kaplan & Strömberg, 2000, 2001).

Suboptimal management behavior can arise due to information asymmetry between stockholders and management and the lack of adequate disciplining mechanisms. In principle, sanctions should be imposed on this inefficient performance by the product and factor markets (Hart, 1984), the managerial labor market (Fama, 1980), the capital markets (Easterbrook, 1984), internal control systems and the market for corporate control (Manne, 1965; Jensen & Ruback, 1983). However, these mechanisms are not always very effective, which is partly due to information problems.[25] Successful private investors are able to mitigate uncertainty by reducing information asymmetry and impose disciplining mechanisms.

Takeover premiums in the '80s are larger when management holdings are lower, indicating higher potential agency costs (Easterwood, Hsieh, & Singer, 1988). The observed positive effects of PTPs are higher for management buyouts than for non-management buyouts (Grammatikos & Swary, 1986; Travlos & Millon, 1987), and management ownership in PTPs has a positive influence on managerial motivation and leads to enhanced working conditions, better attitudes and improved relationships with other managers.[26] It is management stock ownership, rather than increased leverage, that is responsible for the change in objectives, strategy, organisational structure and performance (Thompson, Wright, & Robbie, 1992; Phan & Hill, 1995; Holthausen & Larcker, 1996).

2.3.2.5. Organisational efficiencies/Corporate entrepreneurship. Many PTPs restructured businesses that had overdiversified in earlier merger waves (Wright, Thompson, & Robbie, 1991). These firms were typically characterized by certain organisational inefficiencies, such as an excessive head office staff or a central, bureaucratic internal control system (Fox & Marcus, 1992). Downsizing, decentralisation and reorganisation by divesting unrelated assets and business units generated various benefits (Jensen, 1989). Decision power was transferred to those closely involved in the business process, leading to accelerated and better informed decision-making (Fama & Jensen, 1983; Lowenstein, 1985; Hite & Vetsuypens, 1989; Palepu,

[25] This was pointed out by Liebenstein (1966), Williamson (1975), Jensen (1986, 1989, 1993), Shleifer & Vishny (1988) and Rappaport (1990), among others.
[26] Long (1978) points out that employee ownership in general gives rise to improved employee attitudes, more integration, involvement, commitment and satisfaction, and improved organisational performance.

1990). Increased visibility of performance and responsibility lead to better management incentives and monitoring (Child, 1984), and middle management positions were eliminated, thereby further encouraging decentralisation and increased accountability (Baker & Wruck, 1989; Easterwood, Seth, & Singer, 1989). Management also developed a more entrepreneurial attitude with respect to innovations (Hill & Snell, 1989; Busenitz & Barney, 1997).

Most of the above organisational improvements are even more important in management buyouts of business units of large diversified groups, where the internal labor and capital markets, as well as central monitoring, do not always perform adequately (Thompson & Wright, 1987). Investment funds may not be allocated on the basis of rates of return, but rather as a result of relative internal power relations or strategic planning based on non-profit maximizing objectives. Moreover, problems may occur because of limited central resources, bad monitoring and lack of adequate incentives.[27] To meet their short-term objectives, management of public firms may sometimes sacrifice valuable long-term projects. After a PTP, strategic controls generally replace financial controls as owners are now closely involved in managing the company and making key decisions. This control change facilitates investing in profitable long-term projects, and encourages spending on innovation and corporate entrepreneurship activities (Baysinger & Hoskisson, 1990; Hitt, Hoskisson, & Ireland, 1990).

The enabling and facilitating roles of collective ownership and the freedom from inappropriate corporate control are important justifications for PTPs (Green, 1992). PTPs result in better resource allocation and improved organisational and strategic decision-making. Several studies show that PTP firms are more innovative, introduce more new products, pursue more new markets and enlarge their customer base (Kaplan, 1989c; Malone, 1989; Bull, 1989; Wright, Thompson, & Robbie, 1992). There is a higher commitment to developing new products and commercialising new technology; the quality and size of the R&D function is enhanced; and new business creation activities are intensified. New R&D projects and new product introductions usually lead to an increase in firm value (Zahra, 1993). PTP firms focus more on their core activities and show lower growth in terms of personnel and sales. Firm size and the degree of diversification are reduced, and firms stress efficiency rather than growth (Seth & Easterwood, 1993; Phan & Hill, 1995; Wiersema & Liebeskind, 1995).

[27] For instance, Jones (1992) finds that PTP firms use planning, management accounting and control systems that are better tuned down to the organisation, as these systems no longer need to conform to the parent.

2.3.3. Non-idiosyncratic sources of value creation in a PTP: reduced information asymmetry

Reduced information asymmetry includes the underinvestment problem and the costs of being listed.

2.3.3.1. Reduced information asymmetry between firm and financier – the underinvestment problem. In some cases, information asymmetry and the accompanying adverse selection problems make public financing inaccessible or too expensive because the capital markets are unable to adequately evaluate projects and companies (Akerlof, 1970; Myers & Majluf, 1984; Amit, Glosten, & Muller, 1990; Lerner, 1995).[28] If so, firms may decide to forgo investing, even in an intrinsically valuable investment project. Private equity investors are experts in information gathering and processing, in screening potential investment targets and in long-term follow-up of their portfolio companies (Chan, 1983). Syndication, networking and specialisation make their information collection and processing much more efficient (Bygrave, 1987; Lerner, 1994; Gifford, 1995). Fried & Hisrich (1994) base private equity investors' information processing benefits on economies of scale, economies of scope and learning-curve effects. Moreover, their concentrated ownership often goes hand in hand with a more direct and complete transfer of information. Private investors are thus more efficient in evaluating projects than the financial market and are better able to finance them at fair terms, thereby allowing the private firm to take on all valuable investment opportunities.

2.3.3.2. No costs and obligations of stock listing. A stock listing involves a number of costs and obligations, mainly meant to reduce information asymmetry between the firm and its public investors. These include costs for the actual listing, regulatory costs of being a public concern, the costs of disclosing all required information and investor relations costs (see DeAngelo, DeAngelo, & Rice, 1984b). Moreover, listing may bring additional costs and obligations: the potential loss of control due to hostile takeover; restrictions on management's decision power; higher taxes due to increased financial accounts' transparency; investor relations expenses; and disclosing sensitive and strategic information (Roëll, 1996; Pagano et al., 1996, 1998).

[28] This information asymmetry is one explanation for the underpricing of some quoted companies: small caps are not or are to a lesser extent analysed by investment banks, receive limited attention ('neglected firms') and little information is available, leading to depressed stock market valuations as compared to their intrinsic value.

Maupin (1987) finds as major reasons for going private: internal cash flows minimize the need for primary equity markets; current share price does not represent fair value; and trading activity is low. Furthermore, there are stock market pressures to maintain short-term earnings (partly due to information asymmetry) and stock prices; these pressures may have a harmful influence not only on how events are reported but also on the events themselves. There is a tendency in public companies to emphasize reported earnings at the expense of potential tax savings (Lowenstein, 1985). In contrast, PTP firms focus more on cash flow maximization rather than maximizing earnings and minimizing earnings variability (Lowenstein, 1985; Bull, 1989). Stein (1985) points out that a PTP relieves a firm of the burden of regulation and of market pressures for quarterly results, pressures that inhibit careful attention to long-range planning and shareholder value improvement.

2.3.4. Idiosyncratic sources of value creation in a PTP: leverage of core competencies

A private investor's bundle of resources combined with the resources of the PTP target determine the total idiosyncratic target value. The acquisition price is determined by the uniqueness of its resources and value creation that derives from shared resources is bid away. This can be observed from the empirical evidence on PTPs presented above: there is a clear relation between the takeover premium and acquisition price and shared capabilities/sources of value, such as benefiting from tax shields, increasing management holdings and reducing excess cash flow. In order to appropriate part of the value creation, a private equity investor requires distinct valuable resources, and has to focus on deals in which its resources offer the most value creating opportunities. The idiosyncratic sources of value include providing value added services and exploiting portfolio and intertemporal synergies.

2.3.4.1. Value added services and reputational effects. Companies financed by a private equity group can make use of the group's extensive network and relationships: customers, suppliers, other investors, and access to more sophisticated resources in banking, legal and other areas, etc. (Bradford & Smith, 1997). The PTP firm can also benefit from the private investor's expertise and competencies with regard to strategy, operational and financial management, human resources and marketing policy, and mergers and acquisitions (Wright, Hoskisson, & Busenitz, 2001). The private equity investor not only finances the company, but also provides a number of value added services, including valuable direction and oversight, as

well as involvement in the company's day-to-day management as an active consultant[29] (Diamond, 1985; Bradford & Smith, 1987; Gorman & Sahlman, 1989; Sahlman, 1990; Sapienza, Manigart, & Vermeir, 1996). Furthermore, the target company benefits from an increased reputation and higher credibility as it has gone through the private investor's thorough selection process. This might for example lead to enhanced bank financing terms or even access to bank financing in the first place. Though management buyouts have generally been seen as requiring less investor involvement than the more early-stage venture capital investments, some of them may have significant entrepreneurial opportunities which necessitate greater involvement by the private equity provider, who may play an important role in developing the entrepreneurial opportunities dimensions.[30] For such companies, the private investor contributes to top management decision-making by keeping strategy on track, establishing new ventures/acquisitions, broadening market focus, and reviewing R&D, budgets and marketing plans (Bruining & Wright, 2002).

2.3.4.2. Portfolio synergies.[31] The target buyout firm might provide synergies with the private investor's other portfolio companies. Joint operating efficiencies may result from combining research and development, procurement, distribution, sales and marketing, other business supporting services and headquarters operations. Integration of (parts) of these firms leads to a larger company with increased market power and gives rise to economies of scale. The wider application range of production facilities, process or product know-how and distribution channels provide potential economies of scope.

2.3.4.3. Intertemporal synergies. The investor resources may have intertemporal synergies with future follow-up investment opportunities. For instance, the potential buyout candidate may be part of a buy-and-build strategy in which a private equity investor initially undertakes a platform acquisition and then leverages core competencies onto follow-on acquisitions in a broadened geographical base. Additional value is created through the consolidation of synergistic acquisitions as operations become more integrated, cost efficiencies are realized, and market share increases. Within such a buy-and-build strategy, acquisitions are no longer

[29] Wright, Thompson, & Robbie (1992) report that 30% of the buyout managers consider the involvement of a venture capital provider very useful. Manigart et al. (2001) show that venture capital firms with specialist skills both add value and are better placed to control risks.

[30] These are: innovativeness, proactiveness, competitive agressiveness, risk taking and autonomy (see e.g. Lumpkin & Dess, 1996).

[31] Usually, synergies and intertemporal synergies are more widely available for strategic buyers than for financial investors; as a result, private investors face heavy competition from these corporate acquirers when trying to take a firm private.

viewed as stand-alone investments but rather as links in a chain of interrelated investments in which the early investments are prerequisites and set the path to follow. Besides, by making investments, firms learn about their capabilities, skills and assets. The PTP target will be valued differently by various investors according to their resource base. Moreover, when initial resources differ, what investors learn by doing the PTP will differ, and the value of this information will also differ as private investors have different real options (Bernardo & Chowdry, 2002).

The flexibility of a sequential or staged acquisition in a buy-and-build can provide great benefits to the investor when there is major uncertainty about the consolidation. Once uncertainty about the success of the first stage is resolved, the investor can expand operations or simply decide not to proceed with the next stage (i.e., not exercise the real option) or even sell the company to another player. Pricing the first of an expected series of acquisitions requires a real options framework, allowing a dynamic analysis of the target's synergistic growth potential. When several private investors may acquire the initial platform company, this represents a shared opportunity, and a high takeover price is typically paid for this type of investment (only after the acquisition does the platform provide idiosyncratic resources that can be levered onto follow-up investments). Within this framework, it is clear that not only the initial platform has a much higher value than on a stand-alone basis, but this also holds for follow-on acquisitions, which provide potential synergies and further growth options themselves.[32]

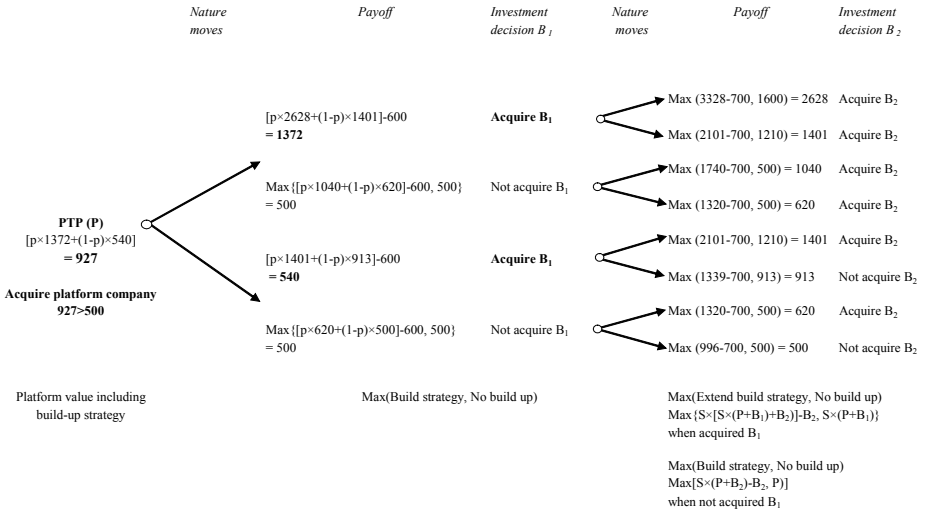
One of many buy-and-build examples is the acquisition of DuPont's connector systems unit (later renamed Berg Electronics) by Hicks, Muse, Tate & Furst in 1993. The buy-and-build included seven follow-on acquisitions, whereby Berg improved its efficiency in marketing and distribution. Berg went public in 1996 and was eventually acquired by Framatone in 1998, providing a generous return to its shareholders. The valuation of the platform company should consider the real option value of future follow-on investments. A buy-and-build unlocks value in several ways. First, there is a financial leverage effect. The investor typically uses a significant amount of debt to finance the acquisitions. Besides creating valuable tax shields, the resulting highly levered financial structure strengthens managerial incentives to improve efficiency and cash flow. Second, a buy-and-build strategy unlocks synergistic value through economies of scale or scope, and the increased size of the consolidated firm is likely to result in enhanced market power. Moreover, as the firm becomes

[32] Smit (2001) provides a comprehensive description and discussion of the buy-and-build strategy.

larger and more mature, the private equity investor is likely to have more attractive exit opportunities.

The future investment opportunities of a private equity investor and their value depend on the resources accumulated and the path chosen by the investor, as the value of levering its core competencies is path-dependent. Figure 2.4. illustrates a simplified valuation example of an asset accumulation strategy under uncertainty which involves a sequence of decisions. The acquisition of the second build-up firm, B_2, is more valuable when the investor has purchased the first build-up, B_1.

Figure 2.4.
Real Option Valuation of a PTP Platform Company: A Numerical Example of Path-Dependent Options



In the first period, the firm may acquire the platform company in a PTP (P), which allows for follow-up acquisitions. In the second period, the investor has to choose between making the first build-up acquisition (B_1), providing the opportunity to make further build-up investments, or temporarily not going ahead with the perceived build-up strategy. In the third period, the investor can choose to make an additional build-up investment (B_2) or make no follow-on acquisitions. In the case that B_1 was not acquired, the investor can add follow-up opportunity B_2 to its platform, or abandon the buy-and-build strategy. Note that the choices that are available in the future and the values at the nodes depend not only on the state of

nature but also on the decisions taken along each trajectory. The option provided by the platform company is solved using backward induction.

Suppose that the platform company has a stand-alone value (SAV) of $500 mio (P), the first build-up has a SAV of $600 mio ($B_1$) and the second expansion has a SAV of $700 mio ($B_2$). For simplicity, acquisition prices are assumed to equal the SAV. The synergies of merging are expected to be 10%, but might be higher (up-factor u:1.15) or lower (down-factor d:1/1.15). Thus, we define a synergistic multiplicative factor (S) that indicates how the combined firm value evolves. Its expected value is 1.1, in the next period it may be uS (1.27) or dS (0.96). In the last period, it is equal to uuS (1.45), udS/duS (1.1) or ddS (0.83). In the final period, the firm has to decide whether purchasing the second build-up is more valuable than not investing, in case it has acquired B_1 in the previous period: the value it obtains equals $\text{Max}(S \times [S \times (P + B_1) + B_2)] - B_2, S \times (P + B_1))$. For instance, in the upper branch of the tree (uuS) the value of the combined firms would be $1.45 \times [1.45 \times (500 + 600) + 700)] = 3328$; this value is obtained by purchasing B_2 at a price of 700, and thus has a net value of 2628, which is higher than the value of making no further investment ($1.45 \times (500 + 600) = 1600$). Hence, the build strategy is continued in this situation. In case it has not acquired B_1, the firm has to determine whether purchasing the second build-up target B_2, combined with the initial platform, is more valuable than not investing. The value it obtains equals $\text{Max}(S \times (P + B_2) - B_2, P)$. For example, suppose we are in the lowest branch of the tree (ddS), the value of purchasing B_2 combined with the PTP platform is $0.83 \times (500 + 700) = 996$; the net value is obtained by subtracting the investment of 700 and equals 296. As this value is below the value of the platform when no build-on occurs (500), the private investor does not invest. In a similar way the end node values of all possible trajectories are calculated. Note that the value of acquiring B_2 is affected by the investment decision to acquire B_1.

In the second period, the investor has to consider whether it acquires the first build-up or not. For instance, in the upper branch of the tree (uS) acquiring the first build-up provides an option on the upper payoffs in the third period: the value of this option depends on those future payoffs and is equal to 1372, which is higher than the value of not investing in the follow-up investment opportunity (500), so B_1 is acquired. In the down branch of the tree (dS) the first build-up provides an option on the payoffs in the third period with a value of 540, which is higher than the value of not investing in B_1 (500); the first add-on acquisition is made.

The value of levering core competences via the add-on investment opportunity depends on the earlier path chosen and the private investor's accumulated resource base. The

value of the follow-up investments is path-dependent in the sense that the value of the end nodes depends on the decisions taken along the path (e.g., in case that B_1 is not acquired, the ddS trajectory results in an end node value of 500, while it results in an end node value of 913 in case B_1 is acquired).

The value of the platform, \$927 mio, can be obtained via backward induction of the option tree using the risk-neutral valuation approach within a binomial model (with p = [1 - d] / [u - d] = 0.465). Therefore, correctly regarding the opportunity to make follow-on investments as an option and not an obligation adds an additional \$126 mio (difference between value within option framework, \$927 mio, and NPV framework, 1.1 × {1.1 × [\$500 mio + \$600 mio] + \$700 mio} - \$600 mio - \$700 mio = \$801 mio) to the value of the initial platform, of which the acquisition provides the opportunity (the compound option) to make follow-on investments. Note that this is a simplified example. The valuation of more realistic cases is based on the same principles, but is often far more complex due to multiple interacting options, competitive interactions and different types of uncertainty.

2.4. The evolution of value creation and the process of replication and renewal of idiosyncratic capabilities

Management buyouts have traditionally involved the organisational restructuring of firms facing agency problems and operating in mature sectors with limited investment opportunities. The early buyout literature focused on value creation through reducing agency costs, stemming from overdiversification, overinvestment and insufficient accountability. The conglomeration trend of the 1960s reversed itself by the mid-1970s and through the 1980s as changing market circumstances and economic turbulence made many of these conglomerates inefficient. In restructuring moves designed to go back to the core business, many firms divested unrelated and inefficient businesses through sales to private equity groups. In the beginning of the 1990s, economic stagnation and a high level of competition resulted in a drop in investor returns, as most of the private investor once unique capabilities had lost their idiosyncratic nature, and the number of public-to-privates decreased significantly.

Because of competition and imitability, empirical research shows a strong relation between total tax shields and the takeover premium paid in PTPs. The value of tax shields can be obtained by many players and is predictable, and is therefore almost fully reflected in the takeover price (Lowenstein, 1985; Kaplan, 1988, 1989b; Grundfest, 1989; Hayn, 1989; Kieschnick, 1989; Lehn & Poulsen, 1989). This holds as well for the other non-idiosyncratic

resources. On the other hand, buyout investors reap the gains from operating improvements, and these show no relation with the takeover premiums in the '80s (Kaplan, 1989b). Empirical research supports that the investor's distinct resources and capabilities provide a barrier that shields from competition.

With imperfect information, when target values are hard to assess, private investors should be very careful not to overbid and thereby avoid become a victim of the winner's curse. Weston & Chen (1994) find overbidding for many PTPs at the end of the 1980s, due to high competitive pressure from the many buy-out funds that were raised at the time, attracted by the high returns in the early 1980s. The premium paid in buyouts with three or more actual or potential bidders is higher and acquirers show negative abnormal returns (Lowenstein, 1985; Bradley, Desai, & Kim, 1988). Singh (1990) argues that many buyouts are preceded by takeover attempts, hence the private equity investor has to take these other potential acquirers into account. Thus, by the end of the '80s competition clearly affects the bidding premiums paid by private equity firms and strategic bidders and, as a result, the market for PTPs dried up.

