Export Prices, Trade Dynamics and Economic Development

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Export Prices, Trade Dynamics and Economic Development

Export prijzen, dynamiek in internationale handel en economische ontwikkeling

Thesis

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by

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Acknowledgment

When starting with your PhD thesis you know that it will be a lot of hard work. Being used to working hard, this has never bothered me. However, when writing my PhD thesis, working hard gained a new dimension. Writing my PhD thesis has nevertheless brought me more than I could have imagined beforehand. A honeymoon on the Philippines for example.

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My loving wife, Hanneke, and son, Tobias, the love and joy that you both bring to my life everyday I cannot express. Walking in the morning with Tobias and Aslan (our dog), while Tobias imitates the sounds of the animals that pass by, were the necessary moments of relaxation and clearing my head at the start of the day. Hanneke your love and support in so many ways has helped me immeasurably. Helping me by reading articles and drafts (while I was driving), being a listening ear, making me laugh and giving advice to mention a few things. Therefore I dedicate this thesis to you. Getting married and becoming a farther while writing my PhD thesis was a challenge, however I would not have wanted it any other way. Together with you and God, who provides and leads the way, the future will be an adventure.

"The Lord is my shepherd; I have everything I need"
Psalm 23:1

Gerrit Hugo van Heuvelen
Maasdam, October 2016

Contents

Chapter 1

Introduction and Outline

1.1 Introduction

"The test of progress is not whether we add more to the abundance of those who have much; it is whether we provide enough for those who have too little" (Franklin D. Roosevelt)

In the world we live there are high income countries, that according to the World Bank (WB) classification, have a Gross National Income (GNI) per capita of above $12,275 and poor countries that have a GNI per capita below $995 in 2010. Stuck in between these two categories there are also countries, they are called middle-income countries. The countries that have been dubbed middle-income countries have a hard time moving up to the highest income group, the Middle-Income Trap is a term given to this phenomenon. The Philippines is a country that is often said to be in this trap as it has remained a middle-income country for the past few decades. This thesis is part of a project that analyzes the Middle-Income Trap with a special focus on the Philippines.

The contribution of this thesis to the Middle-Income Trap debate is twofold: Firstly, a proposition of a time duration definition of the Middle-Income Trap is made, putting the development of middle-income countries in an 'historical' context. Secondly, analyzing the Philippine economy using a new transaction level dataset constructed by the author of this thesis. The thesis is concentrated more around the second aspect than the first, as four of the five chapters are attributed to it. The research of the Philippine economy revolves around export prices and trade dynamics, contributing to the trade literature. There are many question unanswered in the trade literature of which many are of the utmost importance for economic development. This thesis tackles questions that are both relevant for the trade literature and the economic development of the Philippines.

The dataset used in this thesis is so-called transaction-level data, implying that the data is at firm-product-destination level. The recent availability of transaction-level data for different countries has sparked the trade literature as it has permitted researchers to examine new dimensions. For the first time the products and destinations to which firms exported could be analyzed. This new data has uncovered a wealth of new empirical stylized facts. For example, Manova and Zhang (2012) show that firms vary export prices over destinations even within the same product category. They also find a correlation between the amount exported to a destination and the export price of the respective firm. Hinting on the fact that quality is not only a difference between firms but also of importance within a firm as different levels of quality can be produced. The importance of within-firm reallocation in driving output growth is signified by Bernard et al. (2006). They find that net adding and dropping by continuing firms account, between 1972 and 1997, for $\frac{1}{3}$ of aggregate U.S manufacturing growth. The focus has therefore shifted to the changes that happen within a (exporting) firm. This thesis focuses, for example, on firm-product-destination spell duration in the third chapter and the changing of exporting products within firms over time in the fourth chapter. Through analyzing Philippine firm trade this thesis tries to understand what drives the export choices of a firm and how this influences the economic development of the Philippines.