The period after 1992, characterized by economic growth, saw a revival of the private equity industry and its profitability. The new investment trend in private equity combined the restructuring motives from the '80s with a focus on growth. Stock market indices at the end of the 1990s reached record levels, resulting in exits at high valuations for private investors. These substantial returns gave rise to the creation of numerous new private equity firms and high commitment levels of funds, thereby increasing supply and competition (Gompers, 1998). This resulted in higher deal valuations and a downward pressure on realised returns. Gompers & Lerner (2000) find that a rise in funds raised and in the number of private equity investors results in higher valuations and lower returns ("too much money chasing too few deals"). A doubling of funds raised by private equity firms results in a valuation level increase of 7% to 21%. As a consequence, due to the change over time in the idiosyncratic nature of the investor's sources of value and capabilities, venture capitalists had to search for new markets. This was stimulated by the declining opportunities in the US and the UK, and their accumulated expertise gave them a comparative advantage over domestic competitors in those markets in seeking out and taking advantage of emerging opportunities (Wright, Thompson, & Robbie, 1992; Wright & Robbie, 1998).

Private equity investors used to be mainly financial investors; during the '90s however, they have become active competitors of strategic players, searching for synergies. While the value creation of buyouts in the 1980s found its origin in restructuring cumbersome

conglomerates, the new trend in private equity focuses much more on the value added of growth. Buyout specialists have developed innovative approaches, and the scope of leveraged buyouts has broadened from mature, slow-growth industries to high-growth industries. Besides the more traditional type of buyouts, in which cost reduction and strategic reorientation are the key value drivers, there are also buyouts that derive their value mainly from product development, innovation and exploiting entrepreneurial growth opportunities.[33]

This evolution is due to a considerable change in the idiosyncratic nature of the various sources of value. Those that relate to reducing agency problems and information asymmetry are not very specific anymore as many private equity investors possess the necessary capabilities to perform these activities. Among these, direct monitoring, obtaining organisational efficiencies and avoiding the underinvestment problem are idiosyncratic to some degree as they require specific information and skills. The sources of value destruction are somewhat idiosyncratic, as one investor is better able to cope with the costs of going private than the other, though these difference are rather limited. However, all of the sources of value described in the section 'leverage of core competencies' are likely to be more idiosyncratic. This holds for the value added services and reputational effects, but even far more for the portfolio and intertemporal synergies. Because every investor has a different resource base and portfolio of companies, there will be substantial difference in the extent to which synergies, both current and intertemporal, can be realised. Therefore, when we look back to our framework, the real option value component in particular will differ among rival private investors.

As the previous investments and the experience of a private equity investor determine its current resources and capabilities, path dependency will become more important for explaining a private investor's acquisition strategy. The private equity market will see a further move away from financial transactions into more innovative approaches and hybrid deals, such as buy-and-build strategies, which allow the private investor to lever its core competences and to fully exploit its unique capabilities. One way to acquire unique capabilities is through specialisation, networking and syndication. Private investors need to develop managerial and operating skills such as marketing and supply chain management that are useful in their whole investment portfolio. In order to make use of these skills in an optimal way, further specialisation in specific industry segments, technologies, geographic

[33] According to its characteristics (managerial/entrepreneurial mindset - aimed at efficiency/strategic innovation), a buyout can be categorized as an efficiency-oriented buyout, a revitalisation buyout, an entrepreneurial buyout, or a buyout failure (Wright et al., 2000; 2001).

areas or investment stages is desirable. Private equity firms might consider partnering up with corporate acquirers, thereby benefiting from the partner's industry-specific knowledge and management capabilities.

2.5. Conclusions

In this chapter, we use a combination of strategic management theory and financial economics to develop implications for the value appropriation in public-to-private transactions and to explain the observed evolution in this market. Investor-specific competencies and resources allow buyout investors to appropriate the value creation in a PTP. Due to competition in the market for private equity, any value creation arising from shared competencies is fully reflected in the price paid to the old shareholders. An important implication of the knowledge-based view is that private investors should build distinctive resources so as to be in a unique position to create value, and should focus on those going-private deals in which their distinctive resources offer the most value-creating opportunities.

The traditional sources of value creation in PTPs like the financial and some of the operational effects have become non-idiosyncratic. Private equity investors can only appropriate the value created by levering their core capabilities onto the target and exploiting the follow-up investment opportunities the target offers. As a result, the private equity market moves away from the traditional type of transactions based on financial restructuring into more specialization, innovative approaches and hybrid deals. A buy-and-build strategy, for instance, allows the private investor to benefit from levering its unique competencies. Private investors further specialize in specific industries and technologies, and extend their networking and deal syndication to obtain an idiosyncratic resource base. This resource accumulation further reinforces the path-dependent character of a private investor's investment strategy. The path dependency of accumulating resources and making investments under uncertainty result in unique investment opportunities for a specific investor and allow to appropriate part of the value created, due to the idiosyncratic buyer value, its unique information and/or its idiosyncratic real option parameters.

Studies in finance may benefit from incorporating strategy and further linking the two fields (e.g., by considering firms as bundles of resources, acknowledging the occurrence of path dependency, etc.). Valuable future research may be provided by empirical studies of PTPs that explicitly examine value creation given the target's and private investor's unique

resources, and that concentrate more on the ‘leveraging core competencies’ value sources rather than on the widely documented traditional sources.

Chapter 3

Acquisitions as a Real Options Bidding Game

Chapter 3: Acquisitions as a Real Options Bidding Game[34]

Abstract

This chapter uses a unified treatment of real options and game theory to examine the occurrence of bidding contests within a competitive environment of imperfect information and asymmetric bidders. Competing potential buyers may sequentially perform due diligence and incur costs (option premium) to become informed about their firm-specific target value (underlying value) before making a bid (exercise price). The first player's bid reveals a signal on its own and the rival's target value, thereby affecting the value of the rival's option to bid on the target and the probability of a bidding contest. We find that bidding contests are more likely to take place between moderately correlated buyers, whereas rather diverse or just very similar buyers are less likely to compete.

3.1. Introduction

Acquisitions are known to have sometimes a beneficial and occasionally a very detrimental impact on a corporation's performance. Empirical research on this topic indicates that, on average, acquisitions create value but most of this added value is reflected in the acquisition price. However, the resulting low acquirer returns exhibit substantial variation. In bidding contests in particular, heterogeneity between rival bidders and information asymmetry between them determine the acquisition premium (Bradley, Desai, & Kim, 1988; Fishman, 1988). The real options-game model presented here examines the bidding process, the likelihood of a bidding contest and the expected value appropriation for the acquirer. The implications of the model are built on signaling by heterogeneous[35] players. The information about target value that is revealed to a rival by a bid depends on the (dis)similarity of resources of the rival bidders. The bidding strategy, the likelihood of a bidding contest and the

[34] This chapter is based on the paper 'Acquisitions as a Real Options Bidding Game', Han Smit, Ward van den Berg & Wouter De Maeseneire, Working Paper Tinbergen Institute, TI 084/2, 2004. I would like to thank Michael Fishman, Erwan Morellec and Enrico Perotti for comments on this chapter. This chapter has also benefited from presentations at the Corporate Finance Day, Ghent University (2004) and at the Strategic Management Society Conference, San Juan, Puerto Rico (2004).

[35] Bernardo & Chowdry (2002) also link a firm's resources to its real options. A firm will make specialized or general investments, depending on what it expects to learn about its resources.

expected acquisition price are determined by new and less obvious parameters such as volatility and correlation between bidders' resources.

Firms often invest aggressively in due diligence before making acquisitions. Early, detailed, and rigorous transaction screening yield a significant advantage in placing a successful bid to many deals or avoid that the other deals are being taken too far through the process. The due diligence investment of an interested bidder can in this sense be considered as the purchase of a real option on the target's value. The due diligence costs (option premium) a potential buyer needs to incur reveals the target value (underlying value) and are thus a prerequisite before making a bid (exercise price). A potentially interested bidder will only perform due diligence and incur the associated cost if this is justified by the real option value. The opportunity to bid on a target, however, is not an exclusive but rather a shared option, where the acquisition price is determined by competition between potential buyers.

The specific acquirer's assets, resources and capabilities and their fit with those of the potential target determine the actual value for each potential buyer (Barney, 1986). A public opening bid might reveal an attractive takeover target for rivals and provokes closer scrutiny of the target by other bidders. The extent to which an opening bid affects an uninformed rival's beliefs concerning its target value and its expected gains from the acquisition depends on the bidders' resources. For instance, a high bid indicates a high value for the initial bidder and a similar rival is likely to assign a high value to the target as well, whereas this bid would give no indication on the value for an unrelated rival.

Fishman (1988) and Hirshleifer & Png (1989) also relate the expected gains in a bidding contest to the costs associated with acquiring information. Fishman (1988) offers the interesting insight that the price of a target in a bidding contest may exhibit a jump when some contestants have imperfect and costly information. We contribute insights from option theory to Fishman's model and show that uncertainty and correlation between bidders determine the information revealed by the opening bid. Our model builds on Fishman (1988) and presents a two player setting, where the initial bidder may decide to make a pre-emptive or an accommodating bid after performing due diligence. When the bid provides an accommodating signal, the second bidder invests in due diligence and an English auction[36] unfolds. However, when the initial bidder has offered a pre-emptive bid, the costs of due diligence are higher than the second bidder's option value on the target. The rival will abstain from entering a bidding contest and the first bidder acquires the target at the pre-emptive bid.

[36] The target is then acquired at the second highest player's value. For an excellent overview of auction theory see Krishna (2002).

Our model provides several novel implications that can in principle be tested. In contrast to common beliefs, value appropriation is not strictly decreasing with the level of relatedness between bidders (correlation) but follows a U-shaped form. The opening bid provides a double signal to the rival. When correlation is high (bidders are similar), the opening bid signals high target value for the rival, inducing him to invest in due diligence and potentially join in a bidding contest. However, at the same time, due to the great similarity, acquisition prices will be high and value creation will be bid away in the contest, making the second player less inclined to invest in due diligence. When rival bidders are different (correlation is low) the second player is less likely to invest as well, since the bid signals low target value. As a consequence, both very low and very high levels of correlation enhance the ability to make a pre-emptive bid and increase the initial bidder's value appropriation. Intermediate levels of correlation may result in a bidding contest and low value appropriation. Furthermore, value appropriation increases in case of higher uncertainty and higher expected value for the initial bidder. Greater uncertainty to the second bidder increases the likeliness of a bidding contest and reduces the value appropriation.

The remainder of the chapter is as follows. In Section 3.2., we provide a brief review of background literature on bidder heterogeneity and information asymmetry to support the economic fundamentals of our model. In Section 3.3., we present our real option-game model. The model's results are discussed in Section 3.4., and Section 3.5. elaborates upon the model's implications. Section 3.6. summarizes this chapter and its main findings.

3.2. Literature on value appropriation in acquisitions: heterogeneity and imperfect information

From empirical research it is clear that acquisitions may create value, but there is substantial variation in how this value is split up between target and acquirer.[37] A successful tender offer increases the combined value of the target and acquiring firm by about 7 to 10% on average (Bradley, Desai, & Kim, 1988; Seth, 1990; Stulz, Walkling, & Song, 1990). Further evidence suggests that acquiring firms on average earn a return close to zero, though

[37] There are several alternative explanations with respect to how value creation is distributed between target and acquirer. Market power, hubris, overpayment, and other factors play a role (Chatterjee, 1992; Seth, Song, & Pettit, 2000; Capron, Mitchell, & Swaminathan, 2001). Moreover, agency-related and free-rider problems are important variables as well (e.g., Grossman & Hart, 1980; Bagnoli & Lipman, 1988; Stulz, 1988; Lang, Stulz, & Walkling, 1991; Slusky & Caves, 1991; Jennings & Mazzeo, 1993; Song & Walkling, 1993; Burkart, 1995; Hartzell, Ofek, & Yermack, 2004) but our model does not consider these problems. For a more comprehensive discussion on value appropriation in acquisitions, we refer to Bruner (2002), Capron & Pistre (2002) and King, Dalton, Daily, & Covin (2004).

there is tremendous variation in these returns (e.g., Berkovitch & Narayanan, 1993). The underlying causes of this variation in acquisition returns have enjoyed continuous attention in the empirical literature. However, further theoretical development explaining the variation in value appropriation is desirable (Fuller, Netter, & Stegemoller, 2002).

Recently, several articles have used real options and games to explain the occurrence and returns of mergers (Smith & Triantis, 1994, and Smit, 2001). Lambrecht (2004) shows that firms have an incentive to merge in periods of economic expansion when mergers are motivated by economies of scale, which provides a rationale for the procyclicality of merger waves. Morellec & Zhdanov (2004) have developed a model that is consistent with the general empirical observation that target shareholders' returns are larger than returns to bidding shareholders and that returns to bidding shareholders can be negative if there is competition for the target acquisition.

The existence of *information asymmetry* between rival bidders has a significant influence on competition for deals and the size of the acquisition premium (Barney, 1988). For instance, a *buyer's initial stake (toehold)* results in a financial and strategic advantage and to higher bidder returns (e.g., Grossman & Hart, 1981; Shleifer & Vishny, 1986; Franks & Harris, 1989; Stulz, Walkling, & Song, 1990). In addition, those returns could be attributed to the information advantage provided by the initial shareholding (Burkart, 1995). Bradley, Desai, & Kim (1988) have shown that bidder returns were higher before the acceptance of the 1968 Williams Act, which requires a bidder to disclose private information about the target. A larger part of the value creation goes to the acquirer when buying a *private firm or a subsidiary* rather than a public firm. In addition to the lack of liquidity, this can be explained in part by limited information that is available, higher information costs for rivals, and consequently lower competition for the target. This is consistent with the findings of Fuller, Netter, & Stegemoller (2002), who show that acquirer returns are more positive for larger *non-public targets* and more negative for larger public firms. In our model, information on the idiosyncratic target value is acquired at a cost, such as consultancy and banker fees related to due diligence, but essentially creates an option to acquire the target. We show that a bid may reveal part of this information to potential rival bidders, and that the information revealed depends critically on the heterogeneity between bidders (correlation).

Heterogeneity as a result of the specific match between the target's and the acquirer's resources creates the ability of a buyer to avoid bidding away all the value creation through high takeover prices (Chatterjee, 1986, 1992; Barney, 1988). The target will have different values for heterogeneous buyers. Capron & Pistre (2002), for example, show that acquirers

earn abnormal returns only when they can transfer their own unique resources to the target, which prevents the competitive bidding process from fully unfolding.[38] Parenting advantage (Campbell, Goold, & Alexander, 1995), complementary resources (Harrison, Hitt, Hoskisson, & Ireland, 2001) and absorptive capacity (Zahra & George, 2002) might be considered as partly inimitable valuable resources and are therefore important factors in explaining the appropriation of value creation in acquisitions.

In our model, we analyze the effect of heterogeneity on the information signaled to rivals by the opening bid, and we develop implications for the likelihood of bidding contests to occur.

3.3. Option and game model

In this section we develop our real option-game model in which players sequentially retrieve information on the target value and we determine the optimal Bayesian Nash equilibrium under an accommodating or deterrent bidding strategy.

3.3.1. Assumptions of the option-game model

We assume a two-player setting of the bidding game. Contests with more than two bidders seldom occur.[39] In our model, Player A is the first to investigate the target value at time $t = 0$; at $t = 1$, Player A is informed about its target value and offers its initial takeover bid. Player B observes this public bid and can infer some information on the target value for both itself and the rival, enabling him to better assess the expected acquisition price and real option value obtained by performing due diligence. Player B will only invest in due diligence if the option value to bid on the target exceeds the costs of due diligence, I.[40] If Player B decides to invest in due diligence, the target becomes the subject of a bidding contest between informed players at $t = 2$. The winning bidder's value appropriation is contingent on its rival's

[38] Distinctive competences provide an isolating mechanism and allow acquirers to capture the value creation brought about by these unique resources (e.g., Chatterjee, 1986, Singh & Montgomery, 1987; Barney, 1988; Bradley, Desai, & Kim, 1988; Jarrell & Poulsen, 1989; Nathan & O'Keefe, 1989; Slusky & Caves, 1991).

[39] For instance, in the study of Bradley, Desai, & Kim (1988) 65 out of 73 multiple bidder contests involved only two bidders.

[40] In a takeover, a potential acquirer has to invest resources in searching for an appropriate target, evaluating potential sources of value and preparing the actual bid. These costs include fees to counsel and to investment banks, management time and the cost of obtaining the required amount of financing. Initial investigation of and identification of valuable targets may be a very costly activity (e.g., Chowdry & Nanda, 1993; Burkart, 1995).

value (= acquisition price). If Player B does not invest in due diligence, Player A acquires the target at its binding opening bid.

We assume that common beliefs about expected target values, uncertainty around those values, and correlation between rivals' target values are available to all participants in the game. The decisions are based on those common beliefs and observed players' actions. We denote the present or expected value of the uncertain target value by $V_A(0) = E_0\left(V_A(2)\right)$ and $V_B(0) = E_0\left(V_B(2)\right)$ for Players A and B respectively.[41] The volatility or uncertainty can be different for both players and reflects the extent to which the actual value can deviate from the expected value; it is given by σ_A and σ_B. The correlation between bidders' target values is denoted by ρ.

The information search period has been standardized to one.[42] In the due diligence process small pieces of information on the acquisition value emerge, gradually reducing uncertainty, until at the end of the search the player knows its private actual target value, denoted by $V_A^* = V_A(2)$ and $V_B^* = V_B(2)$ for Players A and B, respectively. We assume a risk-neutral world, in which the resolution of uncertainty about the actual target value during the process of information search is represented by the geometric Brownian motion in Equation 3.1..[43]

$$dV_i(t) = V_i(t)\sigma_i dZ_i(t) \quad for\ i = A, B \tag{3.1.}$$

The Brownian motions of the actual target values, $Z_A(t)$ and $Z_B(t)$[44], are correlated by a factor ρ, with $-1 \le \rho \le 1$. The correlation reflects the degree of uniqueness of the rival bidders' resources and capabilities. When ρ equals 0, the two prospective buyers do not share any resources or capabilities that contribute value in the acquisition. For increasing

[41] In a risk neutral world, the present value equals the expected value, if the discount rate is zero. For simplicity, we do not apply a risk-free time discount, as the entire acquisition game takes place within a short time horizon. Introducing a discount rate would not alter the model's results.

[42] Takeover contests can last weeks or even months. Bradley, Desai, & Kim (1988) report that for their sample of multiple-bidder contests the ultimately successful offer was made on average more than six weeks after the initial offer.

[43] Alternatively, we could have assumed that the actual target values are lognormally distributed at $t = 2$, but the Brownian motion describes precisely the due diligence process.

[44] The notion of time in the Brownian motions $Z_A(t)$ and $Z_B(t)$ relates to the information that is released at a certain stage in the due diligence process (between begin $t = 0$ and end $t = 1$) and should not be confused with the decision at discrete time in the overall model, where Player A first investigates between time 0 and 1 and Player B investigates between time 1 and 2. If viewed in this way, the Brownian motions should be defined as $Z_A(t)$ and $Z_B(t\text{-}1)$.

values of ρ a larger proportion of value creation in the acquisition results from similar capabilities and resources, and competition would become more intense in a bidding contest. For instance, tax shields in management buyouts can be obtained by many investors and stem from similar resources, whereas improving operations requires idiosyncratic capabilities (Kaplan, 1989). For $\rho = 1$, competitors are identical in their value creation competences and a bidding contest would transfer all value creation to the present shareholders. In case of negative correlation, a resource of the target or acquirer that has greater value to one player than initially expected will likely have a lower value for the competitor. An example would be the case of an inefficient business unit of a target that is making huge losses. If one player cannot perform the required restructuring, while the rival bidder is an expert in transforming inefficient businesses into successful ones, this would result in negative correlation between the rival bidders' value of this resource.

Finally, we assume -similar to most tender offer literature (e.g., Bradley, Desai, & Kim, 1988; Burkart, 1995)- that managers of bidding firms seek to maximize their shareholders' wealth, that there are no transaction costs in bidding, that offers cannot be withdrawn (binding bids) and that all takeover bids are public information. Furthermore, we assume that a player who does not know its actual target value will never enter a bidding contest solely on the basis of common knowledge.[45] Any bid must exceed the seller's reservation price, *RES*, which is the price at which current owners are willing to sell their stake in the target. It is assumed to be equal to the target's stand-alone value, or to the financial market value in the case of a listed firm. We do not consider free-rider problems, as did Grossman and Hart (1980), and assume that current owners are rather passive in the transaction.

3.3.2. Option value for second bidder

At t = 1, Player A has conducted due diligence and has offered a bid, b_A, thereby signaling its value to Player B who is contemplating investment in due diligence. The real option for Player B to bid on the target resembles the exchange option of Margrabe (1978), as the uncertain target value to Player A (= price) is exchanged for the uncertain target value to Player B, but it also incorporates the information offered by Player A's initial bid, b_A. Player

[45] Barney (1986) and Fishman (1988) make this assumption as well: without being informed, acquirers can create value only when they are lucky.

A's bid provides a lower bound to Player A's target value distribution, V_A', which is at least as large as the bid.[46] Furthermore, correlation between the players' target values determines the bid's impact on Player B's update of its target value and uncertainty. When firms are similar, a high bid indicates a high value for Player A and therefore a high value for Player B is more likely as well. At time 1 the value of Player B's option to bid on the target is given by Equation 3.2., where we take the truncation of the price distribution into account, or $V_A^* > V_A'$.[47]

$$C(1) = E_Q\left(\max(V_B(2) - V_A(2),0) \mid V_A'\right) \tag{3.2.}$$

To obtain a closed form solution for the option value of Equation 3.2., we first examine the impact of the opening bid b_A on Player B's beliefs on the target's value distribution for both players. At time 1 Player A has complete knowledge on its target value. Player B can infer some information on Player A's value, as the lognormal distribution of the value at time 1 is now truncated by the lower bound V_A'. The paths of the Brownian motion $Z_A(t)$ that attain a value at t = 2 below $k = \left(\ln(\mathrm{V}_A') - \ln(E(V_A)) + \frac{1}{2}\sigma_A^2\right)/\sigma_A$ are not feasible anymore. Hence, the expected target value of Player A conditional on its implied bid, $E_1(V_A(2) \mid V_A')$, is given by the truncated expectation in Equation 3.3..

$$E_1(V_A(2) \mid V_A') = V_A(0)N\left(\sigma_A - k\right)/N\left(-k\right) \tag{3.3.}$$

Thus, Player A's bid results in an upwards update of Player B's beliefs about Player A's expected target value. Moreover, when rivals' target values are correlated, the bid reveals that certain due diligence outcomes on the value of the shared resources are not feasible. This affects Player B's expected target value, as some values of $Z_B(t)$ are more likely to occur if the lower paths of $Z_A(t)$ have not been attained. In case of positive correlation Player B's expected target value will increase by a bid of Player A, while the update is downwards for

[46] As we will discuss later, Player A's bid signals that its actual target value is strictly higher than the bid and at least equal to the implied bid, V_A'.

[47] In Equation 3.2. the option value is updated for the information on the minimal acquisition price revealed by b_A. In the Appendix Equation (A.17.) we present the option value for Player B when there is also information in the type of bid (pre-emptive or accommodating).

negative correlation. Equation 3.4. provides Player B's updated expected target value after observing Player A's bid.

$$E_1(V_B(2) \mid V_A') = V_B(0)N(\rho\sigma_B - k)/N(-k) \tag{3.4.}$$

If $\sigma_A > \rho\sigma_B$ Player A's bid has a larger impact on the expected value to Player A than to Player B. Player B's shared resources are not sufficiently valuable to overcome the unique value creation that Player A might realize.

Player B's option value to bid on the target can now be expressed in terms conditional on the lower bound on Player A's value revealed by its initial bid.[48,49]

$$C(1) = E_1(V_B(1) \mid V_A')M(d_1, d_2, \rho_1) / N(d_2) - E_1(V_A(1) \mid V_A')M(e_1, e_2, \rho_1) / N(e_2) \tag{3.5.}$$

The parameters[50] of the standard bivariate and univariate normal distribution functions *M* and *N* are given by

$$d_1 = \frac{\ln(E(V_B)) - \ln(E(V_A)) + \frac{1}{2}\sigma_{B/A}^2}{\sigma_{B/A}}$$

$$d_2 = \frac{\ln(E(V_A)) - \ln(V_A') + \rho\sigma_A\sigma_B - \frac{1}{2}\sigma_A^2}{\sigma_A}$$

$$e_1 = \frac{\ln(E(V_B)) - \ln(E(V_A)) - \frac{1}{2}\sigma_{B/A}^2}{\sigma_{B/A}}$$

$$e_2 = \frac{\ln(E(V_A)) - \ln(V_A') + \frac{1}{2}\sigma_A^2}{\sigma_A}$$

The variance of the ratio $V_B(1)/V_A(1)$ is given by $\sigma_{B/A}^2 = \sigma_A^2 + \sigma_B^2 - 2\rho\sigma_A\sigma_B$, while the correlation between the ratio $V_B(1)/V_A(1)$ and the variable $V_A(1)$ is given by $\rho_1 = (\rho\sigma_B - \sigma_A)/\sigma_{B/A}$.

[48] The derivation of Equation 3.5. and Equation 3.9. can be found in the Appendix.
[49] In Section 3.3.3. and in Equation A.17. of the Appendix we present a solution that updates this option value for both the minimal value for Player A and the signal given by whether it follows an accommodating or pre-emptive strategy.
[50] Note that $d_2 = \rho\sigma_B - k$ and $e_2 = \sigma_A - k$, which enables us to further simplify Equation 3.5..

Let us consider some properties of this option. For a bid close to zero, or when no bid is offered, the option value collapses to the Margrabe simple exchange option given by $V_B(0)N(d_1)-V_A(0)N(e_1)$. For very low bids, the signal provided by Player A's implied bid is weak and does not much alter Player B's beliefs about its own or Player A's expected target value. For higher bids, the influence on option value depends on uncertainty and correlation, which both affect the probability of a successful takeover and the updated value for the players. For very high bids ($\lim V_A' \to \infty$) the option can take one of two values. If $\rho\sigma_B < \sigma_A$, the option value converges to zero. A high bid increases the expected target value to Player A by far more than to Player B, and Player B will surely lose in a bidding contest. On the other hand, if $\rho\sigma_B > \sigma_A$, a high bid indicates an even larger value for Player B than for Player A and Player B would certainly win a bidding contest. The option value will then become infinitely large.

3.3.3. Pre-emption or accommodating competition

Player A must deliberate at time 1 whether to quote a high pre-emptive bid or a lower bid that allows the rival to enter a bidding contest. The gains from quoting a pre-emptive bid are known in advance, while the option value of an accommodating bid strategy depends on the unknown target value to Player B. For which level a bid acts pre-emptive depends on the value of the alternative of offering an accommodating bid, which we will consider first.

After due diligence, Player A knows its own target value $V_A(2) = V_A^*$ and can update its beliefs about Player B's target value based on their common resources and capabilities. The value of this shared component in the Brownian motions $Z_A(t)$ and $Z_B(t)$ is thus known to Player A, who is informed about the realization of $Z_A^*(2) = l = \left(\ln(V_A^*) - \ln(E(V_A)) + \frac{1}{2}\sigma_A^2\right)/\sigma_A$. Hence, Player A knows the probability distribution of Player B's target value conditional on $V_A(2) = V_A^*$, and the updated expected value equals

$$E_1(V_B(2) \mid V_A^*) = V_B(0)\varphi(l - \sigma_B\rho)/\varphi(l) \tag{3.6.}$$

where $\varphi(x)$ is the standard normal probability density function evaluated at *x*, where $-\infty < x < +\infty$. If Player A's value is smaller than expected, *$V_A(0)$*, it is more likely that Player B's value

is also smaller than initially expected, $V_B(0)$, under positive correlation. The variance in the geometric Brownian motion that describes Player B's possible values is therefore reduced as well and is given by

$$dV_B(t) = \sqrt{(1-\rho^2)}\sigma_B V_B(t) dZ_{B|A}(t) \tag{3.7.}$$

The Brownian motion $Z_{B|A}(t)$ is independent of $Z_A(t)$. Player A will make a pre-emptive bid only if the expected payoff from preventing Player B from participating in a bidding contest outweighs the higher purchase price. The value of quoting a low bid and facing competition from Player B is given by the option

$$D(1) = E_Q(\max(V_A^* - \max(V_B(2), b_A), 0)) \tag{3.8.}$$

The minimum acquisition price equals the initial bid, b_A. A competitor will enter the bidding contest if its target value is higher than this opening bid. When Player A values the target higher than Player B, it acquires the target at a price $V_B(2)$; otherwise, Player B acquires the target and Player A's payoff is zero. The present value of this option at $t = 1$ is given in closed form by

$$D(1, V_A^*) = V_A^* N(d_1) - E_1(V_B(2) \mid V_A^*)\big(N(e_1) - N(e_2)\big) - b_A N(f_1) \tag{3.9.}$$

where the parameters are given by

$$d_1 = \frac{\ln(V_A^*) - \ln(E_0(V_B(1) \mid V_A^*)) + \frac{1}{2}(1-\rho^2)\sigma_B^2}{\sqrt{(1-\rho^2)}\sigma_B}$$

$$e_1 = \frac{\ln(V_A^*) - \ln(E_0(V_B(1) \mid V_A^*)) - \frac{1}{2}(1-\rho^2)\sigma_B^2}{\sqrt{(1-\rho^2)}\sigma_B}$$

$$e_2 = \frac{\ln(b_A) - \ln(E_0(V_B(1) \mid V_A^*)) - \frac{1}{2}(1-\rho^2)\sigma_B^2}{\sqrt{(1-\rho^2)}\sigma_B}$$

$$f_1 = \frac{\ln(b_A) - \ln(E_0(V_B(1) \mid V_A^*)) + \frac{1}{2}(1-\rho^2)\sigma_B^2}{\sqrt{(1-\rho^2)}\sigma_B}$$

Player A's option value under an accommodating bid strategy is decreasing in the level of the bid b_A. In a bidding contest, the likelihood of a successful acquisition depends only on Player B's target value, which is not affected by a higher or lower bid. A higher bid only increases the average acquisition price, as the opportunity to acquire the target at the rival's value, which may be lower than the bid, has been forestalled. In an accommodating bid strategy, Player A therefore has an incentive to offer an opening bid as low as possible and will hence offer a bid equal to the reservation price.

Player B can obtain the option to bid by investing in due diligence at costs I. Player A can avoid a bidding contest when it has the opportunity to offer a pre-emptive bid that results in a Player B's option value that is smaller than the information costs. Player A will follow a pre-emptive bid strategy if the pre-emptive bid is lower than the expected purchase price in a bidding contest. If Player A offers the pre-emptive bid, Player B infers that the value of pre-emption exceeds the value of accommodation for the actual target value of Player A. The lower bound on Player A's target value distribution is therefore not given by the pre-emptive bid, $\tilde{b}_A$, itself, but by the implied pre-emptive bid, b_A^{imp}, at which the value of accommodation equals the value of pre-emption. At this implied pre-emptive bid, Player B's option value to bid on the target equals the due diligence costs.

$$b_A^{imp} = \inf\{b_A : C(0, b_A) < I\} \tag{3.10.}$$

The pre-emptive bid itself is the difference between the implied pre-emptive bid and the value of the option to accommodate at a target value equal to this implied pre-emptive bid.

$$\tilde{b}_A = b_A^{imp} - D(1, b_A^{imp}) \tag{3.11.}$$

To summarize, Player A may choose a pre-emptive bid and receive the certain payoff, $V_A^* - \tilde{b}_A$, or the option value under an accommodating bid strategy, $D(1, V_A^*)$, dependent on its actual target value, V_A^*. There are three equilibrium regions. If Player A's target value is below the pre-emptive bid ($V_A^* < \tilde{b}_A$), it accommodates. For target values between the pre-emptive and the implied pre-emptive bid ($\tilde{b}_A < V_A^* < b_A^{imp}$) accommodating is preferred as well, despite the fact that its value exceeds the pre-emptive bid. From a certain threshold,

$V_A^* > b_A^{imp}$, offering a pre-emptive bid yields a higher payoff than accommodating competition.

The pre-emptive bid depends on the uncertainty of and correlation between bidders. If $-1 < \rho < \sigma_A / \sigma_B$, a pre-emptive bid exists since Player B's option value decreases in Player A's bid and will thus become smaller than the information costs. If $\rho\sigma_B > \sigma_A$, the option value increases in the initial bid and pre-emption is impossible, except in the special case where the reservation price is already deterrent. The pre-emptive bid decreases in due diligence costs, as the implied pre-emptive bid decreases more than the value of the option under an accommodating strategy.

Finally, if Player A accommodates a double signal is provided to Player B: i) Player A's target value is at least as large as the reservation price (= accommodating bid); and ii) an accommodating bid implies that player A could not offer a high pre-emptive bid and Player A's actual value is consequently lower than the threshold level b_A^{imp}. In the Appendix Equation A.17., this cap on Player A's value is accounted for in Player B's option. Player B's option value increases due to the cap on Player A's value.

3.4. Results of the model

In this section we discuss the initial bidder's decision between the alternative strategies -offering a high pre-emptive or a low accommodating bid- and examine Player A's expected value appropriation. In our analysis, we focus on the impact of correlation and uncertainty about actual target value.

3.4.1. Pre-emptive bidding: option value for Player B

Player B will invest in due diligence after observing Player A's bid when its option value exceeds the information costs. Player A knows the parameter values of this option and can offer a pre-emptive bid to deter Player B from entering the bidding contest.

Figure 3.1. shows the influence of Player A's implied bid (=lower bound on its value distribution) on Player B's real option value to bid on the target under various parameter settings. As noted, in the special case where Player A has offered no bid or a bid equal to zero the option collapses to the Margrabe exchange option. In this case, Player B's option value decreases in the level of correlation. In line with conventional wisdom, higher correlation

decreases total uncertainty about the difference in values that both bidders assign to the target (ratio of value and price). In general, heterogeneity between bidders' resources -measured in our context by correlation- leaves room for appropriation of value in competitive bidding.

However, when acknowledging the signaling effect of Player A's implied bid on price and value for Player B, the option value of Player B becomes a non-linear function of the implied bid, and the impact of correlation on option value becomes more complex. At high correlation levels the implied bid has a limited impact on the option value: the likely acquisition price increases, but so does the expected target value. However, at low or even negative levels of correlation the bid signals a low target value, and the non-linearity becomes more apparent.

The comparative static analysis presented in Figure 3.1. shows three types of curvatures, depending on the correlation: strictly increasing, strictly decreasing and initially increasing but later decreasing. First, when $\rho < 0$, the option value is strictly decreasing in the level of the implied bid. A higher bid reduces the expected value for Player B, while its beliefs about the acquisition price (i.e., the expectation of Player A's value) increase. Second, when $0 < \rho < \sigma_A / \sigma_B$ the option value is (often marginally) increasing for a low implied bid[51] and is decreasing for higher bids. In this case, the total uncertainty for Player A is higher than Player B's uncertainty on the shared target resources. Consequently, a higher bid increases Player B's conditional expected value (since $\rho > 0$), but Player B's belief of the acquisition price increases by an even larger amount (since $\rho\sigma_B < \sigma_A$; e.g., the curves in Panels D and F for $\rho = 0.9$ and in Panel C for $\rho = 0.6$). Third, when $\rho\sigma_B > \sigma_A$ the option value is strictly increasing in the level of the bid. When the uncertainty surrounding the shared resources faced by Player B is higher than the total uncertainty faced by Player A, a higher bid reveals information for Player B that increases its expected target value by more than the expected price. An example is shown in Panel C for the case $\rho = 0.9$.

In the base case of Panel A, the target's (unconditional) expected value for both players equals 100 and uncertainty around this expectation is 0.3 ($\sigma_i = 0.3$). By offering an implied pre-emptive bid, P^A, Player A can deter Player B from bidding because the information costs exceed Player B's option value. Due to non-linearity the S-shaped option value functions for different correlation levels intersect. Whether higher correlation facilitates or hinders pre-emptive bidding therefore depends on the option value function vis-à-vis the

[51] The maximum is, however, often located close to a bid of zero and the curve seems to be strictly decreasing.

level of information costs, *I*. When a low pre-emptive bid is sufficient (e.g., high costs) the effect on price exceeds the signal on value and higher correlation has a negative effect on the option value and the pre-emptive bid. When a high pre-emptive bid is required (e.g., low costs) the effect on value dominates the effect on price and higher correlation has a positive effect on option value, driving the pre-emptive bid upward.

Panel B shows that higher uncertainty for Player A ($\sigma_A = 0.4$) amplifies the S-shaped form of the option value function relative to the base case. Player B's acquisition price is more uncertain than its target value. Similar to Margrabe's exchange option, higher uncertainty about the acquisition price would increase option value, since it increases the volatility in the difference between players' actual target values. Interestingly, the bid's signaling effect on price is stronger than in the base case, while its effect on Player B's value has not been altered, thereby reducing option value. When a low pre-emptive bid is sufficient, the increased price uncertainty dominates the larger acquisition price and the option value rises. In cases where Player A has to make a high pre-emptive bid, the increased price uncertainty is dominated by the larger acquisition price and option value decreases. For instance in the example of Panel B, the implied pre-emptive bid is lower as compared to the base case of Panel A (for $\rho = 0.3$, from P^A to P^B).

Panel C shows the effect of higher uncertainty for Player B ($\sigma_B = 0.4$) on option value. In this situation target value is more uncertain than target price. Now, the bid conveys a more significant adjustment in Player B's expected value. In general[52], the option value and the pre-emptive bid rise (for $\rho = 0.3$, from P^A to P^C). Pre-emptive bidding may even become impossible when $\rho\sigma_B > \sigma_A$.

Panel D shows the case of higher uncertainty for both players (to $\sigma_i = 0.4$) and thus combines the effects of the two previous panels. More uncertainty about resources and capabilities increases the attractiveness of conducting due diligence, as a greater potential is to be explored. With some exceptions, the option values in Panel D are shifted upward relative to Panel A, increasing the implied pre-emptive bid (for $\rho = 0.3$, from P^A to P^D).

Panels E and F show the influence of expected target value on option value. A higher expected value of Player A (Panel E) reduces the bid's signaling function. In general, the

[52] Only in the special case of negative correlation a decline in Player B's value might offset the increase in volatility.

option value and required pre-emptive bid will be lower (for $\rho = 0.3$, from P^A to P^E).[53] Higher expected value to Player B (Panel F) increases its option value and the implied pre-emptive bid (for $\rho = 0.3$, from P^A to P^F).

3.4.2. Accommodation: option value for Player A in a bidding contest

The value of accommodating competition depends on Player A's actual target value and its update on Player B's expected target value (= expected acquisition price). Player A will accommodate when this strategy is more valuable than pre-emption. Accommodating competition may result in a lower acquisition price and hence larger value appropriation, but Player A faces the risk of paying more or even losing the contest.

Figure 3.2. shows Player A's real option value as a function of its actual target value when competition is accommodated. In the numerical example we set the reservation price equal to 80. If Player A's actual value, V_A^*, equals the reservation price, the option value is zero, and the option value increases for higher actual target. The shared resources (correlation between the players' target values) are an important factor for the shape of the function. The impact of correlation depends on the initially expected value for Player A and the actual target value which is private information of Player A. When Player A's actual value is lower than initially expected (100 in our example) and correlation is positive, Player B's value -and hence the acquisition price for Player A- is likely to be smaller. When actual target value is higher than initially expected, the effect of correlation on the acquisition price update is opposite. Player A's option value therefore increases in the correlation level at low actual values due to lower acquisition prices, while it decreases in correlation for large actual target values due to higher acquisition prices (as can be best viewed in Panels C and E of Figure 3.2.).[54]

Panel B shows the option value when the uncertainty faced by Player A is higher than for Player B.[55] Player A's negative or positive update on the expected acquisition price is

[53] For negative correlation option value might decrease as compared to the base case, since the bid's adverse effect on Player B's expected value is smaller.

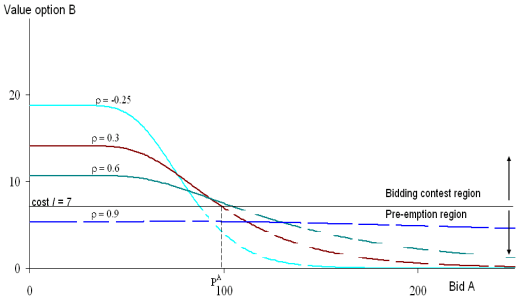
[54] In the case of negative correlation, the option value converges for higher target values to the maximum value appropriation, $V_A^* - RES$ (or a 45 degree line), as it is becoming less and less likely that Player B's value would exceed the reservation price. For positive correlation the value of the option is always less than this 45 degree line, as the acquisition price is likely higher than the reservation price.

[55] In the simple case (not depicted) when no correlation is present, $\rho = 0$, the higher uncertainty has no influence on the price and the same option value would result.

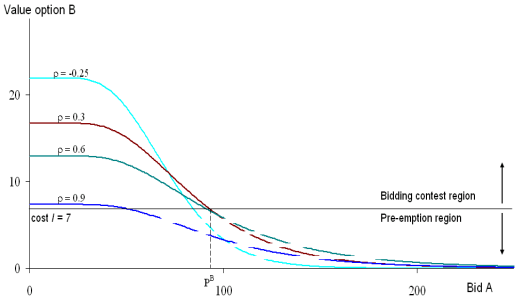
Figure 3.1.
Second Bidder's (Player B) Option Value to Enter a Bidding Contest after Observing the First Bidder's Offer (Player A) at Time 1

In each panel the curves represent different correlation levels between Player A's and Player B's target value. Panel A shows the standard case where both players' expected value equals 100 and uncertainty is 30%. In Panel B, only uncertainty for Player A has risen to 40%, while in Panel C only uncertainty for Player B has increased to 40%. In Panel D both players' uncertainty has increased to 40%. In Panel E Player A's expected target value rises to 110, while in Panel F Player B's expected target value is 110. In all panels, we assume a due diligence cost of 7. The level of the implied pre-emptive bid is given by that implied bid at which the option value equals the costs. A dotted line represents option value if the second bidder does not purchase the option to enter the bidding contest. A continuous line represents the option value when the second bidder will purchase the option and enters the bidding contest.