1.2 Outline

This thesis consists of five self-contained chapters covering different topics related to export prices, trade dynamics and economic development. The thesis is outlined as follows:

Chapter 2 is linked to the dataset that the author has collected, merged and cleaned in the Philippines with the help of the Philippine Statistical Authority (PSA) and is based on van Heuvelen (2016b). In this chapter the construction of the dataset is briefly discussed, after which an overview of the Philippine economy is given using the new dataset. The focus is mainly on the dynamics in concentration, prices and composition of trade in the Philippines in terms of exports, although the imports will also be discussed. This chapter ends with a special focus on the top hundred products that the Philippines exports over the sample. These top products summarize Philippine trade in a comprehensible way.

Chapter 3 searches to quantify the Middle-Income Trap and is based on van Heuvelen (2016d). The Middle-Income Trap is a term that has been used to label countries that break out of the lower income group, but fail to attain high income status. However, one of the main short comings of the Middle-Income Trap definition is the lack of a clear measure that distinguishes trapped countries from those that are not. This chapter uses Maddison's GDP per capita to create an absolute income classification in order to examine the evolution of middle–income countries over a time period of 60 years. A new duration definition is proposed in order to make a distinction between countries that are stuck and those that are not. This study finds, using different methods and approaches that the estimated average transition time needed for countries to move past the middle-income segment is between 43-44 years. Therefore countries that have been classified as a middle-income country for a period longer than the estimated transition time should be classified as stuck in the Middle-Income Trap. The Philippines is one of the countries that can be defined as stuck in the Middle-Income Trap.

Chapter 4 is based on Pelkmans-Balaoing, van Heuvelen and Viaene (2016). This chapter explores firms' export dynamics in emerging economies where local firms face stiff foreign competition, both at home and abroad, and thus compelled to choose the level of quality in which to export. A model of vertical product differentiation is developed and tested where the link between export performance and product quality is central. The impact of other governmental decisions related to multiple uncertainties faced by exporters such as exchange rate, freight and trade policies, are investigated as well. Using discrete survival analysis, this chapter shows that export spells have a notable short duration, 20 months on average. Particularly 72.2% of trade relationships in year one do not survive to year two. Market uncertainties, particularly those linked to exchange rates and transport costs increase the probability of firm exit as expected. Export survival rates are highest among firms that select an export price contained in the interval between the median and mean of the international distribution of product prices. In contrast, those choosing a price located at both ends of this distribution have the least chance of survival.

Chapter 5 examines the export switching and co-exporting of products of Philippine firms over a time period of 22 years and is based on van Heuvelen (2016a). This chapter analyses how export firms change from their (initial) specific skill set over time. The skill set of a firm is assumed to be revealed by the main export product in term of yearly export revenue, also called the"Core Competency". A new empirical stylized fact that main product switches are also frequent is found for the Philippine data, thereby hinting on possible changes in the skill sets of firms over time. Using co-exporting of products by the same firm in a certain year similarities between products are identified. Products more frequently co-exported are seen as more similar in terms of production. This chapter finds that switching behavior depends, among other factors, on exporter age, size and the similarity of the products exported. This chapter also finds that the younger/smaller firms are more likely to switch and when they switch make more unrelated switches, while the reverse is true for older/larger firms.

Chapter 6 is based on van Heuvelen (2016c). This chapter revisits 4 stylized facts of export prices found in Manova and Zhang (2012). This exploratory chapter replicates part of the analysis of Manova and Zhang (2012) for the Philippines. Finding, among other stylized facts, that firms vary prices over destinations and that higher revenues are correlated with higher export prices. The stylized fact that correlation between prices and revenue is more pronounced in richer destinations in Manova and Zhang (2012) is not found for this data. The analysis is extended with a section on the price dispersion within fourteen products over time adopting part of the framework used in Lach (2002). In this extension tentative evidence is found in favor of random pricing versus consistent pricing, this in the sense that firms do not consistently set high or low export prices over time when compared to local producers. Although prices that fall in the highest and lowest category have relatively lower mobility over time.