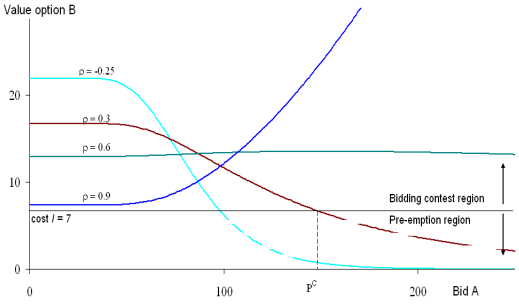
Panel A. Base Case



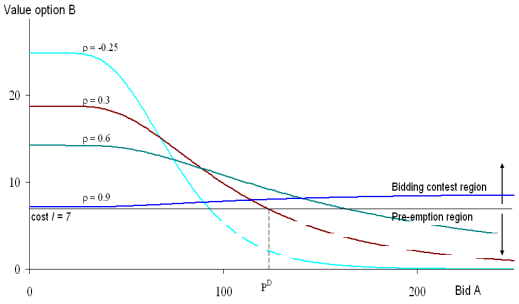
Panel B. Larger Uncertainty to Player A:
Option value increases and decreases



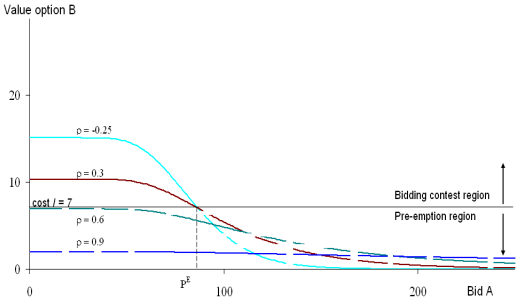
Panel C. Larger Uncertainty to Player B:
Option value increases



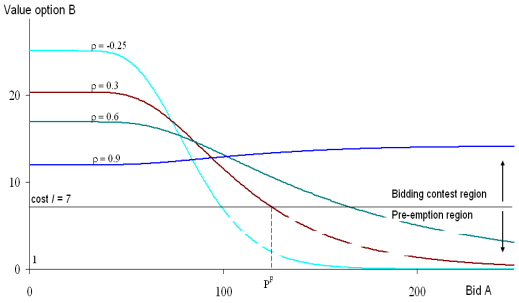
Panel D. Larger Uncertainty to Both Players:
Option value increases



Panel E. Larger Expected Value for Player A:
Option value decreases



Panel F. Larger Expected Value for Player B:
Option value increases



smaller. As can be observed from Panel A and B differences in option values due to correlation are therefore smaller under higher uncertainty to Player A.

Panel C depicts the case where uncertainty on Player B's value (or the acquisition price) is higher. As usual, higher price uncertainty increases option value, but it has also an effect on the updated expected acquisition price. Player A's update will be larger, which may reinforce or offset the option value increase due to the larger uncertainty. When the actual target value is lower than expected, the downwards update on the acquisition price will be larger under positive correlation, raising option value. When the actual target value is higher than expected, the option value will decrease under positive correlation, partially or totally offsetting the increase due to larger uncertainty. An extreme example is given by the option value curve for $\rho = 0.9$, where the option value converges to zero for large actual target values. The effect of higher uncertainty to Player B on its option value are opposite for negative correlation.

In Panel D uncertainty to both players is increased and the results of previous two cases might reinforce or offset each other. In Panel E a larger expected value to Player A increases option value for positive correlation and reduces it for negative correlation. A higher expected value to Player B (Panel F) reduces the option value in any case.

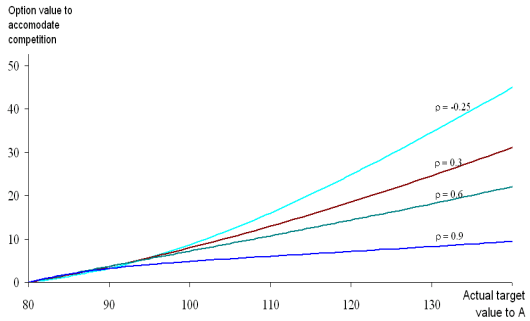
3.4.3. Deliberation of Player A: pre-emption or accommodation

At t = 1 Player A deliberates between making a pre-emptive bid or a lower bid that allows the rival to participate in a bidding contest. The gains from a pre-emptive bid are certain, $V_A^* - \widetilde{b}_A$. The value of allowing the competitor to enter the contest equals $D(1)$ from Equation 3.9.. For low target values, $V_A^* < \widetilde{b}_A$, Player A finds it optimal to place a low bid and accommodate competition, which is represented by the smooth line in Figure 3.3.. For values $\widetilde{b}_A < V_A^* < b_A^{imp}$ Player A makes a profit when offering the pre-emptive bid, but the value of accommodation is higher, as can be observed in Figure 3.3.. The value of offering the pre-emptive bid, $V_A^* - \widetilde{b}_A$ (represented by the thin dotted line), is less than the value of accommodating competition. The level of the pre-emptive bid $\widetilde{b}_A$ is given by the value where the diagonal dotted line crosses the X-axis. The pre-emptive bid is offered for $V_A^* > b_A^{imp}$, when pre-emption yields a higher return than accommodation. The implied pre-emptive bid is represented by the vertical dotted line.

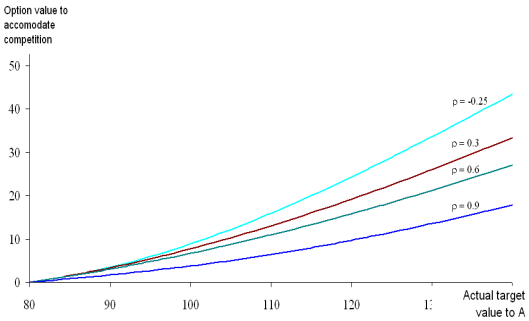
Figure 3.2.
First Bidder's (Player A) Option Value to Accommodate Competition at Time 1

If the second bidder enters a bidding contest, the first bidder's payoff of the potential acquisition is affected as the rival raises the takeover price. Panel A shows the standard case where both players' expected value equals 100 and uncertainty is 30%. In Panel B only uncertainty for Player A has risen to 40%, while in Panel C only uncertainty for Player B has increased to 40%. In Panel D both players' uncertainty has increased to 40%. In Panel E Player A's expected target value rises to 110, while in Panel F Player B's expected target value is 110. In all panels, the reservation price equals 80.

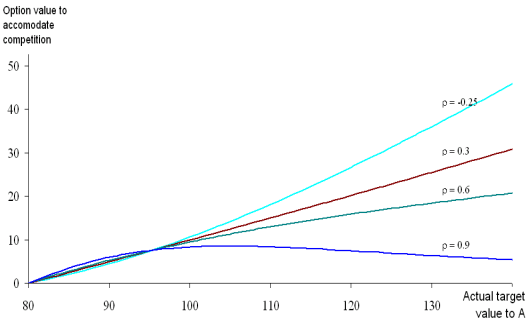
Panel A. Base Case



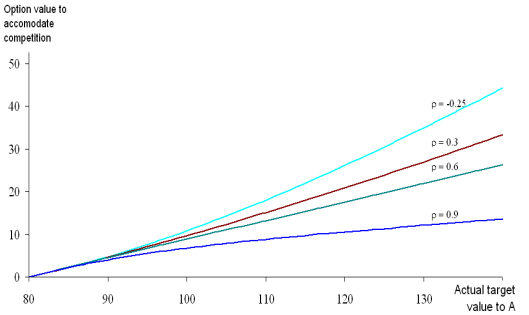
Panel B. Larger Uncertainty to Player A:
Option value increases and decreases



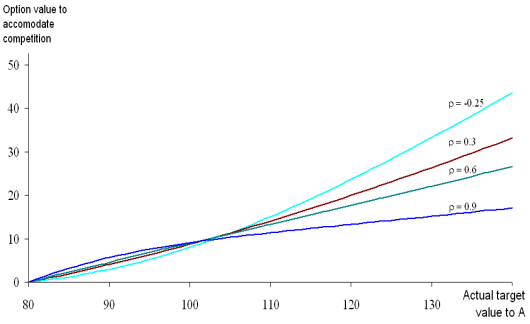
Panel C. Larger Uncertainty to Player B:
Option values increases and decreases



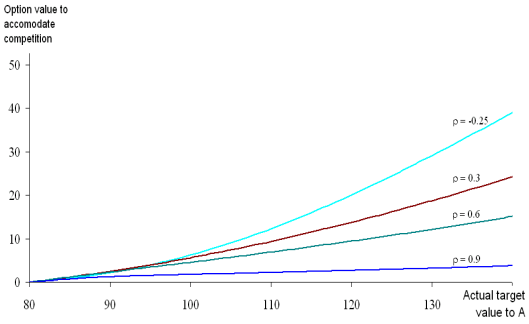
Panel D. Larger Uncertainty to Both Players:
Option value increases or decreases



Panel E. Larger Expected Value to Player A:
Option value increases and decreases



Panel F. Larger Expected Value to Player B:
Option value decreases



Panel A, the base case, shows for each actual target value the expected value appropriation for Player A. Due to non-linearities in option value for Player B, a correlation level exists above which the pre-emptive bid no longer increases but instead decreases in correlation.[56] The pre-emptive bid shifts right in correlation, but from a certain threshold level it shifts left again, as can be best viewed in Panel B. This can be explained if we revisit Figure 3.1.. When the option value intersects the cost line, the pre-emptive bid can fall in the low cost region (correlation increases the pre-emptive bid) or high cost region (correlation decreases the pre-emptive bid). When correlation is very high and the opening bid is equal to the reservation price, Player B's option to bid on the target may be less valuable than the due diligence costs. Player A can then appropriate all value creation and no bid premium is offered (e.g., the curve $\rho = 0.9$ in Panels A, B and E).

When competition is accommodated, the results from Section 3.4.2. on Player A's option value apply. For high actual target values the option value to accommodate competition decreases in correlation (see Figure 3.2.). This reinforces the effect of larger correlation on offering a pre-emptive bid for high target values: not only the pre-emptive bid decreases but also the alternative of accommodation is less valuable.

In Panel B (higher uncertainty for Player A) we observe lower pre-emptive bids. As the pre-emption lines shift to the left, the first bidder appropriates a higher proportion of value. The high or low cost regions are a function of information cost vis-à-vis option value. Increased uncertainty to Player A shifts the minimum of the U-shaped value appropriation function to a lower correlation level.[57]

Panel C of Figure 3.1. shows that it is more difficult to deter competition under higher uncertainty for Player B. As Player B's option value increases, the pre-emptive bid shifts to the right. As can be confirmed from Section 3.4.2., the value of the accommodation option is higher for low target values and it might even exceed the value of pre-emption in the base case.

Panel D again unites the previous both cases. The value of Player B's option to bid on the target increases in uncertainty, raising the pre-emptive bid. A higher uncertainty to both players also results in a higher value of the accommodation option. For high actual target

[56] The value appropriation for actual target values where a pre-emptive bid is chosen is minimal for this correlation level. In Panel A a correlation of 0.63 would minimize value appropriation for large actual target values.

[57] The minimal value appropriation under pre-emption is now attained at a correlation of 0.41 instead of 0.63 in the base case. Panel B shows that the pre-emptive bid for a correlation level of $\rho = 0.6$ is lower than for $\rho = 0.3$ and value appropriation is accordingly higher.

values, the value appropriation will be less than in the base case where pre-emption occurs. However, for smaller actual target values, the value of the option to accommodate competition will be more valuable than in the base case where a pre-emptive bid is offered or competition is accommodated. The increased uncertainty to both players shifts the minimum of the U-shaped value appropriation function to a higher correlation.

A higher expected value to Player A (Panel E) facilitates offering a pre-emptive bid and raises the value of the option to accommodate competition under positive correlation, so value appropriation will be larger. A larger expected target value to Player B (Panel F) reduces Player A's expected value appropriation. The pre-emptive bid will be higher, and the option to accommodate competition becomes less valuable.

To summarize, the value appropriation by the initial bidder decreases with a higher rival option value to bid on the target or lower information costs, resulting in higher pre-emptive bids, or with a lower value of accommodating competition. For high target values, value appropriation takes a U-shaped function in correlation. It initially decreases until correlation reaches a certain level; from that level on, value appropriation rises with correlation.

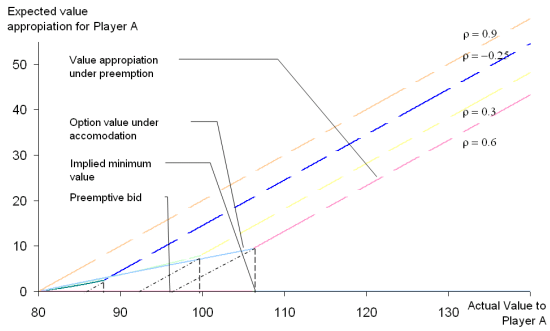
3.5. Discussion of the model results and model extensions

The value of a target depends on its resources and the related and complementary resources of the potential acquirer. Potential acquirers differ in their resource base and part of the value created in the acquisition is unique. The uncertainty around the expected value and the correlation between potential bidders are determined by the match between the resources of the target and potential acquirers. The degree of correlation and (asymmetric) uncertainty depends on the proportion of shared and unique resources of acquirers. When the initial bidder controls more unique, potentially valuable resources (rather than shared resources) its expected target value is likely to be higher and correlation lower. Part of the value creation in the acquisition cannot be replicated by rivals. In many cases unique resources increase uncertainty about target value (e.g., the acquirer possesses a unique technology with an uncertain match with the target). It is hard for outsiders to make inferences on the value of these unique resources in relation to the target. Likewise, the holder of unique resources has a more complicated task to assess the use and value of its unique resources within the target. Of course, there are situations in which the addition of unique resources to a player's bundle of

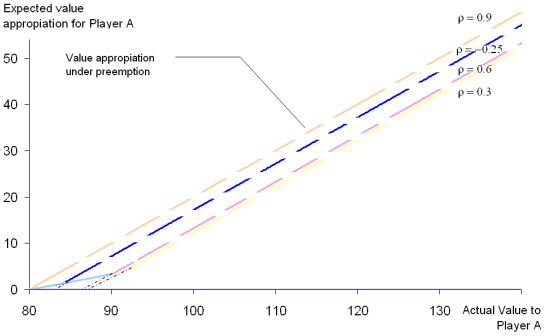
Figure 3.3.
First Bidder's (Player A) Expected Value Appropriation of a Bidding Contest with Opportunity to Pre-empt or Accommodate Rival Bidder (Player B) at Time 1

Expected acquirer return is certain if the pre-emptive bid is quoted (represented by the dotted line), and uncertain when competition is accommodated. In the latter case, it is equal to the expected value of the real option to accommodate competition (represented by the continuous line). The pre-emptive bid is given by the intersection of the dotted line with the X-axis. Panel A shows the standard case where both players' expected value equals 100 and uncertainty is 30%. In Panel B, only uncertainty for Player A has risen to 40%, while in Panel C only uncertainty for Player B has increased to 40%. In Panel D both players' uncertainty has increased to 40%. In Panel E Player A's expected target value rises to 110, while in Panel F Player B's expected target value is 110. In all panels, the reservation price equals 80.

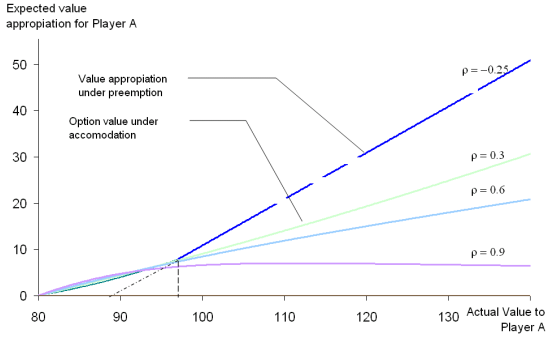
Panel A. Base Case



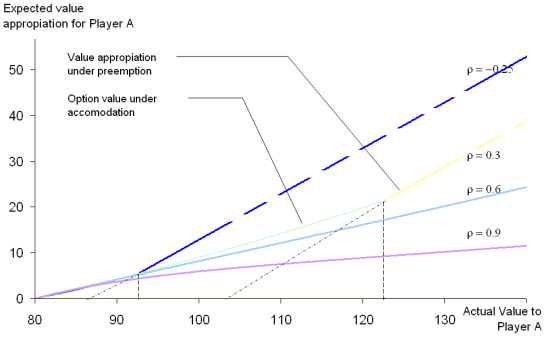
Panel B. Larger Uncertainty to Player A: Value appropriation increases



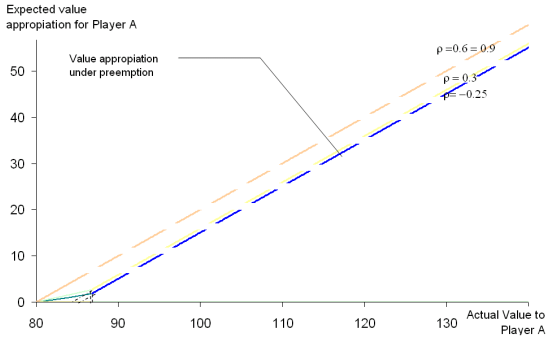
Panel C. Larger Uncertainty to Player B: Value appropriation increases and decreases



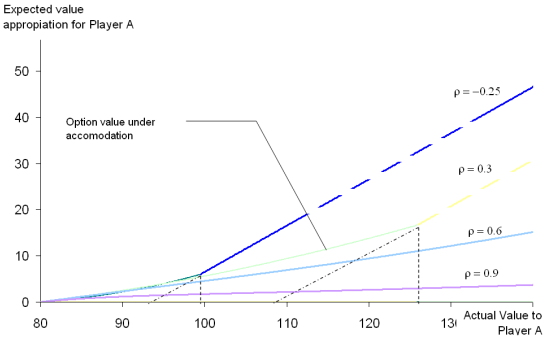
Panel D. Larger Uncertainty to Both Players: Value appropriation increases and decreases



Panel E. Larger Expected Value to Player A: Value appropriation increases



Panel F. Larger Expected Value to Player B: Value appropriation decreases



resources may reduce the uncertainty about its target value. For instance, a high quality (unique) distribution channel that can be used for the target's products may decrease uncertainty.

From finance and strategy literature, it is known that firms need unique, idiosyncratic skills to generate abnormal returns in acquisitions, since for common resources competition drives up the takeover price and, as a consequence, value appropriation is low or non-existent. Imperfect and costly information might change this result. In order to compete for the target, a rival must incur due diligence costs that it expects to recover. The initial bidder, who is informed about its target value, therefore has a strategic competitive advantage, as it can affect the rival's beliefs about expected gains from the acquisition. A key feature of our model lies in the opening bid, which contains a signal on both the initial bidder's and the rival's target value. The ability of the first bidder to influence the later entrant's behavior by setting the appropriate opening bid depends on the degree of relatedness between bidders and the bidders' uncertainty.

The extent to which value-creating capabilities in the acquisition are shared or, on the contrary unique, has a sophisticated effect on value appropriation. When the first bidder offers the opening bid, the second bidder updates its own expected value of the acquisition in a potential bidding contest. The impact of this update depends on correlation between the bidders. On one hand, the rival's expected target value increases in the level of correlation and on the other hand, the acquisition price in the contest will also be closer to its target value. A certain tradeoff in both effects exists, in which bidding contests are most likely when there is an intermediate level of correlation. For low correlation, the opening bid reveals only a high acquisition price, not a higher target value to the rival. High correlation implies that both players' target values are closer to each other and that value creation will be bid away in a contest. For intermediate correlation, the opening bid provides an upwards update on target value, while leaving room for favorable due diligence outcome on the acquisition price and for value appropriation.

Larger asymmetries in uncertainty between players can strengthen or weaken the signal of the opening bid. Increased asymmetric uncertainty can therefore offset the increase in option value as caused in general by higher uncertainty. When a player's target value is surrounded by larger uncertainty, this player has more power in the first stage of the bidding game in which players decide on investing in due diligence.

Our model provides a number of interesting new implications. The likelihood of bidding contests to occur depends on correlation. A bidding contest between players operating

in different industries is not very likely as correlation is low. Similarly, we do not expect bidding contests between rivals who possess different experience/skills, when one bidder is a strategic buyer and the other a financial investor, or when one bidder is aiming for a vertical acquisition while the other is pursuing a horizontal acquisition. Likewise, a bidding contest is not likely to take place between similar firms within an industry, as the due diligence costs are too high as compared with the potential gains. The highest probability of a bidding contest occurs when rivals are characterized by intermediate correlation (e.g., financial bidders who pursue different strategies for the target, strategic bidders in the same sector that differ in their resource base, a high cost-high quality vs. low cost player). Thus, we expect bidding contests to unfold when the target is under scrutiny of several players that differ in some aspects but are not completely different.

The likelihood of bidding contests depends also on the uncertainty both players face. When the second bidder is more uncertain about its target value, the option to perform due diligence is more valuable, lowering value appropriation for the initial bidder. On the other hand, if the second bidder has higher uncertainty about the acquisition price (=initial bidder's target value) and observes a high opening bid as well, he is less induced to retrieve information, resulting in higher value appropriation for the initial bidder. We expect that a bidding contest is less likely to unfold and that the initial bidder captures the highest amount of value appropriation when the initial bidder is a young firm[58] or operates in a different sector than the target (high uncertainty about its target value). Bidding contests are also less likely when potential rival bidders are larger, mature firms (low uncertainty due to experience in matching resources) or when information costs are high (e.g., the target is a complex firm to value).