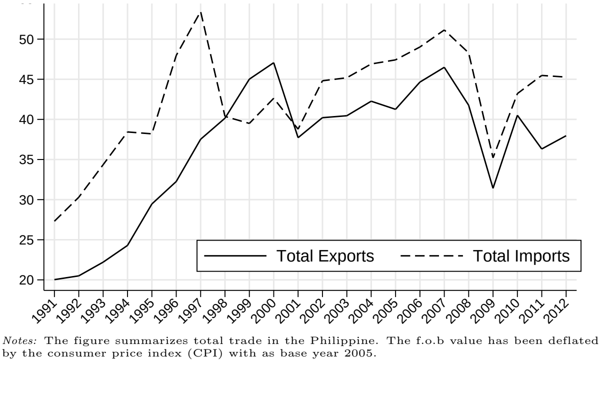
Chapter 2

The Data: an Overview of Philippine Trade

2.1 Introduction

The Philippine economy is the 44^{th} largest economy in the world according to 2013 World Bank (WB) Gross Domestic Product (GDP) statistics. Over the last 22 years, the Philippines have imported more goods than that they have exported in terms of f.o.b value, showing a current account deficit for almost every year between 1991-2012. (See Figure 2.1) This trend occurs, at least in part, due to the large influx of remittances to the Philippines. Export value in real terms has remained below its peak in 2000, showing a strong drop in 2009. Behind this general trade trend there are dynamics at work. This paper will give an overview of trade in the Philippines. In the process showing the dynamics in concentration, prices and composition of trade and describing the data that will be used in the consecutive chapters, with the exception of chapter 3.

Figure 2.1: Philippine Trade



Notes: The figure summarizes total trade in the Philippine. The f.o.b value has been deflated by the consumer price index (CPI) with as base year 2005.

2.2 Data

Merging and Cleaning the Data

This thesis employs a new dataset that matches the firm surveys and trade transactions records collected by the Philippine Statistics Authority (PSA) over the period $1991-2012$. The firm survey data comprises eight Annual Survey of Establishments ($1997, 1998, 2001, 2003, 2005, 2008, 2009$ and 2010) and three Census of Philippine Business and Industry ($2000, 2006$ and 2012).[1] All the large firms with 200 or more employees (in some years, 100 or more) are surveyed, while the rest are sampled.

The Philippine data used in this thesis has been gathered, combined and cleaned by the author of this thesis with help from the PSA. The data consist of three parts which in turn consist of many cross sections of data. Each part has been merged separately before being merged to the other parts. All the cleaning and merging is programmed in one STATA do-file that uses the background excel files of raw data in the process. Therefore the raw data is never altered and all the steps made by the author can be traced through the respective do-file. This is done in order to ensure consistency and traceability over time.

The first two parts of data are the universe of export and import customs data from 1991-2012. The customs data consist of separate cross sections for each year. The magnitude of the import data is notably larger than that of the export data. There are three corrections made to the trade data. The first correction is that of trader codes over time. The trader codes are unique over time, implying that no two firms can have the same trader code. However, in some cases a firm is given a different trader code over time. Therefore the PSA crosschecked the trader codes for consistency by verifying address, establishment control number, firm name and tax information number. This led to the correction $1,614$ firms with usually two and sometimes three trader codes.[2] This cleaning of the data is only done for the firms for which the trade data can be linked to the survey data.[3]

The second correction involves matching the PSCC (Philippine Standard Commodity Classification) 7-digit classification (harmonized to the SITC (Standard International Trade Classification) Rev. 3 until 5 digits) to the PSCC 10-digit classification (harmonized to the HS (Harmonized System) classification) which is used from 2006 onwards. The difficulty in correcting this change in classification is that in some cases multiple 7-digit categories match to a single 10-digit category, clearly indicating that the change in classification is not merely a switch to a more detailed classification. The PSCC 7-digit classification was tailored to the Philippine economy while the 10-digit classification was created in order to harmonize trade statistics between the Association of Southeast Asian Nations (ASEAN) member countries. In order to merge the data over time and insure consistency a 7-digit category that the firm previously exported is taken as the corresponding classification whenever multiple 7-digit categories match to the same 10-digit category. For example 10-digit product category A matches with 7-digit product category B, C and D however firm 1 produced product B the year before then B is assigned to all product from 2006 onwards that are classified A. The number of single PSCC 10-digit categories with multiple 7-digit categories is very limited, however when they are encountered

[1]The 1997 survey is a combined survey covering both 1996 and 1997.

[2]One example is a firm name written with and without apostrophe that is given a different trader code. These and multiple of other examples confirm the uniqueness of the trader code however endanger the consistency. Therefore corrections are of the utmost importance. There are also a couple of examples of multiple firm branches operating under the same trader code. The firm survey information of the respective branches is then combined to the unique trader code.

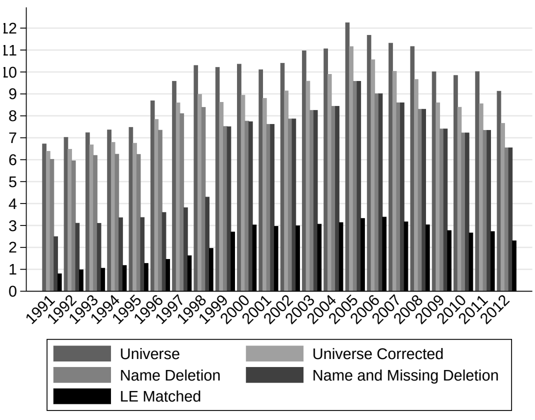
[3]Only firms that appear in the manufacturing survey and therefore in the list of establishments, can be linked to the trade data.

the strategy is applied in order to ensure within firm consistency. [4] The third correction related to the product classification concordance over time is the concordance of unit values over time. If the unit value in which the product is measured changed over time then gross kilos was used in order to ensure consistency over time.

The last part of the data consists of manufacturing firm surveys. The survey data is a lot more complex to merge. The manufacturing surveys change over time comprising of more or fewer questions and different questions over time. The 2001 survey, for example, is the shortest consisting of only 8 pages, while the 2009 survey consist of 12 pages. Also within a year the PSA often had a short questionnaire for smaller firms and a more extensive survey for larger firms. All these differences made merging the manufacturing surveys a tedious process. Before matching the survey over time the questionnaires are compared and corresponding questions over time are given the same code. Therefore questions that appeared in multiple surveys could be traced. Due to changing surveys over time multiple questions only appeared in part of the sample. Also even if a question did appear in multiple years the response to that specific question could be low. Therefore questions with a high response rate that appear in every survey are limited. On top of this the manufacturing surveys have a certainty stratum. Only firms with more than 100 or in some years 200 employees are in this certainty stratum. This implies that firms with fewer employees are subject to sampling. Therefore smaller firms often only appear in one survey. Due to the difference in questionnaires and sampling the panel dimension of the firms' survey data is very limited and mostly revolves around the large firms.

Sample Choice

Figure 2.2: Number of Firms by Sample



Notes: Source: Author's own calculation

The export data, which is used most extensively, is the data discussed in this section. The question which sample one should use in the analysis is always a difficult one. Figure 2.2 shows that choices can lead to very different export sample sizes. The first sample that can be used is the full sample without

[4]There are 401 10-digit products which match in most cases to two (68.1%) up to a maximum of 35 7-digit product categories. Most of the products with this matching problem are also of less importance as the average importance ranking in terms of total revenue of these products is 3135. Indicating that this complication is mostly contained to relatively unimportant products for the Philippine economy. Also only 410 observations in the sample have this multiple matching difficulty.

any correction.(Universe sample) The disadvantage of this sample is that certain firms and products will be added to the analysis that have little to do with what the Philippine firms actually produce or are hard to link directly to the production of the goods. There are two aspects of the data that can be cleaned in order to make a distinction between firms and products that have little to do with the Philippine production of export products and firms and products that do. Firstly, products that cannot be linked to the Philippine economy can be deleted from the analysis. (Universe Corrected sample) Product categories 'Good returned to the country whence exported', 'other commodities temporarily imported/exported', 'personal and household effects of travel' and 'replacement of returned good' are examples of product categories that are excluded in the Universe Corrected sample. These product categories are relatively uninformative and hard to link to the production of the product. The product categories excluded comprise most of the products that form the category 93 in the PSCC classification, with the notable exception of PSCC items 93101 till 93102 which contains products built on consignment basis.