A typical young firm is less likely to experience a rival bidder but is more likely to join a bidding contest as a second player, as the first bidder's offer triggers his interest. As a consequence, outsiders are the main opponents within bidding contests. An outsider, more uncertain about its value and to a lesser extent correlated with the first bidder, may show up in the takeover battle. Within bidding contests, we expect that initial bidders will be those with high expected value and considerable uncertainty, while we expect rival bidders also to be faced with high uncertainty and to be related to some extent with the first (not too little, but neither too much).

[58] Bernardo & Chowdhry (2002) suggest, for example, that younger and smaller firms still have a lot to learn about (the value of) their resources and therefore face higher uncertainty than more mature and larger firms.

The timing of the rival bidder's decision to invest in due diligence is exogenous in our model. However, our results do not change when we consider endogenous timing, because firms are inclined to invest sequentially in order to optimally use the revelation of information. To show this, we consider the possible timing game presented in a matrix in Figure 3.4.. *(i, ii)* When firms invest sequentially the value of the first entrant is given by F_i, and the value of the second to enter the bidding contest by S_i. *(iii)* When both players decide to invest simultaneously in due diligence, there is no information revelation and the payoff is given by the value of the Margrabe exchange option N_i minus the due diligence costs. *(iv)* When both rivals defer, the game is repeated in the next period (D_i).

Figure 3.4.

Timing of the Due Diligence Investment Game

A player can either wait or invest in due diligence. When both players invest they receive the option value of a bidding contest reduced with the due diligence costs. The value of entering first is given by the expected value of either a deterrence or an accommodating strategy reduced by the due diligence costs. The value of entering second is given by the value of entering the bidding contest when it is optimal to invest in due diligence. The deferral value is the present value of the next period's game.

		Player B: invest	Player B: wait
Player A	invest	(N_A, N_B)	(F_A, S_B)
Player A	wait	(S_A, F_B)	(D_A, D_B)

Simultaneous investment in due diligence (N_A, N_B) is not a Nash equilibrium. In order to benefit from the information revealed by a bid it is always preferred that the rivals invest sequentially and thereby potentially avoid unnecessary due diligence investment of the second player in the game ($S_i > N_i$). Dependent on the actual payoffs, the three other cells constitute an equilibrium. Firms will invest sequentially when $F_i > D_i$. A coordination problem arises in a symmetrical game when there are two equilibria, in which one player invests and the other player waits. However, asymmetry in the payoffs might facilitate solving the coordination

game by finding a unique Nash equilibrium or at least a focal point. We note that due to the opportunity to offer a pre-emptive bid F_i is larger than N_i.

The value of waiting, D_i, depends on additional uncertainty besides the incomplete information in our model. The actual target value may change as developments in the economy or business environment create new opportunities for the employment of the combined target's and acquirer's resources. Over time not only the target's reservation price, and potential rival bidders' expected value, but also uncertainty itself and correlation may evolve. When the game is repeated in the next period the firms may defer until a sequential revelation equilibrium results. Endogenous timing will therefore result in sequential investment and will not affect the main results of our model.

3.6. Conclusions

In this chapter we use a real options-game model that examines the bidding process, the likelihood of a bidding contest and the expected value appropriation for the acquirer. We focus on the role of information asymmetry and on heterogeneity in the rival bidders' resource base. A firm's capabilities and resources, combined with those of the target, determine its expected target value, uncertainty around it, and the correlation with rivals' target values. In our model, an uninformed bidder may acquire the option to bid on the target by performing due diligence. A potentially interested buyer will only become an informed bidder when its option value exceeds the due diligence costs. The initial bidder can affect the rival's option value since the opening bid provides a signal on its own and on the rival's target value. The first bidder may therefore choose a strategy to bid high and pre-empt rivals, or to bid low and accommodate competition, when pre-emption is too costly.

By considering a bidding contest as a sequential option game within a resource-based perspective of bidders, our model introduces the roles of uncertainty and correlation for the likelihood of a bidding contest and value appropriation. The extent to which value-creating capabilities in the takeover are shared between rival bidders (correlation) has a U-shaped effect on value appropriation. Very high levels and very low levels of correlation lead to a rise in value appropriation due to pre-emption, under imperfect information. At intermediate levels of correlation a bidding contest may occur and value appropriation is lower. The magnitude and sign of the bidding signal further depends on the uncertainty both players face.

Our model could be further expanded by including bidding costs, examining the endogenous timing of making a bid and determining endogenously which player offers the

opening bid. Under uncertainty, rivals may defer investment until major macroeconomic uncertainties are resolved.

Appendix to Chapter 3

A. Derivation of Player B's option to bid

Before any due diligence Players A and B share common beliefs on the target value for each of them, both given by a lognormal distribution or the solution of a geometric Brownian motion from Equation 3.1. at $t = 1$.

$$V_i = E(V_i)\exp\left(-\tfrac{1}{2}\sigma_i^2 + \sigma_i Z_i\right) \qquad \text{for } i = \text{A or B} \qquad \text{(A.1.)}$$

We assume that the drift is absent, or the discount rate is equal to zero. The normally distributed variables Z_A and Z_B are correlated by a factor ρ.

After due diligence, Player A offers a bid b_A and truncates the distribution on its target value by the value V_A' (with $V_A' > b_A$), which is implied by this bid as we will show later. Z_A cannot take values below $k = \left(\ln(V_A') - \ln(E(V_A)) + \tfrac{1}{2}\sigma_A^2\right)/\sigma_A$. The expected value is now given by

$$E(V_A \mid V_A') = \int_k^{\infty} E(V_i)\exp\left(-\tfrac{1}{2}\sigma_A^2 + \sigma_A x\right) f(x)/N(-k)dx = E(V_A)N\left(\sigma_A - k\right)/N\left(-k\right) \qquad \text{(A.2.)}$$

where f(x) is the probability density function of the normal distribution and $f(x)/N(-k)$ gives the pdf. of the truncated distribution. The updated expected value of Player B's target value also depends on the truncation of Z_A by k:

$$E(V_B \mid V_A') = \int_{-\infty}^{\infty}\int_k^{\infty} E(V_B)\exp\left(-\tfrac{1}{2}\sigma_B^2 + \sigma_B y\right) g(x,y)/N(-k)dxdy = E(V_B)N\left(\rho\sigma_B - k\right)/N\left(-k\right) \qquad \text{(A.3.)}$$

where $g(x,y)$ is the pdf. of the bivariate normal distribution.

The value of the option under the risk neutral measure Q conditional on the implied bid V_A' is given by

$$C(1) = E_Q\left(\max(V_B(2) - V_A(1), 0) \mid V_A'\right) \qquad \text{(A.4.)}$$

We can rewrite this to

$$C(1) = E_Q\left(V_B(2)1_{\{V_B(2)>V_A(2)|V_A(2)>V'_A\}} - V_A(2)1_{\{V_B(2)>V_A(2)|V_A(2)>V'_A\}} \mid V'\right) \quad \text{(A.5.)}$$

which in turn can be rewritten by changing the numeraire:[59]

$$C(1) = V_B(1) \times Q_{V_B}\left(V_B(2) > V_A(2) \mid V_A(2) > V'_A\right) - V_A(1) \times Q_{V_A}\left(V_B(2) > V_A(2) \mid V_A(2) > V'_A\right) \quad \text{(A.6.)}$$

The conditional probabilities can be calculated by adjusting the drift of the geometric Brownian motions describing $V_A(t)$ and $V_B(t)$ in accordance to the right probability measure Q_{V_A} or Q_{V_B}. The solution is given by Equation 3.5. or

$$E_1(V_B(1) \mid V'_A)M(d_1, d_2, \rho_1) / N(d_2) - E_1(V_A(1) \mid V'_A)M(e_1, e_2, \rho_1) / N(e_2) \quad \text{(A.7.)}$$

where the parameters of the standard bivariate and univariate normal distribution function *M* and *N* are given by

$$d_1 = \frac{\ln(E(V_B)) - \ln(E(V_A)) + \frac{1}{2}\sigma^2_{B/A}}{\sigma_{B/A}}$$

$$d_2 = \frac{\ln(E(V_A)) - \ln(V'_A) + \rho\sigma_A\sigma_B - \frac{1}{2}\sigma^2_A}{\sigma_A}$$

$$e_1 = \frac{\ln(E(V_B)) - \ln(E(V_A)) - \frac{1}{2}\sigma^2_{B/A}}{\sigma_{B/A}}$$

$$e_2 = \frac{\ln(E(V_A)) - \ln(V'_A) + \frac{1}{2}\sigma^2_A}{\sigma_A}$$

The variance of the ratio $V_B(1)/V_A(1)$ is given by $\sigma^2_{B/A} = \sigma^2_A + \sigma^2_B - 2\rho\sigma_A\sigma_B$, while the correlation between the ratio $V_B(1)/V_A(1)$ and the variable $V_A(1)$ is given by

[59] See Geman, El Karoui, & Rochet (1995).

$$\rho_1 = \frac{\rho\sigma_B - \sigma_A}{\sigma_{B/A}}.$$

B. Derivation of Player A's option under an accommodating strategy

After due diligence, Player A knows the realization of $Z_A^*(2) = l = \left(\ln(V_A^*) - \ln(E(V_A)) + \frac{1}{2}\sigma_A^2\right)/\sigma_A$ and can therefore infer a more precise expected value of Player B's target value, which is given by the conditional expectation

$$E_1(V_B(2) \mid V_A^*) = \int_{-\infty}^{\infty} E(V_B(0)) \exp\left(-\tfrac{1}{2}\sigma_A^2 + \sigma_A y\right) g(l, y) dy = V_B(0)\varphi(l - \sigma_B\rho)/\varphi(l) \quad \text{(A.8.)}$$

Also, the conditional uncertainty on the value $V_B(2)$ is smaller and the standard deviation is given by $\sqrt{(1-\rho^2)}\sigma_B$. The value of the option is now

$$D(1) = E_Q(\max(V_A^* - \max(V_B(2), b_A), 0))$$

(A.9.)

This can be rewritten by changing the numeraire as

$$D(1) = V_A^* Q(V_B(2) < V_A(2)) - V_B(1) Q_{V_B}(V_B(2) < V_A(2), V_B(2) > b_A) - b_A Q(V_B(2) < b_A) \quad \text{(A.10.)}$$

By changing the drift under the right probability measure we arrive at

$$D(1) = V_A^* N(d_1) - E_1(V_B(2) \mid V_A^*)\left(N(e_1) - N(e_2)\right) - b_A N(f_1) \quad \text{(A.11.)}$$

where the parameters are given by

$$d_1 = \frac{\ln(V_A^*) - \ln(E_1(V_B(1) \mid V_A^*)) + \frac{1}{2}(1-\rho^2)\sigma_B^2}{\sqrt{(1-\rho^2)}\sigma_B}$$

$$e_1 = \frac{\ln(V_A^*) - \ln(E_1(V_B(1) \mid V_A^*)) - \frac{1}{2}(1-\rho^2)\sigma_B^2}{\sqrt{(1-\rho^2)}\sigma_B}$$

$$e_2 = \frac{\ln(b_A) - \ln(E_1(V_B(1) \mid V_A^*)) - \frac{1}{2}(1-\rho^2)\sigma_B^2}{\sqrt{(1-\rho^2)}\sigma_B}$$

$$f_1 = \frac{\ln(b_A) - \ln(E_1(V_B(1) \mid V_A^*)) + \frac{1}{2}(1-\rho^2)\sigma_B^2}{\sqrt{(1-\rho^2)}\sigma_B}.$$

The option value decreases in the level of the opening bid b_A. For a higher opening bid, the expected acquisition price increases, while the probability of a successful acquisition is not altered. To maximize the value of the bidding contest, Player A will therefore offer a bid as low as possible, i.e. equal to the *RES*.

C. Derivation of Player B's option to bid when Player A accommodates

When Player A does not offer a pre-emptive bid, it signals to Player B that its value is lower than the threshold, b_A^{imp}, above which pre-emption is preferred. In addition to the minimal price (value for Player A) truncating the value distribution from below, the distribution is now also truncated from above, enabling a more accurate valuation of the option to bid on the target. The normally distributed variable, Z_A, cannot take values below $k_1 = \left(\ln(RES) - \ln(E(V_A)) + \frac{1}{2}\sigma_A^2\right)/\sigma_A$ or above $k_2 = \left(\ln(b_A^{imp}) - \ln(E(V_A)) + \frac{1}{2}\sigma_A^2\right)/\sigma_A$. In this case, the conditional expected value is given by:

$$\begin{aligned} E(V_A \mid b_A = RES) &= \int_{k_1}^{k_2} E(V_i)\exp\left(-\tfrac{1}{2}\sigma_A^2 + \sigma_A x\right) f(x)/\left(N(k_2) - N(k_1)\right)dx = \\ &= E(V_A)\left(N\left(k_2 - \sigma_A\right) - N\left(k_1 - \sigma_A\right)\right)/\left(N(k_2) - N(k_1)\right) \end{aligned} \qquad \text{(A.12.)}$$

The conditional expected value for player B is given by

$$\begin{aligned} E(V_B \mid b_A = RES) &= \int_{-\infty}^{\infty}\int_{k_1}^{k_2} E(V_B)\exp\left(-\tfrac{1}{2}\sigma_B^2 + \sigma_B y\right) g(x,y)/\left(N(k_2) - N(k_1)\right)dxdy = \\ E(V_B)&\left(N\left(k_2 - \rho\sigma_B\right) - N\left(k_1 - \rho\sigma_B\right)\right)/\left(N(k_2) - N(k_1)\right) \end{aligned} \qquad \text{(A.13.)}$$

The value of the option for Player B conditional on the bid *RES* and the pre-emption threshold $\widetilde{V}_A$ is given by

$$C(1) = E_Q\left(\max(V_B(2) - V_A(2), 0) \mid RES < V_A(2) < b_A^{imp}\right) \tag{A.14.}$$

We can rewrite this to:

$$C(1) = E_Q\left(V_B(2)1_{\{V_B(2)>V_A(2)|RES<V_A(2)<b_A^{imp}\}} - V_A(2)1_{\{V_B(2)>V_A(2)|RES<V_A(2)<b_A^{imp}\}} \mid RES < V_A(2) < b_A^{imp}\right) \tag{A.15.}$$

which in turn can be rewritten by changing the numeraire:

$$\begin{aligned} E(1) = {} & V_B(1) \times Q_{V_B}\left(V_B(2) > V_A(2) \mid RES < V_A(2) < b_A^{imp}\right) - \\ & - V_A(1) \times Q_{V_A}\left(V_B(2) > V_A(2) \mid RES < V_A(2) < b_A^{imp}\right) \end{aligned} \tag{A.16.}$$

The conditional probabilities can be calculated by adjusting the drift of the geometric Brownian motions describing $V_A(t)$ and $V_B(t)$ in accordance to the right probability measure Q_{V_A} or Q_{V_B}. The solution is given by

$$\begin{aligned} & E_1(V_B(1) \mid b_A)\left(M(d_1, d_3, -\rho_1) - M(d_1, d_2, -\rho_1)\right)/\left(N(d_3) - N(d_2)\right) - \\ & E_1(V_A(1) \mid b_A)\left(M(e_1, e_3, -\rho_1) - M(e_1, e_2, -\rho_1)\right)/\left(N(e_3) - N(e_2)\right) \end{aligned} \tag{A.17.}$$

where the parameters of the standard, bivariate and univariate normal distribution function *M* and *N* are given by

$$d_1 = \frac{\ln(E(V_B)) - \ln(E(V_A)) + \frac{1}{2}\sigma_{B/A}^2}{\sigma_{B/A}}$$

$$d_2 = \frac{\ln(RES) - \ln(E(V_A)) - \rho\sigma_A\sigma_B + \frac{1}{2}\sigma_A^2}{\sigma_A}$$

$$d_3 = \frac{\ln(E(b_A^{imp})) - \ln(E(V_A)) - \rho\sigma_A\sigma_B + \frac{1}{2}\sigma_A^2}{\sigma_A}$$

$$e_1 = \frac{\ln(E(V_B)) - \ln(E(V_A)) - \frac{1}{2}\sigma_{B/A}^2}{\sigma_{B/A}}$$

$$e_2 = \frac{\ln(RES) - \ln(E(V_A)) - \frac{1}{2}\sigma_A^2}{\sigma_A}$$

$$e_3 = \frac{\ln(E(b_A^{imp})) - \ln(E(V_A)) - \frac{1}{2}\sigma_A^2}{\sigma_A}$$

D. Proof that Player B's option value increases in value when acknowledging that Player A accommodates

The option value $E(1)$ can be written as a function of $C(1|b_A)$ with an offer b_A equal to the reservation price, *RES*, or the threshold, b_A^{imp}:

$$E(1) = \frac{\left(1 - N(k_1)\right)C(1 \mid RES) - \left(\left(1 - N(k_2)\right)C(1 \mid b_A^{imp}\right)}{N(k_2) - N(k_1)} \qquad \text{(A.18.)}$$

The value of the option $E(1)$ can only become lower than $C(1|RES)$ when $C(1|b_A^{imp})$ is higher than C(1|*RES*). This cannot happen, as the value of the option $C(1|RES)$ is always larger than *I,* otherwise the *RES* acts as the pre-emptive bid and $C(1|RES) = C(1|b_A^{imp}) = I$. Hence $E(1) > C(1|RES)$. When $\rho\sigma_B > \sigma_A$ Player B's option value strictly increases in Player A's bid, but then a pre-emptive bid cannot be made and b_A^{imp} does not exist. When the reservation price is already deterrent, $E(1)$ equals zero.

E. Proof of the existence of a Bayesian-Nash equilibrium

We assume that Player A has invested in due diligence and is informed about its actual target value, $V_A^* > RES$. This player can offer any bid b_A higher than or equal to the reservation price, *RES*. In a possible bid contest it will raise its bid until its target value has been reached. Player B can decide to invest an amount I in due diligence, observes then its actual target value V_B^* and joins the bidding contest if V_B^* is higher than the opening bid of Player A. If Player B decides not to invest, it will not be informed and cannot enter the bidding contest.

There are multiple equilibria. They are of the form that Player A offers a high bid, b_A', when its valuation exceeds a certain threshold, V_A', and offers the reservation price in the

other case. The high pre-emptive bid is given by $b'_A = V'_A - D(1, V'_A)$. Player B will invest in due diligence when Player A's opening bid equals the reservation price and will enter the bidding contest if its actual target value exceeds the reservation price. Player B does not invest in due diligence when it observes the high pre-emptive bid.

Player B is deterred by the bid b'_A since Player A will only offer this bid when its valuation exceeds the threshold V'_A. At any actual target value higher than this threshold, Player B's option value is lower than its cost. The minimal value of this threshold V'_A to be deterrent is given by b_A^{imp}, which is defined by the following condition:

$$b_A^{imp} = \min\left\{ b_A \mid C(1, b_A) \le I, \frac{\partial C(1, b_A)}{\partial b_A}(b_A^{imp}) < 0 \right\} \qquad \text{(A.19.)}$$

The accompanying pre-emptive bid is given by $\tilde{b}_A = \tilde{V}_A - D(1, \tilde{V}_A)$. For any value $V_A^* > b_A^{imp}$, Player B is deterred by the pre-emptive bid, as $\frac{\partial C(1, b_A)}{\partial b_A}(V_A^*) < 0$ holds for all $V_A^* > b_A^{imp}$.

When, on the other hand, the second part of the condition in Equation A.19. does not hold, the knowledge that $V_A^* > V'_A$ could invite Player B to enter the bidding contest rather than deter him. In this case a maximum level of the threshold exists and is given by the conditions:

$$b_A^{\max} = \max\left\{ b_A \mid C(1, b_A) \le I, \frac{\partial C(1, b_A)}{\partial b_A}(b_A^{\max}) > 0 \right\} \qquad \text{(A.20.)}$$

The optimal Bayesian-Nash equilibrium is given by the following set of strategies.

Player A's strategy: offer an accommodating bid, *RES*, when the actual target value, V_A^*, is less than the threshold b_A^{imp} and offer a pre-emptive bid, $\tilde{b}_A$, when the actual target value, V_A^*, exceeds the threshold, b_A^{imp}.

Player B's strategy: when observing an accommodating bid, *RES*, invest in due diligence and join a bidding contest and when observing a pre-emptive bid, $\tilde{b}_A$, do not invest in due diligence and do not join a bidding contest.

Proof

Suppose that $V_A^* > b_A^{imp}$ and Player A still offers an accommodating bid. Player B will then enter the bidding contest and Player A's payoff is the lower option value $D(1)$, instead of the higher pre-emption value, $V_A^* - \widetilde{b}_A$. Pre-emption would be preferred. Suppose that $V_A^* < b_A^{imp}$ and Player A offers the pre-emptive bid. Player B will not enter the bidding contest and Player A's payoff will be $V_A^* - \widetilde{b}_A$, while the value of accommodating $D(1)$ is higher. As a consequence, Player A's strategy is optimal.

Suppose that Player B does not invest in due diligence and observes an accommodating bid. Its payoff will be zero, while if it had entered, it would have received the positive amount of $E(1) - I$. Investing in due diligence is preferred. Suppose that Player B does invest in due diligence and observes a pre-emptive bid. Its payoff will be the negative amount of $C(1 \mid \widetilde{b}_A) - I$, while not investing would have yielded a payoff of zero. As a consequence, Player B's strategy is optimal. Note that in case of positive correlation $V_A^* - \widetilde{b}_A > D(1)$ for all $V_A^* > b_A^{imp}$ and that $V_A^* - \widetilde{b}_A < D(1)$ for all $V_A^* < b_A^{imp}$.