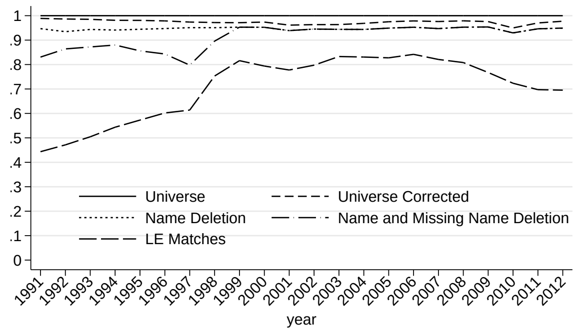
Secondly, firms that are not involved with the production of goods but, for example, only engage in the trade of the good can be excluded. There are two strategies for identifying the firms that are engaged in production (i.e. manufacturing firms). The first option is to use name deletion in order to identify manufacturing firms. (Name deletion sample) This strategy involves deleting firms with certain words within their name.[5] The problem with this strategy is that in the years before 1999 on average 42.9% of the firms have no name in the customs data. If the firms with no name are also deleted from the analysis then the sample in the years before 1999 drastically drops. (Name and Missing Deletion sample) Including the firms with missing names overestimates the number of manufacturing firms while excluding these firms leads to a drastic underestimation of the number of manufacturing firms before 1999. (See Figure 2.2) The second option is to use the matched firm dataset. These are the traders' codes that have been matched to the list of establishments (LE) of manufacturing firms from the PSA. This last sample ensures that the respective firms are manufacturing firms. (LE matched sample) This sample is corrected for multiple trader codes used by the same firm over time. The list of establishments from 1996 onwards has been used for this matching which is updated by the manufacturing surveys that the PSA performs. Therefore in years in which large manufacturing surveys are held the number of identified manufacturing firms increases. Therefore it will underestimate the number of manufacturing firms although this underestimation is more prominent in the years before 1996. However, once the firm is linked to a trader code the trade activity of the respective firms can be traced throughout the sample.

The sample used for the different chapters can differ when the analysis changes. For this chapter, for example, the Name Deletion sample is used. This sample slightly overestimates the number of manufacturing firms before 1999; however this sample comes closest to capturing the whole sample of manufacturing firms over time. In chapters four and five the LE matched sample is used as consistency over time is of the essence and in the fourth chapter firm survey data is exploited, while in chapter six the Name and Missing Deleted sample is used.[6] In terms of total export revenue the decision of the sample does not seem to matter greatly as even the smallest sample still accounts for a significant part of the total export revenue in most years. (See Figure 2.3)

[5] In practice this involved deleting exporters that had in their name the words importer, exporter, export, import, trading, trader, moving, logistic and shipping. This is a similar strategy as employed in Manova and Zhang (2012). Although not perfect this method nevertheless deletes a large portion of non-manufacturing firms. The author must stress that the do-file that performed this deletion is constructed in such a way that the author does not, at any time, see any firm name. This was done for confidentiality reasons.

[6] As can be seen in Figure 2.2 there is no distinction between the Name and Missing Deleted and the Name Deleted sample after 1999.

Figure 2.3: Percentage of Total Revenue Accounted for by Sample



Notes: Source: Author's own calculation

2.3 Philippine Trade

2.3.1 The Composition

A preliminary glimpse of the composition of Philippine trade can be given by the yearly top 10 products, in terms of revenue, that the Philippines export and import over the sample period.[7] The Philippine top 10 exports contain products like shrimps and prawns (frozen), coconut oil, wood carvings and different apparel items. However most of the top 10 consists of electronic products. (e.g. semi-conductor devices and digital monolithic integrated units) Electronic products are the most important manufacturing sector of the Philippines in terms of export value. On the import side the top ten consists of transportation (e.g. cars and airplanes), inputs for the electronic and apparel sectors, petroleum and related products and staples (e.g. rice and wheat).

There are 2,532 distinct products, a product being defined as a 7-digit PSCC, exported in 1991; while 3,781 products are exported in 2012. Showing an increasing trend in distinct products exported over time. Of all the products that were exported in 1991 67.1% are still exported in 2012 and they account for 66.7% of the total export value in 2012. For imports 5,987 different products are imported in 1991 while 6,531 different products were imported in 2012, also displaying an increasing trend over time. Of all the different products that were imported in 1991 78.0% are still imported in 2012 and they account for 78.8% of the total import value in 2012. Trade therefore displays a certain amount of consistency over time, although this consistency is more pronounced for import than export products.

The importance of export and import products in terms of revenue, however, does change over time. Of the top ten export products in terms of total value in 1991 only 3 remain in the top ten in 2012.[8] This is also the case for imports as only 3 remain in the top ten in 2012.[9] Nonetheless there is a certain amount of consistency as 28 (29) products account for the top 10 exports (imports) of the Philippines in terms of yearly export (import) value over a time period of 22 years.[10] Even though the Philippines import a total of 8,981 different products and on average 6,222 different products

[7]See appendix 2.B.1 and 2.B.2 for lists of top ten exports and imports.

[8]The top ten export products in 1991 rank in decreasing order 3^{rd}, 4^{th}, 105^{th}, 175^{th}, 7^{th}, 150^{th}, 23^{rd}, 177^{th}, 19^{th} and 30^{th} in 2012.

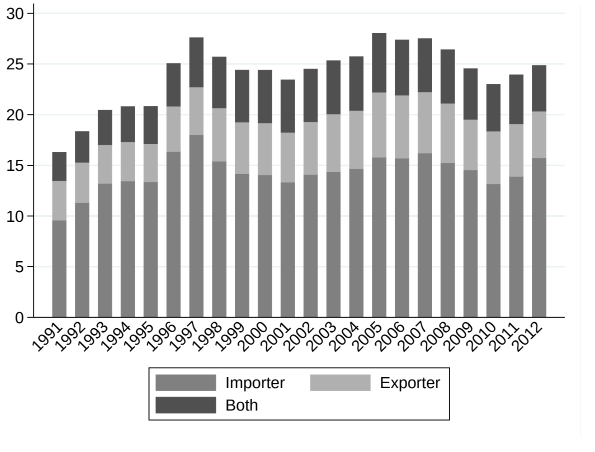
[9]The top ten import products in 1991 rank in decreasing order 1^{st}, 2^{nd}, 26^{th}, 5^{th}, 91^{st}, 11^{th}, 12^{th}, 9^{th}, "not imported" and 64^{th} in 2012.

[10]The top 10 exports (imports) account for at least 39.8%(29.4%) and on average account for 53.8% (43.9%) of total yearly value. (See appendix for list of top 10 exports and imports.)

per year only 310 account for the top 100 products in terms of yearly import value. These products account for 69.1%-82.5% and on average 75.9% of yearly import value. These products however only account for 27.5% of total import transactions. The Philippine firms export a total of 7,209 different products and on average 3,008 different products per year. However only 299 export products account for the top 100 export products in terms of yearly export value. These 299 export products account for 86.4%-94.2% and on average 91.0% of yearly total export revenue. These products also account for 42.3% of total export transactions. Part of this paper will focus on the products that constitute the top 100 over the 22 years of the sample. As these products summarize to a great extent and in a comprehensible way the Philippine economy.

The number of firms engaged in trade display a similar trend as total trade of the Philippines. (See Figure 2.4) Basically when total trade increases more firms enter and fewer exit and the reverse when total trade decreases. Firms that solely import comprise the largest group in the Philippines, accounting for 59.7% of the total firms that engage in trade. While firms that solely export and firms that both import and export constitute 20.8% and 19.4% of the firms engaged in trade.

Figure 2.4: Number of Firms by Trade Activity (in 000's)

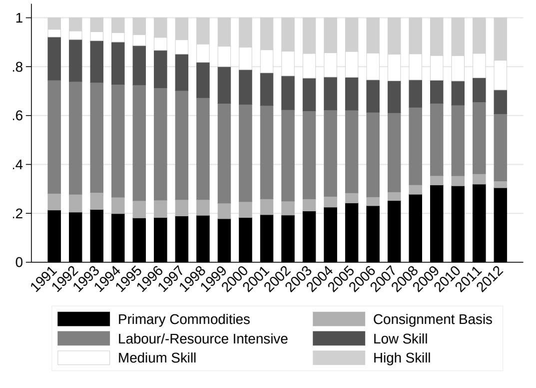


Therefore firms are more likely to import than export. Of the firms that export a little less than half of these firms also import. There is, however, a magnitude difference between the two. Firms that export and import are notably larger than firms that solely export or import. The median size in terms of yearly export revenue for the solely exporting firm is \$21,860 while for firms that both export and import it is \$189,342. The same is true of firms that only import versus firms that do both. The median size in terms of yearly import value for the solely importing firm is \$33,524 while for firms that both export and import it is \$254,043. Clearly displaying that the firms that both import and export dominate Philippine trade. The difference in the median size of import and export value for firms that engage both in import and export indicates that for the medium firm imports are larger than exports.