This forms the optimal set of strategies, as the payoff to the first player is maximized by choosing the pre-emptive bid $\widetilde{b}_A$ and threshold b_A^{imp}. By choosing a higher threshold V_A' the value of either entering a bid contest or pre-emption is reduced for any actual target value $V_A^* > b_A^{imp}$. If Player A would still choose to pre-empt, its payoff is reduced, as the pre-emptive bid has increased. If Player A does not pre-empt anymore, but accommodates, its payoff is reduced as well. The value of accommodation is less than the value of pre-emption with the lowest pre-emptive bid $\widetilde{b}_A$, as $\frac{\partial D(1)}{\partial V_A^*}(b_A^{imp}) < 1$. This condition might not hold in case of negative correlation and high implied pre-emptive bids. We will address this issue in the next subsection of this appendix.

Summarizing, Player A will not offer a bid other than *RES* or the pre-emptive bid $\widetilde{b}_A$. A bid higher than $\widetilde{b}_A$ would yield a lower payoff for Player A. Player B will still not join the bidding contest, and Player A has only raised its acquisition price. A bid between *RES* and $\widetilde{b}_A$ would also yield a lower payoff. Player B will enter the bidding contest and only the expected price is raised, but the probability of a successful takeover is not altered. Finally, a bid lower than *RES* is not feasible, as the present owners will only sell at a bid of at least size *RES*. We refer to Fishman (1988) for an in-depth analysis of the equilibrium concept.

F. Additional remarks for the case with negative correlation

In the case of negative correlation, Player A's value of the option to accommodate can become so large at high actual target values that it exceeds the payoff of the pre-emptive bid. The likely outcome of Player B's due diligence is a target value smaller than the reservation price, as the players are negatively correlated. Hence, for low and high actual target values an accommodating bid is offered, while for intermediate actual target values the pre-emptive bid is offered. The pre-emptive bid, $\widetilde{b}_A$, and the high threshold above which accommodation is preferred again, $\widetilde{V}_A$, are given by

$$\widetilde{b}_A = \inf\{b_A : E(0,b_A) < I\},\ \widetilde{V}_A = \inf\left\{V_A : D(1) > V_A - \widetilde{b}_A\right\} \tag{A.21.}$$

When Player A has offered the accommodating bid, Player B knows that Player A's actual target value is between the reservation price *RES* and the threshold b_A^{imp} or above the higher threshold $\widetilde{V}_A$. Player B's option value can now be written as

$$E(1) = \frac{(1-N(k_1))C(1\,|\,RES) - ((1-N(k_2))C(1\,|\,b_A^{imp}) + ((1-N(k_3))C(1\,|\,\widetilde{V}_A)}{N(k_2) - N(k_1) + 1 - N(k_3)} \tag{A.22.}$$

The probability that Player A's value is above the threshold $\widetilde{V}_A$ and offers the accommodating bid is given by $N(k_3)$, where $k_3 = \left(\ln(\widetilde{V}_A) - \ln(E(V_A)) + \frac{1}{2}\sigma_A^2\right)/\sigma_A$. As the option value of Player B $C(1|b_A)$ is strictly decreasing in the bid b_A when correlation is negative, it is clear that $C(1|RES) > C(1|b_A^{imp}) > C(1|\widetilde{V}_A)$ and therefore $E(1)$ is always larger than $C(1|RES)$. Player B will therefore always invest in due diligence when Player A offers an accommodating bid. The following set of strategies forms a Bayesian-Nash equilibrium in the case of negative correlation.

Player A's strategy: offer an accommodating bid, *RES*, when the actual target value, V_A^*, is less than the threshold $\widetilde{b}_A$ or above the threshold $\widetilde{V}_A$ and offer a pre-emptive bid, $\widetilde{b}_A$, when the actual target value, V_A^*, lies between the thresholds b_A^{imp} and $\widetilde{V}_A$.

Player B's strategy: when observing an accommodating bid, *RES*, invest in due diligence and join a bidding contest and when observing a pre-emptive bid, $\widetilde{b}_A$, do not invest in due diligence and do not join a bidding contest. The proof is analogous to the case of positive correlation.

It could occur that $b_A^{imp} \geq \widetilde{V}_A$ and the pre-emptive bid will never be offered. This is the case when $\frac{\partial D(1)}{\partial V_A^*}(b_A^{imp}) > 1$.

Summary and conclusion

Sophisticated valuation techniques such as adjusted present value (APV) and real options (RO), attract ever-increasing attention from theory and practice. A huge number of papers provide various applications of these advanced tools, for instance valuing R&D, strategic alliances and real estate. Real options have also been used for valuing acquisitions. However, notwithstanding the rich knowledge about valuation models applicable for valuing takeovers, there remains a need to further develop theories about the distribution of the value creation between the target's and acquirer's shareholders. Strategic management literature underlines the impact of possessing unique capabilities, and both the strategic and financial literature emphasize the role of information asymmetry in explaining value appropriation in acquisitions.

In this dissertation both simple and more complex valuation models are discussed, and we propose a real option-game model that analyzes the acquirer's value appropriation. In our valuation and value appropriation models, the specific resources and capabilities of the evaluator are considered. By taking the acquirer resources into account and by developing a new application of a combined option-game model, this PhD thesis is taking a step in further bridging the gap between finance theory and strategic management.

The thesis consists of the collection of three chapters: '*The Valuation of IPOs by Underwriting Investment Banks and the Stock Market*', '*The Role of Investor Capabilities in Public-to-Private Transactions*', and '*Acquisitions as a Real Options Bidding Game*'. The first chapter is empirical work, the second is a conceptual synthesis and the third one is based on theoretical modeling. The common topic in these pieces is valuation (all three chapters) and value appropriation (second and third chapter). This dissertation discusses the real option framework in addition to the traditional valuation frameworks.

The first chapter '*The Valuation of IPOs by Underwriting Investment Banks and the Stock Market*' examines the accuracy of the valuation models used by the underwriting investment banks for 49 IPOs listed on Euronext Brussels between 1993-2001. Many papers have been published about the accuracy of valuation methods and about IPOs. However, the literature about IPO valuation and IPO valuation accuracy is limited. In Belgium, pre-IPO valuation estimates by the underwriting investment bank are available in the IPO prospectus. This permits us to investigate the accuracy of the ex-ante valuation models as used by the

underwriting investment bank, while related papers analyze the ex-post value estimates of academics.

We find that for each IPO several valuation methods are used, of which the discounted free cash flow (DFCF) method is the most popular. However, the valuation result provided by the dividend discount model (DDM) is closest to the offer price, suggesting that investment banks use the DDM to set the offer price. When comparing the DDM valuation results with the price on the stock market after listing, we find that DDM tends to underestimate the value, while DFCF results in a pretty accurate predictor of the stock price. Interviews with investment bankers indicate that underwriters consciously underprice IPOs, by applying a discount to DFCF value estimates. DFCF is considered to be the most reliable method. DDM estimates are on average closer to the preliminary offer price than other value estimates, because DDM tends to underestimate value. When multiples valuation is used, investment banks rely mostly on future earnings and cash flows. Moreover, multiples valuation based on post-IPO forecasted earnings and cash flows leads to more accurate valuations than multiples valuation based on earnings and cash flows in the IPO-year. Consistent with the hypothesis that lead underwriters use other valuable information (such as investors' demand for the IPO) besides value estimates to set the final offer price, our results indicate that the final offer price is closer to the post-IPO stock market price than the individual value estimates provided by the various methods. Real option techniques currently have not been used or even discussed for any of the IPOs in our sample.

The second chapter '*The Role of Investor Capabilities in Public-to-Private Transactions*', examines the value of a public-to-private leveraged management buyout (PTP) from the perspective of a private investor. It provides an overview of the sources of value creation and destruction in PTPs. We discuss all potential sources of value, hence we take into account the real options generated by a PTP. Next to the traditional value components (reducing agency problems and information-asymmetry, tax shields) we discuss the importance of levering the private investor's core competencies. These allow benefiting from the synergetic benefits that might exist between the target and the current portfolio companies, and the intertemporal synergies, i.e., the opportunity to generate synergetic effects in the future by making follow-on investments which build on the initial PTP platform. An additional value component is provided by the information learned by making the buyout: the transaction allows the investor to become better informed about its resources and skills, thereby allowing him to make better investment decisions in the future. All the sources of value are integrated within an expanded adjusted present value criterion, which incorporates

the operational, financial value and real option value of a public-to-private. We provide an integration of finance and strategic management, and use that combined view to value public-to-privates, as well as to explain the developments observed within this type of acquisitions.

The chapter explores the evolution in the market of public-to-privates: due to the ever increasing levels of competition, the value generated by traditional sources of value is largely bid away. As a result, private equity investors aim for extracting value via exploiting non-traditional value sources like levering their core competencies. This leads for instance to a further specialisation as to build unique resources that allow private equity players to appropriate part of the value creation in the buyout. It also gives an explanation for the so-called path dependency of their investments: the previous investments in other portfolio companies determine the current resources and capabilities and therefore indicate which current and future investment opportunities are valuable. Furthermore, it provides an impulse to pursue innovative investment strategies such as buy-and-build: the public-to-private target is considered as a platform investment which provides the opportunity of making a number of follow-on investments. Within this strategy, the private investor tries to lever its own or the platform company's core competences onto the follow-on acquisitions. The valuation of such a strategy requires a real option model that incorporates potential competitor bidders' reactions.

The third chapter '*Acquisitions as a Real Options Bidding Game*' investigates the acquirer value appropriation in takeover contests. Empirical research indicates that acquisitions create value but most of this added value is reflected in the takeover premium. However, the resulting low acquirer returns show substantial variation. In bidding contests in particular, heterogeneity between rival bidders and information asymmetry affect the acquisition price. The real options-game model presented here examines the bidding process, the likelihood of a bidding contest and the expected acquirer value appropriation.

Bidders often perform due diligence before making acquisitions. This investment in due diligence investment can be considered as the purchase of a real option on the target's value. The due diligence costs (option premium) a potential buyer needs to incur reveals the target value (underlying value) and are thus a prerequisite before making a bid (exercise price). A potentially interested bidder will only perform due diligence if this real option value is higher than the cost. However, the opportunity to bid on a target is a shared option, where the acquisition price is determined by competing bidders. A public opening bid might reveal an attractive takeover target for rivals and induce a close scrutiny of the target by other bidders. The extent to which an opening bid affects an uninformed rival's beliefs concerning

its target value and its expected gains from the acquisition depends on the bidders' resources. For example, a high bid indicates a high value for the initial bidder and a similar rival is likely to have a high target value as well.

The implications of our model build on signaling by heterogeneous bidders. The bidding strategy, the likelihood of a bidding contest and the expected acquisition price are determined by new and less obvious parameters such as volatility and correlation between bidders' resources. In contrast to common wisdom, value appropriation does not strictly decrease with the level of relatedness between bidders but has a U-shaped form. Both very high and very low levels of correlation result in a higher value appropriation due to pre-emption of rival bidders, whereas at intermediate levels of correlation a bidding contest may occur and value appropriation is likely to be lower. Furthermore, value appropriation increases in case of higher uncertainty and higher expected value for the initial bidder. Greater uncertainty to the second bidder increases the likeliness of a bidding contest and reduces the value appropriation.

This dissertation aims to contribute to our knowledge about company valuation and about the value appropriation of acquirers. We have illustrated the importance of incorporating the real option perspective for both valuation and value appropriation. In addition, at the end of each chapter we have identified a number of potential directions for future research. These include examining what valuation methods are used by practitioners, such as financial analysts and investment bankers, how they actually deploy those models in practice and whether the use of real options is on the rise. It would also be worthwhile investigating why discounted dividend and discounted cash flow models that should produce identical results in theory provide different outcomes in reality. Another valuable suggestion for future work can be derived from acknowledging that the strategic intuition behind the evaluation and the decision making process of economic agents can benefit from the discipline of a more rigorous analytical process that draws from concepts of finance theory. For instance, there is a need to incorporate the insights and consequences of real options thinking to a wider range of applications and to make the so-called strategic value of any transaction or investment project more explicit. Research that combines insights from finance and strategic management to evaluate transactions and to analyze the potential value appropriation would also be helpful in contributing to the current state of scientific knowledge regarding valuation and value appropriation.

References

- Admati, A., & Pfleiderer, P. 1994. Robust financial contracting and the role of venture capitalists. ***Journal of Finance***, 49 (2): 371-402.
- Aggarwal, R., & Rivoli, P. 1990. Fads in the initial public offering market? ***Financial Management***, Winter: 45-57.
- Akerlof, G. 1970. The market for 'lemons', qualitative uncertainty and market mechanisms. ***Quarterly Journal of Economics***, 84 (3): 488-500.
- Alford, A. 1992. The effect of the set of comparable firms on the accuracy of the price-earnings valuation method. ***Journal of Accounting Research***, 30 (1): 94-108.
- Amihud, Y. 1989. Leveraged management buyouts and shareholders wealth. In Y. Amihud (Ed), ***Leveraged management buyouts: causes and consequences***: 3-34. Homewood, Il.: Dow-Jones Irwin.
- Amihud, Y., & Lev, B. 1981. Risk reduction as a managerial motive for conglomerate mergers. ***Bell Journal of Economics***, 12: 605-616.
- Amihud, Y., & Mendelson, H. 1986a. Liquidity and stock returns, ***Financial Analysts Journal***, 42 (May-June): 43-48.
- Amihud, Y., & Mendelson, H. 1986b. Asset pricing and the bid-ask spread. ***Journal of Financial Economics***, 17: 223-249.
- Amihud, Y., & Mendelson, H. 1988. Liquidity and asset prices: financial management implications. ***Financial Management***, 17 (Spring): 5-15.
- Amit, R., Glosten, L., & Muller, E. 1990. Entrepreneurial ability, venture investments and risk sharing. ***Management Science***, 36 (10): 1232-1245.
- Anand, J., & Singh, H. 1997. Asset redeployment, acquisitions and corporate strategy in declining industries. ***Strategic Management Journal***, 18 (Summer Special Issue), 99-118.
- Bagnoli, M., & Lipman, B. 1988. Successful takeovers without exclusion. ***Review of Financial Studies***, 1: 89-110.
- Baker, G., Jensen, M., & Murphy, K. 1988. Compensation and incentives: practice vs. theory. ***Journal of Finance***, 53: 593-616.
- Baker, G., & Wruck, K., 1989. Organisational changes and value creation in leveraged buyouts: the case of the O.M. Scott and Sons Company. ***Journal of Financial Economics***, 25: 163-190.

- Baldwin, C. 1987. ***Preemption vs. flexibility in new product introduction***. Unpublished working paper. Harvard Business School.
- Barney, J. 1986. Strategic factor markets: expectations, luck, and business strategy. ***Management Science***, 32 (10): 1231-1241.
- Barney, J., 1988. Returns to bidding firms in mergers and acquisitions: reconsidering the relatedness hypothesis. ***Strategic Management Journal***, 9 (Summer Special Issue): 71-78.
- Barney, J. 1991. Firm resources and sustained competitive advantage. ***Journal of Management***, 17: 99-120.
- Barry, C., Muscarella, C., Peavy, J., & Vetsuypens, M. 1990. The role of venture capital in the creation of public companies: evidence from the going public process. ***Journal of Financial Economics***, 27 (2): 447-471.
- Bartov, E., Mohanram, P., & Seethamraju, C. 2002. Valuation of internet stocks - an IPO perspective. ***Journal of Accounting Research***, 40 (2): 321-346.
- Baysinger, B., & Hoskisson, R. 1990. The composition of boards of directors and strategic control: effects on corporate strategy. ***Academy of Management Review***, 15 (1): 72-87.
- Beatty, R., Riffe, S., & Thompson, R. 1999. The method of comparables and tax court valuations of private firms: an empirical investigation. ***Accounting Horizons***, 13 (3): 177-199.
- Berger, P. 2002. Discussion of valuation of internet stocks-an IPO perspective. ***Journal of Accounting Research***, 40 (2): 347-358.
- Berkman, H., Bradbury, M., & Ferguson, J. (2000). The accuracy of price-earnings and discounted cash flow methods of IPO equity valuation. ***Journal of International Financial Management and Accounting***, 11 (2): 71-83.
- Berkovitch, E., & Narayanan, M. 1993. Motives for takeovers: an empirical investigation. ***Journal of Financial and Quantitative Analysis***, 28 (3): 347-362.
- Berle, A., & Means, G. 1932. ***The modern corporation and private property***. New York: Macmillan Publishing.
- Bernardo, A., & Chowdry, B. 2002. Resources, real options, and corporate strategy. ***Journal of Financial Economics***, 63: 211-234.
- Bhojraj, S., & Lee C. 2002. Who is my peer ? A valuation-based approach to the selection of comparable firms. ***Journal of Accounting Research***, 40 (2): 407-439.
- Boatsman, J., & Baskin, E. 1981. Asset valuation with incomplete markets. ***The Accounting Review***, 56: 38-53.

- Bowman, E., & Hurry, D., 1993. Strategy through the option lens: an integrated view of resource investments and the incremental-choice process. ***Academy of Management Review***, 18 (4): 760-782.
- Bradford, T., & Smith, R. 1997. Private equity: sources and uses. ***Journal of Applied Corporate Finance***, 10 (1): 89-97.
- Bradley, M., Desai, A., & Kim, E. 1983. The rationale behind interfirm tender offers: information or synergy? ***Journal of Financial Economics***, 11: 183-206.
- Bradley, M., Desai, A., & Kim, E. 1988. Synergistic gains from corporate acquisitions and their division between the stockholders of target and acquiring firms. ***Journal of Financial Economics***, 21: 3-40.
- Bruining, H., & Wright, M. 2002. ***Entrepreneurial orientation in management buyouts and the contribution of venture capital***. ERIM Report Series Reference No. ERS-2002-67-ORG, Erasmus Research Institute for Management, Rotterdam, The Netherlands.
- Bruner, R. 2002. Does m&a pay? A survey of evidence for the decision-maker. ***Journal of Applied Finance***, 12 (1): 48-68.
- Bull, I. 1989. Financial performance of leveraged buyouts: an empirical analysis. ***Journal of Business Venturing***, 4 (4): 263-279.
- Burkart, M. 1995. Initial shareholdings and overbidding in takeover contests. ***Journal of Finance***, 50: 1491-1515.
- Busenitz, L., & Barney, J. 1997. Differences between entrepreneurs and managers in large organisations: biases and heuristics in strategic decision-making. ***Journal of Business Venturing***, 12: 9-30.
- Bygrave, W. 1987. Syndicated investments by venture capital firms: a networking perspective. ***Journal of Business Venturing***, 2: 139-154.
- Campbell, A., Goold, M., & Alexander, M. 1995. Corporate strategy: the quest for parenting advantage. ***Harvard Business Review***, 73: 120-132.
- Capron, L., Mitchell, W., & Swaminathan, A. 2001. Asset divestiture following horizontal acquisitions: a dynamic view. ***Strategic Management Journal***, 22 (9): 817-844.
- Capron, L., & Pistre, N. 2002. When do acquirers earn abnormal returns? ***Strategic Management Journal***, 23: 781-794.
- Carter, R., Dark, F., & Singh, A. 1998. Underwriter reputation, initial returns, and the long-run performance of IPO stocks, ***Journal of Finance***, 53 (1): 285-311.
- Carter, R., & Manaster, S. 1990. Initial public offerings and underwriter reputation. ***Journal of Finance***, 45 (4): 1045-1067.

- Chan, Y. 1983. On the positive role of financial intermediation in allocations of venture capital in a market with imperfect information. ***Journal of Finance***, 38: 1543-1561.
- Chatterjee, S. 1986. Types of synergy and economic value: the impact of acquisitions on merging and rival firms. ***Strategic Management Journal***, 7 (2): 119-139.
- Chatterjee, S. 1992. Source of value in takeovers: synergy or restructuring - implications for target and bidder firms. ***Strategic Management Journal***, 13 (4), 267-286.
- Cheng, C., & McNamara, R. 2000. The valuation accuracy of the price-earnings and price-book benchmark valuation models. ***Review of Quantitative Finance and Accounting***, 15: 349-370.
- Chi, T. 2000. Option to acquire or divest a joint venture. ***Strategic Management Journal***, 21 (6): 665-688.
- Child, J. 1984. ***Organisations: a guide to problems and practice***. London: Harper & Row.
- Chowdry, B., & Jegadeesh, N. 1994. Pre-tender offer share acquisition strategy in takeovers. ***Journal of Financial and Quantitative Analysis***, 29 (1): 117-129.
- Chowdry, B., & Nanda, V. 1993. The strategic role of debt in takeover contests. ***Journal of Finance***, 48 (2): 731-745.
- Clarkson, P., Dontoh, A., Richardson, G., & Sefcik, S. 1992. The voluntary inclusion of earnings forecasts in IPO prospectuses. ***Contemporary Accounting Review***, 8 (2): 601-626.
- Comment, R., & Jarrell, G. 1987. Two-tier and negotiated tender offers: the imprisonment of the free-riding shareholder. ***Journal of Financial Economics***, 19 (2), 283-310.
- Damodaran, A. 1994. ***Damodaran on valuation***. Wiley.
- DeAngelo, L. 1990. Equity valuation and corporate control. ***Accounting Review***, 65 (1): 93-112.
- DeAngelo, H., & DeAngelo, L. 1987. Management buyouts of publicly traded companies. ***Financial Analysts Journal***, 43: 38-49.
- DeAngelo, H., DeAngelo, L., & Rice, E. 1984a. Going private: minority freezeouts and stockholder wealth. ***Journal of Law and Economics***, 27 (October): 367-402.
- DeAngelo, H., DeAngelo, L., & Rice, E. 1984b. Going private: the effects of a change in corporate ownership structure. ***Midland Corporate Finance Journal***, 2 (Summer): 35-84.
- Deloof, M., Inghelbrecht, K., & De Maeseneire, W. 2002. ***The valuation of IPOs by underwriting investment banks and the stock market: empirical evidence.*** Working Paper Ghent University 02/136, 2002.