The products in the Philippines can be divided into six broad categories based on production using a similar classification as the UNCTAD product group classification, however slightly tailored for the Philippines. (See Appendix 2.A.1) The category Consignment Basis is added to the group classification as it is a relatively large group, however does not fit in the other five UNCTAD categories.

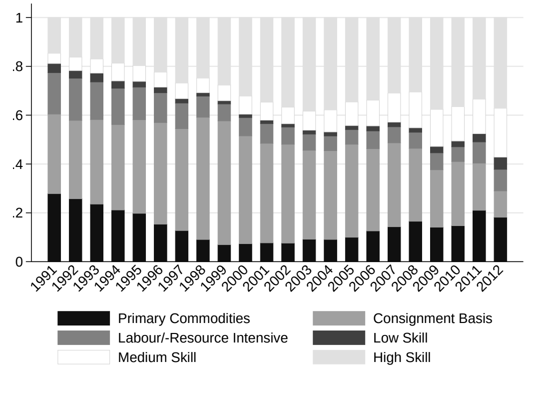
The UNCTAD classified the Consignment category as unclassified. Given the size of this category for Philippine trade excluding it would be a mistake. The Consignment Basis category consists of export goods that are made from materials on consignment basis. In procurement on a consignment basis, a seller delivers certain materials to a firm that is put in the consignment stock of their business. The consignment stock remains the property of the seller until the firm uses material from the consignment stock, processes and sells (exports) it. Once a firm has used materials, it will have liabilities towards the seller that it needs to pay. The firm and the seller can agree on a time period after which the firm has to transfer unused consignment material to its own stock. Firms that produce on consignment basis often add mostly labor to the production process. This sector is therefore related to the labor intensive sector, however distinctly different due to the fact that the inputs are materials on consignment basis, which is often imported. The products produced on consignment basis mainly consist of apparel, footwear and electronic products (e.g. semi-conductors devices).

Figure 2.5: Percentage of Transactions Accounted for per Product Type



Notes: The figure summarizes the number of transactions per product category. Where a transaction is defined as a firm-product-destination-year observation.

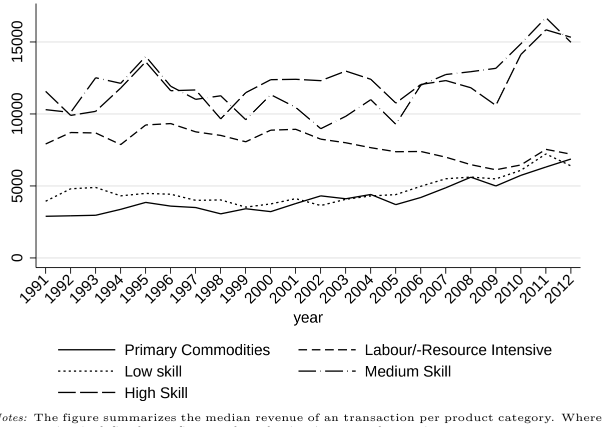
Figure 2.6: Percentage of Revenue Accounted for per Product Type



Notes: The figure summarizes the percentage of total export revenue per product category.

The export in the Philippines is dominated in terms of number of transactions, in decreasing order, by labor-/resource intensive (labor intensive) and primary products. (See Figure 2.5) Where a transaction is defined as a firm-product-country observation. The percentage of transactions attributed to a category is arithmetically determined by the number of firms, different products and countries exported to. Therefore it is not surprising that primary products dominate the transaction data as the Philippines has many firms and export products within this category. It is, however, the dynamics over time in terms of transactions that are especially insightful. It shows a decreasing trend for labor intensive and consignment based products over time. While high skill/capital/technology intensive product (High skill) and medium skill/capital/technology intensive (Medium skill) products have become of increasing importance. In terms of total export value high skill products have become the most important product category followed by goods produced on consignment basis, primary commodities and medium skill products. (See Figure 2.6) What is striking to see is that product categories that are of less importance in terms of transactions, medium skill, high skill and consignment based products, dominate the export revenue. However it is important to note that products produced on consignment basis show a clear decreasing trend over time in terms of total revenue.