- De Maeseneire, W. 2004. ***The role of investor capabilities in public-to-private transactions***. Working Paper Ghent University.
- Demers, E., & Lev, B. 2001. A rude awakening: internet shake-out in 2000. ***Review of Accounting Studies***, June: 331-359.
- Denis, D. 2004. Entrepreneurial finance: an overview of the issues and evidence. ***Journal of Corporate Finance***, 10: 301-326.
- Diamond, S. 1985. ***Leveraged buyouts***. Homewood, Il.: Dow-Jones Irwin.
- Dixit, A., & Pindyck, R. 1994. ***Investment under uncertainty***. Princeton University Press.
- Easterbrook, F. 1984. Two agency-cost explanations of dividends. ***American Economic Review***, 74: 650-659.
- Easterwood, J., Hsieh, V., & Singer, R. 1988. ***The motivation for going private***. Working paper, June.
- Easterwood, J., Seth, A., & Singer, R. 1989. The impact of leveraged buyouts on strategic direction. ***California Management Review***, 32 (1): 30-43.
- Engelen, P.-J. 2000. De 'underpricing'-puzzel bij beursintroducties: recente ervaringen bij Belgische IPO's. ***Maandschrift Economie***, 5: 384-408.
- Fama, E. 1980. Agency problems and the theory of the firm. ***Journal of Political Economy***, 88: 288-307.
- Fama, E., & Jensen, M. 1983. Separation of ownership and control. ***Journal of Law and Economics***, June: 301-325.
- Fenn, G., Liang, N., & Prowse, S. 1997. The economics of the private equity market: an overview. ***Financial Markets, Institutions and Instruments***, 6 (4): 1-105.
- Fernandez, P. 2001. ***Internet valuations: The case of Terra-Lycos***. Working Paper, IESE Business School.
- Finkelstein, S., & Hambrick, D., 1989. Chief executive compensation: a study of the intersection of markets and political processes. ***Strategic Management Journal***, 10: 121-134.
- Firth, M., & Smith, A. 1992. The accuracy of profit forecasts in initial public offerings. ***Accounting and Business Research***, 22: 239 247.
- Fishman, M. 1988. A theory of preemptive takeover bidding. ***The Rand Journal of Economics***, 19: 88-101.
- Fox, I., & Marcus, A. 1992. The causes and consequences of leveraged management buyouts. ***Academy of Management Review***, 17: 62-85.

- Francis, J., Olsson, P., & Oswald, D. 2000. Comparing the accuracy and explainability of dividend, free cash flow, and abnormal earnings equity value estimates. ***Journal of Accounting Research***, 38 (1): 45-70.
- Franks, J., & Harris, R. 1989. Shareholder wealth effects of corporate takeovers. The UK experience 1955-1985. ***Journal of Financial Economics***, 23: 225-249.
- Fried, V., & Hisrich, R. 1994. Toward a model of venture capital investment decision making. ***Financial Management***, 23 (3), Autumn: 28-37.
- Fuller, K., Netter, J., & Stegemoller, M. 2002. What do returns to acquiring firms tell us? Evidence from firms that make many acquisitions. ***Journal of Finance***, 57 (4): 1763-1793.
- Geman, H., El Karoui, N., & Rochet, J.-C. 1995. Changes of numeraire, changes of probability measure and option pricing. ***Journal of Applied Probability***, 32: 443-458.
- Gifford, S. 1995. ***Endogenous opportunity costs and first-best outcomes in a principal–agent model of venture capital.*** Working Paper, Boston University.
- Gilson, R. 1989. Market review of interested transactions: the American Law Institute proposal on management buyouts. In Y. Amihud (Ed.), ***Leveraged management buyouts: causes and consequences***: 217-240. Homewood, Il.: Dow-Jones Irwin.
- Gilson, S., Hotchkiss, E., & Ruback, R. 2000. Valuation of bankrupt firms. ***Review of Financial Studies***, 13 (1): 43-74.
- Gompers, P. 1998. Venture capital growing pains: should the market diet? ***Journal of Banking & Finance***, 22: 1089-1104.
- Gompers, P., & Lerner, J. 2000. Money chasing deals? The impact of fund inflows on private equity valuations. ***Journal of Financial Economics***, 55: 281-325.
- Gonoupolis, D. 2003. ***Accuracy of management earnings forecast in IPO prospectuses***. Working Paper, University of Surrey.
- Gorman, M., & Sahlman, W. 1989. What do venture capitalists do? ***Journal of Business Venturing***, 4: 231-248.
- Graham, J., & Harvey, C. 2001. The theory and practice of corporate finance: evidence from the field. ***Journal of Financial Economics***, 60 (2-3): 187-243.
- Grammatikos, T., & Swary, I. 1986. ***Incentives for public firms to go private: superior information or organisational efficiency***. Working Paper, April.
- Green, S. 1992. The impact of ownership and capital structure on managerial motivation and strategy in management buyouts: a cultural analysis. ***Journal of Management Studies***, 29 (July): 513-535.

- Grenadier, S. 2000a (ed.). ***Game choices: the intersection of real options and game theory***. Risk Books.
- Grenadier, S. 2000b. Option exercise games: the intersection of real options and game theory. ***Journal of Applied Corporate Finance***, 13: 99-107.
- Grossman, S., & Hart, O. 1980. Takeover bids, the free-rider problem and the theory of the corporation. ***Bell Journal of Economics***, 11: 42-64.
- Grundfest, J. 1989. Management buyouts and leveraged buyouts: are the critics right? In Y. Amihud (Ed.), ***Leveraged management buyouts: causes and consequences***: 241-262. Homewood, Il.: Dow-Jones Irwin.
- Hand, J. 1999. ***Profits, losses, and the stock of internet firms***. Working Paper, University of North Carolina, Chapel Hill, NC.
- Hand, J. 2000. ***The role of economic fundamentals, web traffic, and supply and demand in the pricing of US internet stocks***. Working Paper, University of North Carolina, Chapel Hill, NC.
- Harper, N., & Schneider, A. 2004. Private equity's new challenge. ***McKinsey Quarterly***, Summer: 1-6
- Harrison, J., Hitt, M., Hoskisson, R., & Ireland, R. 2001. Resource complementarity in business combinations: extending the logic to organizational alliances. ***Journal of Management***, 27: 679-690.
- Hart, O. 1984. The market mechanism as an incentive scheme. ***Bell Journal of Economics***, 14: 366-382.
- Hartzell, J., Ofek, E., & Yermack, D. 2004. What's in it for me? CEO's whose firms are acquired. ***The Review of Financial Studies***, 17 (1): 37-61.
- Hayn, C. 1989. Tax attributes as determinants of shareholder gains in corporate acquisitions. ***Journal of Financial Economics***, 23: 121-154.
- Hill, C., & Snell, S. 1989. Effects of corporate ownership structure and control on corporate productivity. ***Academy of Management Journal***, 32: 25-46.
- Hirshleifer, D., & Png, I. 1989. Facilitation of competing bids and the price of a takeover bid. ***The Review of Financial Studies***, 2: 587-606.
- Hite, G., & Vetsuypens, M. 1989. Management buyouts of divisions and shareholder wealth. ***Journal of Finance***, 44 (4): 953-970.
- Hitt, M., Hoskisson, R., & Ireland, R. 1990. Mergers and acquisitions and managerial commitment to innovation in m-form firms. ***Strategic Management Journal***, 11: 29-47.

- Holl, P., & Kyriazis, D. 1997. Wealth creation and bid resistance in UK takeover bids. ***Strategic Management Journal***, 18 (6): 483-498.
- Holmström, B., & Nalebuff, B. 1992. To the raider goes the surplus? A re-examination of the free-rider problem. ***Journal of Economics and Management Strategy***, 1: 37-62.
- Holthausen, R., & Larcker, D. 1996. The financial performance of reverse leveraged buyouts. ***Journal of Financial Economics***, 42: 293-332.
- Huang, Y., & Walkling, R. 1987. Target abnormal returns associated with acquisition announcements: payment, acquisition form, and managerial resistance. ***Journal of Financial Economics***, 19: 329-349.
- Huisman, K., 2001. ***Technology investment: a game theoretic real options approach***. Kluwer Academic Publishers, Dordrecht, The Netherlands.
- Huisman, K., & Kort., P. 1999. ***Effects of strategic interactions on the option value of waiting***. Working Paper, Center for Economic Research, DP no. 9992, Tilburg University.
- Ibobotson, R. & Ritter, J. 1995. Initial public offerings. In R. Jarrow et al. (Eds.), ***Handbooks in Operations Research and Management Science***. Volume 9, Elsevier Science.
- Jaggi, B. 1997. Accuracy of forecast information disclosed in the IPO prospectuses of Hong Kong companies. ***The International Journal of Accounting***, 32 (3): 301-319.
- Jarrell, G., & Bradley, M. 1980. The economic effects of federal and state regulations of cash tender offers. ***Journal of Law and Economics***, 23 (2): 371-407.
- Jarrell, G., & Poulsen, A. 1989. The returns to acquiring firms in tender offers: evidence from three decades. ***Financial Management***, 18 (3): 12-19.
- Jelic, R., Saadouni, B., & Briston, R. 1998. The accuracy of earnings forecasts in IPO prospectuses on the Kuala Lumpur Stock Exchange. ***Accounting and Business Research***, 29 (1): 57-72.
- Jennings, R., & Mazzeo, M. 1993. Competing bids, target management resistance, and the structure of takeover bids. ***The Review of Financial Studies***, 6 (4): 883-909.
- Jensen, M. 1986. Agency costs of free cash flow, corporate finance, and takeovers. ***American Economic Review***, 76 (2): 323-329.
- Jensen, M. 1989. The eclipse of the public corporation. ***Harvard Business Review***, 67 (September-October): 61-74.
- Jensen, M. 1993. The modern industrial revolution, exit, and the failure of internal control systems. ***Journal of Finance***, 48 (3): 831-880.

- Jensen, M., & Meckling, W. 1976. Theory of the firm: managerial behavior, agency costs and ownership structure. ***Journal of Financial Economics***, 3 (4): 305-360.
- Jensen, M., & Murphy, K. 1990. Performance pay and top-management incentives. ***Journal of Political Economy***, 98 (2): 225-264.
- Jensen, M., & Ruback, R. 1983. The market for corporate control: the scientific evidence. ***Journal of Financial Economics***, 11: 5-50.
- Jones, S. 1992. The attitudes of owner-managers towards accounting control systems following management buyout. ***Accounting, Organisations and Society***, 17 (2): 151-168.
- Kaplan, S. 1988. ***Sources of value in management buyouts***. Unpublished Doctoral Dissertation, Harvard University, Cambridge, MA.
- Kaplan, S. 1989a. Management buy-outs: evidence of taxes as a source of value. ***Journal of Finance***, 44 (3): 611-632.
- Kaplan, S. 1989b. The effects of management buy-outs on operating performance and value. ***Journal of Financial Economics***, 24: 217-254.
- Kaplan, S. 1989c. Sources of value in management buyouts. In Y. Amihud (Ed.), ***Leveraged management buyouts: causes and consequences***: 95-101. Homewood, Il.: Dow-Jones Irwin.
- Kaplan, S., & Ruback, R. 1995. The valuation of cash flow forecasts: An empirical analysis. ***Journal of Finance***, 50 (4): 1059- 1093.
- Kaplan, S., & Schoar, A. 2003. ***Private equity performance: returns, persistence, and capital flows***. Working Paper 4446-03, MIT Sloan School of Management.
- Kaplan, S., & Strömberg, P. 2000. ***Financial contracting theory meets the real world: an empirical analysis of venture capital contracts.*** Working Paper, University of Chicago, March.
- Kaplan, S., & Strömberg, P. 2001. Venture capitalists as principals: contracting, screening, and monitoring. ***American Economic Review***, AEA Papers and Proceedings, May: 426-430.
- Kester, W. 1984. Today's options for tomorrow's growth. ***Harvard Business Review***, 62 (2): 153-160.
- Kieschnick, R. 1989. Management buyouts of public corporations: an analysis of prior characteristics. In Y. Amihud (Ed.), ***Leveraged management buyouts: causes and consequences***: 35-68. Homewood, Il.: Dow-Jones, Irwin.
- Kim, M., & Ritter, J. 1999. Valuing IPOs. ***Journal of Financial Economics***, 53: 409-437.

- Kim, W., & Sorensen, E. 1986. Evidence on the impact of agency costs of debt on corporate debt policy. ***Journal of Financial and Quantitative Analysis***, 21: 131-144.
- King, D., Dalton, D., Daily, C., & Covin, J. 2004. Meta-analyses of post-acquisition performance: indications of unidentified moderators. ***Strategic Management Journal***, 25: 187-200.
- Klein, A. 1996. Can investors use the prospectus to price initial public offerings? *The* ***Journal of Financial Statement Analysis***, 2: 23-39.
- Kogut, B. 1991. Joint ventures and the option to expand and acquire. ***Management Science***, 37 (1), 19-33.
- Kranenburg, M., Perotti, E., & Rossetto, S. 2004. ***Equity carve-outs as strategic real options***. Unpublished discussion paper.
- Krinsky, I., & Rotenberg, W. 1989. The valuation of initial public offerings. ***Contemporary Accounting Research***, 5 (2): 501-55.
- Krishna, V. 2002. ***Auction theory***. Academic Press.
- Kulatilaka, N., & Perotti, E. 1998. Strategic growth options. ***Management Science***, 44 (8): 1021-1031.
- Lambrecht, B. 2000. Strategic sequential investments and sleeping patents. In: M. Brennan & L. Trigeorgis (Eds.), ***Project flexibility, agency, and product market competition: new developments in the theory and application of real options analysis***: 297-323. London: Oxford University Press.
- Lambrecht, B. 2004. The timing and terms of mergers motivated by economies of scale. ***Journal of Financial Economics***, 72: 41-62.
- Lang, L., Stulz, R., & Walkling, R. 1991. A test of the free cash flow hypothesis: the case of bidder returns. ***Journal of Financial Economics***, 29: 315-335.
- Lehn, K., & Poulsen, A. 1988. Leveraged buy-outs: wealth created or wealth redistributed? In M. Weidenbaum & K. Chilton (Eds.), ***Public policy towards corporate takeovers***. New Brunswick, NJ: Transaction Publishers.
- Lehn, K., & Poulsen, A. 1989. Free cash flow and stockholder gains in going private transactions. ***Journal of Finance***, 44 (3): 771-787.
- Lerner, J. 1994. The syndication of venture capital investments. ***Financial Management***, 23 (3): 16-27.
- Lerner, J. 1995. Venture capitalists and the oversight of private firms. ***Journal of Finance***, 50 (4): 301-318.

- Lichtenberg, F., & Siegel, D. 1990. The effects of leveraged buyouts on productivity and related aspects of firm behavior. ***Journal of Financial Economics***, 27: 165-194.
- Lie, E., & Lie, H. 2002. Multiples used to estimate corporate value. ***Financial Analysts Journal***, 58 (2): 44-54.
- Liebenstein, H. 1966. Allocative efficiency versus X-inefficiency. ***American Economic Review***, 56, : 392-415.
- Lieberman, M., & Montgomery, D. 1998. First-mover (dis)advantages: retrospective and link with the resource-based view. ***Strategic Management Journal***, 19: 1111-1125.
- Liu, J., Nissim, D., & Thomas, J. 2002. Equity valuation multiples. ***Journal of Accounting Research***, 40 (1): 135-172.
- Liu, J., & Thomas, J. 2000. Stock returns ands accounting earnings. ***Journal of Accounting Research***, 38: 71-101.
- Long, R. 1978. The effects of employee ownership on organisational identification, employee job attitudes, and organisational performance: a tentative framework and empirical findings. ***Human Relations***, 31 (1): 29-48.
- Loughran, T., & Ritter, J. 1995. The new issues puzzle. ***The Journal of Finance***, 50: 23-51.
- Lowenstein, L. 1985. Management buyouts. ***Columbia Law Review***, 85 (May): 730-784.
- Lowry, M., & Schwert, G. (2001). ***Biases in the IPO pricing process***. Working Paper, Penn State University.
- Lubatkin, M. 1987. Merger strategies and stockholder value. ***Strategic Management Journal***, 8 (1): 39-53.
- Luehrman, T. 1997. Using APV: a better tool for valuing operations. ***Harvard Business Review***, May-June: 145-154.
- Lumpkin, G., & Dess, G. 1996. Clarifying the entrepreneurial orientation construct and linking it to performance. ***Academy of Management Review***, 21 (1): 135-172.
- Lundholm, R., & O'Keefe, T. 2001. Reconciling value estimates from the discounted cash flow model and the residual income model. ***Contemporary Accounting Research***, 18 (2): 311-335.
- Malone, S. 1989. Characteristics of smaller company leveraged buyouts. ***Journal of Business Venturing***, 4: 349-359.
- Manigart, S., De Waele, K., Wright, M., Robbie, K., Desbrières, P., Sapienza, H., & Beekman, A. 2001. Determinants of required return in venture capital investments: a five country study. ***Journal of Business Venturing***, 17 (4): 291-312.

- Manne, H. 1965. Mergers and the market for corporate control. ***Journal of Political Economy***, 73: 110-120.
- Marais, L., Schipper, K., & Smith, A. 1989. Wealth effects of going private for senior securities. ***Journal of Financial Economics***, 23: 155-191.
- Margrabe, W. 1978. The value of an option to exchange one asset for another. ***Journal of Finance***, 33 (1): 177-186.
- Maupin, R. 1987. Financial and stock market variables as predictors of management buyouts. ***Strategic Management Journal***, 8 (4): 319-327.
- McCarthy, E. 1999. Pricing IPOs: science or science fiction? ***Journal of Accountancy***, 188 (3): 51-58.
- McConnell, J., & Servaes, H. 1990. Additional evidence on equity ownership and corporate value. ***Journal of Financial Economics***, 27: 595-612.
- McGahan, A. 1993. The incentive not to invest: capacity commitments in the compact disc introduction. In: R. Rosenbloom & R. Burgelman (Eds.), ***Research on technical innovation, management and policy***: 177-197. JAI Press, Greenwich, Connecticut.
- McGrath, R. 1997. A real options logic for initiating technology positioning investments. ***Academy of Management Review***, 22 (4): 974-996.
- McGuinness, P. 1993. The market valuation of initial public offerings in Hong Kong. ***Applied Financial Economics***, 3: 267-281.
- Morck, R., Shleifer, A., & Vishny, R. 1990. Do managerial objectives drive bad acquisitions? ***Journal of Finance***, 45: 31-48.
- Morellec, E., & Zhdanov, A. 2004. ***The dynamics of mergers and acquisitions***. Simon School of Business Working Paper No. FR 01-11
- Murphy, K. 1985. Corporate performance and managerial remuneration: an empirical analysis. ***Journal of Accounting and Economics***, 7 (April): 11-42.
- Muscarella, C., & Vetsuypens, M. 1990. Efficiency and organisational structure: a study of reverse LBOs. ***Journal of Finance***, 45 (5): 1389-1414.
- Myers, S., & Majluf, N. 1984. Corporate financing and investment decisions when firms have information that investors do not have. ***Journal of Financial Economics***, 13 (2): 187-222.
- Nathan, K., & O'Keefe, T. 1989. The rise in takeover premiums: an exploratory study. ***Journal of Financial Economics***, 23, 101-119.
- Newbould, G., Chatfield, R., & Anderson, R. 1992. Leveraged buyouts and tax incentives. ***Financial Management***, 21 (1): 50-57.

- Nichols, N. 1994. Scientific management at Merck. ***Harvard Business Review***, 72 (1): 88-99.
- Opler, T. 1992. Operating performance in leveraged buyouts: evidence from 1985-1989. ***Financial Management***, 21 (1): 27-34.
- Pagano, M., Panetta, F., & Zingales, L. 1996. The stock market as a source of capital: some lessons from initial public offering in Italy. ***European Economic Review***, 39 (3-4): 1057-1069.
- Pagano, M., Panetta, F., & Zingales, L. 1998. Why do companies go public? An empirical analysis. ***Journal of Finance***, 53 (1): 27-64.
- Palepu, K. 1990. Consequences of leveraged buyouts. ***Journal of Financial Economics***, 27: 247-262.
- Penman, S., & Sougiannis, T. 1998. 'A comparison of dividend, cash flow, and earnings approaches to equity valuation', ***Contemporary Accounting Research***, 15 (3): 343-383.
- Perotti, E., & Rossetto, S. 2002. ***Strategic advantage and the optimal exercise of entry options***. CEPR Discussion paper no. 3061.
- Peteraf, M. 1993. The cornerstones of competitive advantage: a resource-based view. ***Strategic Management Journal***, 14 (3): 179-191.
- Phan, P., & Hill, C. 1995. Organisational restructuring and economic performance in leveraged buyouts: an ex post study. ***Academy of Management Journal***, 38 (3): 704-739.
- Purnanadam, A., & Swaminathan, B. 2004. Are IPOs really underpriced? ***The Review of Financial Studies***, 17 (3): 811-848.
- Rappaport, A. 1990. The staying power of the public corporation. ***Harvard Business Review***, 68: 96-104.
- Ritter, J. 1991. The long-run performance of initial public offering. ***The Journal of Finance***, March: 3-27.
- Ritter, J. 1998. Initial public offerings. ***Contemporary Finance Digest***, 2 (1): 5-30.
- Ritter, J. 2003. Differences between European and American IPO markets. ***European Financial Management***, 9 (4): 421-434.
- Ritter, J., & Welch, I. 2002. A review of IPO activity, pricing, and allocations. ***The Journal of Finance***, 57 (4): 1795-1828.
- Roden, D., & Lewellen, W., 1995. Corporate capital structure decisions: evidence from leveraged buyouts. ***Financial Management***, 24 (2): 76-87.
- Roëll, A. 1996. The decision to go public. ***European Economic Review***, 40: 1071-1081.

- Roosenboom, P., & Van der Goot, T. 2003. Takeover defences and IPO firm value in the Netherlands. ***European Financial Management***, 9 (4): 485-512.
- Rydqvist, K., & Högholm, K. (1995). Going public in the 1980s: Evidence from Sweden. ***European Financial Management***, 1 (3), 287-315.
- Sahlman, W. 1990. The structure and governance of venture-capital organisations. ***Journal of Financial Economics***, 27: 473-521.
- Sapienza, H., Manigart, S., & Vermeir, W. 1996. Venture capitalist governance and value added in four countries. ***Journal of Business Venturing***, 11: 439-469.
- Schultz, P., & Zaman, M. 1994. Aftermarket support and underpricing of initial public offering. ***The Journal of Financial Economics***, 35: 199-219.
- Schwartz, E., & Moon, M. 2000. Rational pricing of internet companies. ***Financial Analyst Journal***, 56: 62-75.
- Seth, A., 1990. Value creation in acquisitions: a re-examination of performance issues. ***Strategic Management Journal***, 11 (2): 99-115.
- Seth, A., & Easterwood, J. 1993. Strategic redirection in large management buyouts: the evidence from post-buyout restructuring activity. ***Strategic Management Journal***, 14: 251-273.
- Seth, A., Song, K., & Pettit, R. 2000. Synergy, managerialism or hubris? An empirical examination of motives for foreign acquisitions of US firms. ***Journal of International Business Studies***, 31 (3), 387-406.
- Shleifer, A., & Vishny, R. 1986. Large shareholders and corporate control. ***Journal of Political Economy***, 94: 461-488.
- Shleifer, A., & Vishny, R., 1988. Value maximization and the acquisition process. ***Journal of Economic Perspectives***, 2: 7-20.
- Singh, H. 1990. Management buyouts: distinguishing characteristics and operating changes prior to public offering. ***Strategic Management Journal***, 11 (Summer): 111-129.
- Singh, H., & Montgomery, C. 1987. Corporate acquisition strategies and economic performance. ***Strategic Management Journal***, 8 (4): 377-386.
- Slusky, A., & Caves, R. 1991. Synergy, agency, and the determinants of premia paid in mergers. ***Journal of Industrial Economics***, 39 (3): 277-296.
- Smit, H. 2001. Acquisition strategies as option games. ***Journal of Applied Corporate Finance***, 14 (2): 79-89.

- Smit, H., & Trigeorgis, L. 1998. Growth options, competition and strategy: an answer to the market valuation puzzle? In: L. Trigeorgis (Ed.), ***Real options strategies: Concepts, models, and industry applications***. Risk Books.
- Smit, H., & Trigeorgis, L. 2004. ***Strategic investment: options and games.*** Princeton: Princeton University Press.
- Smit, H., van den Berg, W., & De Maeseneire, W. 2004. ***Acquisitions as a real options bidding game***. Working Paper Tinbergen Institute TI 084/2.
- Smith, A. 1904. ***The wealth of nations***. Edited by E. Cannan, New York, Modern Library (1776).
- Smith, A. 1990. Corporate ownership structure and performance: the case of management buyouts. ***Journal of Financial Economics***, 27: 143-164.
- Smith, K. & Triantis, A. 1994. The value of options in strategic acquisitions. In: L. Trigeorgis (Ed.), ***Real options in capital investment: Models, strategies, and applications***. Praeger, New York.
- Song, M. & Walkling, R. 1993. The impact of managerial ownership on acquisition attempts and target shareholder wealth. ***Journal of Financial and Quantitative Analysis***, 28 (4): 439-457.
- Stein, B. 1985. Going private is unethical. ***Fortune***, November 11: 169-170.
- Stulz, R. 1988. Managerial control of voting rights. ***Journal of Financial Economics***, 20: 25-54.
- Stulz, R., Walkling, R., & Song, M. 1990. The distribution of target ownership and the division of gains in successful takeovers. ***Journal of Finance***, 45: 817-833.
- Teece, D., Pisano, G., & Shuen, A. 1997. Dynamic capabilities and strategic management. ***Strategic Management Journal***, 18 (7): 509-533.
- Thompson, R., & Wright, M. 1987. Markets to hierarchies and back again: the implication of management buyouts for factor supply. ***Journal of Economic Studies***, 14: 5-22.
- Thompson, R., Wright, M., & Robbie, K. 1992. Management equity ownership, debt and performance: some evidence from UK management buyouts. ***Scottisch Journal of Political Economy***, 39 (4): 413-430.
- Travlos, N., & Millon, M. 1987. ***Going private: buyouts and determinants of stockholders returns***. Working Paper, April.
- Trester, J. 1998. Venture capital contracting under asymmetric information. ***Journal of Banking & Finance***, 22: 675-699.

- Trueman, B., Wong, M., & Zhang, X. 2000. The eyeballs have it: searching for the value in internet stocks. ***Journal of Accounting Research***, 38: 137-162.
- Tse, S., & Yaansah, R. An analysis of historical and future-oriented information in accounting-based security valuation models. ***Contemporary Accounting Research***, 16 (2): 347-380.
- Weeds, H., 2002. Strategic delay in a real options model of R&D competition. ***Review of Economic Studies***, 69 (3): 729-747.
- Wernerfelt, B. 1984. A resource-based view of the firm. ***Strategic Management Journal***, 5: 171-180.
- Wernerfelt, B. 1995. The resource-based view of the firm: ten years after. ***Strategic Management Journal***, 16 (3): 171-174.
- Weston, J. F., & Chen, Y. 1994. A tale of two eras. ***Business Economics***, 29 (January): 27-33.
- Wiersema, M., & Liebeskind, J. 1995. The effects of leveraged buyouts on corporate growth and diversification in large firms. ***Strategic Management Journal***, 16 (6): 447-460.
- Williams, J., 1993. Equilibrium and options on real assets. ***Review of Financial Studies***, 6: 825-850.
- Williamson, O. 1975. ***Markets and hierarchies***. New York: Free Press.
- Wright, M., Thompson, S., & Robbie, K. 1991. Managerial equity, performance and management buyouts: the European dimension. ***Journal of Applied Corporate Finance***, 3: 46-58.
- Wright, M., Thompson, S., & Robbie, K. 1992. Venture capital and management led leveraged buy-outs: a European perspective. ***Journal of Business Venturing***, 7: 47-71.
- Wright, M., & Robbie, K. 1998. Venture capital and private equity: a synthesis. ***Journal of Business Finance and Accounting***, 25 (5-6): 521-570.
- Wright, M., Hoskisson, R., Busenitz, L., & Dial, J. 2000. Privatisation and entrepreneurship: the upside of management buyouts. ***Academy of Management Review***, 25 (3): 591-601.
- Wright, M., Hoskisson, R., & Busenitz, L. 2001. Firm rebirth buyouts as facilitators of strategic growth and entrepreneurship. ***Academy of Management Executive***, 15 (1): 111-125.
- Wruck, K. 1989. Equity ownership concentration and firm value: evidence from private equity financings. ***Journal of Financial Economics***, 23: 3-28.

- Yee, K. 2004. Forward versus trailing earnings in equity valuation. ***Review of Accounting Studies***, 9: 301-329.
- Zahra, S. 1993. New product innovation in established companies: associations with industry and strategy variables. ***Entrepreneurship: Theory and Practice***, 18 (2): 47-69.
- Zahra, S. 1995. Corporate entrepreneurship and financial performance: the case of management leveraged buyouts. ***Journal of Business Venturing***, 10: 225-247.
- Zahra, S., & George, G. 2002. Absorptive capacity: a review, reconceptualization, and extension. ***Academy of Management Review***, 27: 185-203.

Samenvatting

Geavanceerde waarderingstechnieken zoals de aangepaste contante waarde methode en reële opties maken een opmars, zowel in theorie als in de praktijk. Een groot aantal wetenschappelijke publicaties gaat in op de verschillende mogelijke toepassingen voor deze complexe technieken, bijvoorbeeld in het kader van de waardering van onderzoek en ontwikkeling, strategische allianties en vastgoed. Reële optietechnieken worden ook gebruikt om overnames te waarderen. In tegenstelling tot de uitgebreide kennis omtrent waarderingsmethoden voor acquisities bestaat in de academische financiële literatuur echter een onvolledig begrip van de factoren die de verdeling van de waardecreatie bij overnames tussen overnemer en doelwit verklaren. De strategische literatuur wijst hieromtrent op het belang van unieke capaciteiten, en zowel de financiële als de strategische literatuur beklemtonen de rol die informatie-asymmetrie hierbij speelt.

Deze dissertatie gaat in op de traditionele en op de meer recente, complexere waarderingsmodellen, en we stellen tevens een speltheoretisch reëel optiemodel voor dat de waardetoe-eigening van de investeerder bij een overname analyseert. De modellen voor waardering en waardetoe-eigening houden expliciet rekening met de identiteit en de specifieke capaciteiten van de investeerder. Door strategische aspecten zoals inzichten uit de resource-based view en speltheorie op te nemen in een model voor het bieden op acquisities, tracht deze promotie een bijdrage te leveren aan het overbruggen van de kloof die bestaat tussen strategische inzichten en de waarderingsmethodieken in financieel management.

Dit proefschrift wordt gevormd door een bundeling van artikelen en bestaat uit de volgende 3 hoofdstukken: '*The Valuation of IPOs by Underwriting Investment Banks and the Stock Market*', '*The Role of Investor Capabilities in Public-to-Private Transactions*', en '*Acquisitions as a Real Options Bidding Game*'. Het eerste hoofdstuk betreft een empirisch onderzoek, het tweede is een conceptuele synthese en het derde is gebaseerd op een wiskundig model. De rode draad van deze hoofdstukken is waardering (alle hoofdstukken) en waardetoe-eigening (tweede en derde hoofdstuk). Hierbij komen de traditionele waarderingsmethoden aan bod, aangevuld met het reële optie-perspectief.

Het eerste hoofdstuk is getiteld '*The Valuation of IPOs by Underwriting Investment Banks and the Stock Market*' (co-auteurs: Marc Deloof en Koen Inghelbrecht). In dit stuk wordt de accuraatheid van de verschillende waarderingsmethoden, zoals gebruikt door investment banks, onderzocht voor een steekproef van 49 Belgische IPOs. In België worden

de resultaten van de pre-IPO waardering door de underwriting investment bank in de prospectus gepubliceerd, wat ons toelaat om ex-ante waarderingen door de lead underwriter te gebruiken, terwijl andere papers in dit domein de ex-post waardeschattingen door de onderzoekers zelf evalueren.

Voor de IPO's werden verschillende waarderingsmethoden gebruikt. De DCF (discounted cash flow) methode is de meest populaire, maar de DDM (dividend discount model) methode produceert een waarde die het dichtst bij de intekenprijs ligt. Dit zou suggereren dat de banken de intekenprijs baseren op de resultaten van DDM. Als we de verkregen waardeschattingen via DDM echter vergelijken met de aandelenprijs na de introductie, stellen we vast dat DDM de waarde onderschat, terwijl de DCF methode een vrij accurate predictie geeft van de aandelenkoers. Interviews met investment bankers wijzen erop dat de intekenprijs bewust vrij laag wordt gezet, door een discount toe te passen op de DCF waarde, welke beschouwd wordt als de meest betrouwbare methode. De via DDM verkregen schattingen liggen dichter tegen de intekenprijs omdat deze methode de waarde van de IPO eerder lijkt te onderschatten. Bij een waardering aan de hand van multiples maken underwriters voornamelijk gebruik van toekomstige winsten en cash flows. Deze resulteren in meer accurate waarderingen dan multiples gebaseerd op historische boekhoudkundige cijfers. In lijn met de hypothese dat underwriters andere waardevolle informatie (zoals de marktvraag naar de IPO) gebruiken bij de bepaling van de intekenprijs, stellen we vast dat de finale intekenprijs een betere voorspelling geeft van de aandelenkoers dan de schattingen volgens de verschillende waarderingsmethodes.

Het tweede hoofdstuk is getiteld '*The Role of Investor Capabilities in Public-to-Private Transactions*'. In dit hoofdstuk wordt een uitgebreid overzicht gegeven van de verschillende bronnen van waardecreatie en waardevernietiging. Naast de traditionele factoren (de reductie van vertegenwoordigingsproblemen en informatie-asymmetrie, en belastingsoptimalisatie) worden een aantal nieuwe elementen naar voor gebracht, het 'leveren' van de unieke capaciteiten van de investeerder. Deze kunnen de synergie die gerealiseerd kan worden met de bestaande portefeuille-ondernemingen en de intertemporele synergie omvatten. Laatstgenoemde betreft de opties om later synergieën te creëren door middel van vervolgovernames na de aankoop van een platform onderneming. Een bijkomende waardecomponent ligt verscholen in de informatiewaarde van de buyout: door de transactie leert de investeerder nieuwe zaken over zijn capaciteiten, wat toelaat om in de toekomst betere investeringsbeslissingen te nemen. Deze waardecomponenten worden geïntegreerd in een uitgebreid waarderingscriterium, dat zowel de operationele, financiële en reële

optiewaarde van een public-to-private transactie omvat. De voornaamste bijdrage van dit onderdeel ligt in het feit dat het een integratie biedt van ondernemingsfinanciering en strategisch management, en hiervan gebruik maakt om public-to-privates transacties te waarderen en de waardetoe-eigening door de private investeerder te verklaren.

Dit hoofdstuk geeft tevens een beschrijving van de evolutie in de markt van public-to-privates. Door de immer scherper wordende concurrentie wordt waarde behaald uit de traditionele componenten grotendeels weggeboden en trachten private equity spelers maximaal nieuwe componenten te benutten. Dit resulteert in een steeds verdere specialisatie en verklaart ook de zogenaamde padafhankelijkheid van investeringen (de vroegere investeringen bepalen de huidige capaciteiten en dus de huidige en toekomstige investeringen). Dit heeft geleid tot nieuwe strategieën zoals buy-and-build waarbij de eerste acquisitie gezien wordt als een platform overname, waarna meerdere vervolginvesteringen kunnen plaatsvinden. Getracht wordt om kerncompetenties van de private equity speler of van de platformonderneming te implementeren in deze latere acquisities.

Het derde hoofdstuk is getiteld '*Acquisitions as a Real Options Bidding Game*' (co-auteurs: Han Smit en Ward van den Berg) en onderzoekt de waardecreatie voor de overnemer in biedstrijden. Een overvloed aan empirisch materiaal wijst er op dat overnames waarde creëren maar dat het voornaamste deel hiervan weerspiegeld wordt in de betaalde overnamepremies. Er valt echter een grote variatie waar te nemen in de rendementen voor de overnemer, waarbij sommige overnemers er wel in slagen een deel van de waardecreatie toe te eigenen. Bij biedstrijden in het bijzonder, hebben de heterogeniteit tussen de verschillende bieders en informatie-asymmetrie een belangrijke invloed op de overnameprijs. Wij onderzoeken het biedproces, de kans op een biedstrijd en de verwachte winst voor de overnemer aan de hand van een reëel optiemodel, dat rekening houdt met de reacties van concurrerende bieders (speltheorie).

Potentiële bieders voeren vaak een due diligence uit alvorens overnames te doen. Deze investering in due diligence kan beschouwd worden als de aanschaf van een reële optie op de waarde van het doelwit. De due diligence is kostbaar (optiepremie) maar informeert een mogelijke overnemer over de waarde van het doelwit (onderliggende waarde) en is dus een noodzakelijke investering alvorens de overnemer een bod (uitoefenprijs) kan uitbrengen. Een potentieel geïnteresseerde bieder zal enkel due diligence doen als de reële optiewaarde voldoende hoog is. De mogelijkheid om te bieden op een overnamedoelwit is echter een gedeelde optie, waarbij de overnameprijs wordt beïnvloed door concurrerende bieders. Een publiek overnamebod wijst op een interessant overnamedoelwit en kan aldus de interesse van

concurrenten opwekken. Dit bod heeft ook een impact op de waarschijnlijkheidsverdeling van de doelwitwaarde en dus op de mogelijke overnamewinsten van niet-geïnformeerde bieders. Deze impact hangt af van de heterogeniteit tussen bieders: een hoog bod signaleert een hoge waarde voor de initiële bieder en dus een hoge waarde voor gelijkaardige bieders.

De implicaties van ons model steunen op informatievrijgave in het bod (signaling) door heterogene bieders. De biedstrategie, de kans op een biedstrijd en de verwachte overnameprijs worden binnen ons model bepaald door nieuwe en minder voor de hand liggende parameters zoals onzekerheid en correlatie tussen bieders. De waardetoe-eigening is niet strikt dalend in de mate van heterogeniteit tussen bieders maar vertoont een U-vorm. Zowel een zeer hoge als zeer lage correlatie leidt tot waardetoe-eigening omdat het toelaat concurrentie te vermijden, terwijl een middelmatige correlatie kan resulteren in een biedstrijd en aldus tot een lagere waardetoe-eigening. Daarnaast leiden ook een hogere onzekerheid en een hogere verwachte doelwitwaarde voor de initiële bieder tot hogere overnamewinsten. Een hogere onzekerheid voor de rivaliserende bieder vergroot de kans op een biedstrijd en vermindert de waardetoe-eigening.

Dit proefschrift tracht een bijdrage te leveren aan de wetenschappelijke kennis over waardering en waardetoe-eigening door investeerders. We hebben het belang geïllustreerd van het reële optieperspectief voor zowel waardering als waardetoe-eigening. Daarnaast werden er aan het einde van elk hoofdstuk ook verschillende aanwijzingen gegeven omtrent uitbreiding van de voorgestelde ideeën. Enkele suggesties voor vervolgonderzoek betreffen het in kaart brengen van de waarderingsmodellen die in de praktijk door zakenbankiers gebruikt worden en op welke manier deze toegepast worden. Hierbij is het interessant om na te gaan waarom discounted cash flow en discounted dividend modellen in de praktijk verschillende resultaten opleveren, terwijl deze in theorie nochtans identiek zijn en dus gelijkaardige uitkomsten zouden moeten voortbrengen. Ander nuttig vervolgonderzoek betreft het formaliseren van de strategische intuïtie die schuilgaat achter de evaluatie en besluitvorming van economische agenten met een degelijk analytisch model gebaseerd op concepten uit financieel management. Door het incorporeren van de inzichten en de consequenties van het reële optiedenken kan men de strategische aspecten expliciet tot uiting brengen en een meer volledig beeld krijgen van de waardecomponenten van een transactie.

Curriculum vitae

Wouter De Maeseneire (1977) obtained his Master's degree in Applied Economics magna cum laude from Ghent University, Belgium, in 1999. He joined the Department of Corporate Finance at Ghent University and the Competence Centre Accounting and Finance at the Vlerick Leuven Gent Management School in September 1999. In September 2001, Wouter was awarded with a scholarship from the Fund for Scientific Research-Flanders (Aspirant). In September 2002 he also joined ERIM as a PhD candidate to carry out his doctoral research. His work has been presented at several international conferences e.g., at the conferences of the European Financial Management Association and of the Strategic Management Society. His current research interests include valuation, real options and private equity.

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Essays on Firm Valuation and Value Appropriation

Sophisticated valuation techniques such as adjusted present value and real options, attract ever-increasing attention from theory and practice. A huge number of papers in the academic field provide various applications of these advanced tools, for instance valuing research and development, strategic alliances and real estate. Real options have also been used for valuing mergers and acquisitions. However, notwithstanding the rich knowledge about valuation models applicable for valuing takeovers, there remains a need to further develop theories about the distribution of the value creation between the target's and acquirer's shareholders. In other words, what part of the value creation can the acquirer appropriate? Strategic management literature underlines the impact of possessing unique capabilities, and both the strategic and financial literature emphasize the role of information asymmetry in explaining value appropriation in acquisitions. In this dissertation both simple and more complex valuation models are discussed, and we propose a real option-game model that analyzes the acquirer's value appropriation. In our valuation and value appropriation models, the specific resources and capabilities of the evaluator are considered. By explicitly taking the acquirer resources into account in the valuation analysis, and by developing a new application of a combined option-game model, this PhD thesis is taking a step in further bridging the gap between finance theory and strategic management.

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