Figure 2.7: Median Value of Transactions Within a Product Type



Notes: The figure summarizes the median revenue of an transaction per product category. Where a transaction is defined as a firm-product-destination-year observation.

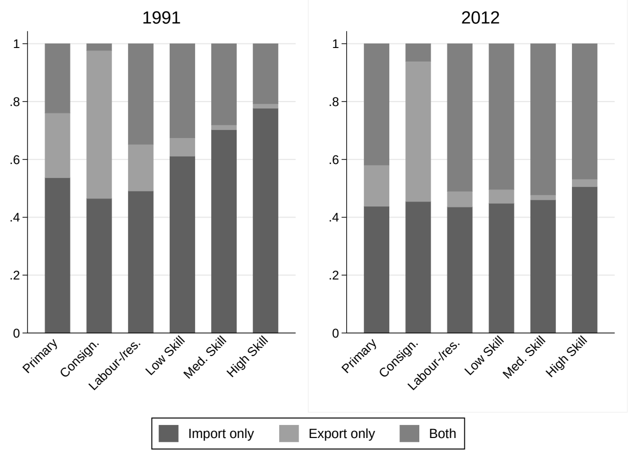
The median revenue size of a transaction by product type clearly shows that products that are Medium and High skill have the largest transactions. (See Figure 2.7) The revenue of a transaction is determined by two factors the quantity and price. Primary commodities are often heavier and receive a lower price than medium and high skill products. Where the quantity is measured in gross kilos. One category that is excluded from this figure is the consignment based products. The median revenue size of a transaction for goods produced on consignment basis is the largest and has an average median transaction revenue of $ 43,879 and is therefore notably larger than other product categories.[11]

The change in export composition is clearly demonstrated by Figure 2.8. Over time more products are being both exported and imported by the Philippines instead of only imported. This trend is most clear for high and medium skill products. This figure hints on a skill upgrade in Philippine exports over time. Unfortunately the classification of the export product does not indicate the value that the Philippine firms add to these products. In terms of global production chains the Philippines could

[11] The broader PSCC product classifications that are present in this category contribute to these larger transaction revenues.

be specialized in final assembly. This would imply that even though they export high skill products they mostly add labor to the production process when assembling the products. Therefore it is of importance to see whether the Philippines exporting firm mainly operates in final goods assembly, in which case the increase in exported medium and high skill final goods implies relatively little in terms of firm skill upgrading.

Figure 2.8: Intra-Industry



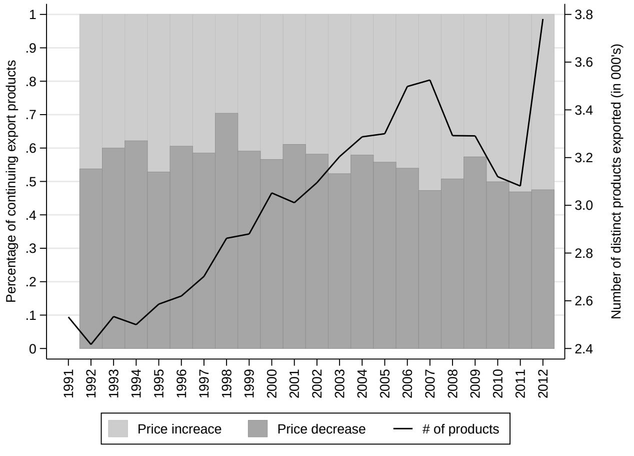
Notes: This figure summarizes the percentage of products that are solely imported, exported or both exported and imported in the Philippines. The categories correspond to the revised UNCTAD classification (see appendix). The number of product per classification remains relatively stable. For example in 2012 1,520 products are classified as high skill products while in 1991 it are 1,568. Therefore the absolute number of products per category does not change greatly, however the composition in trade direction does.

2.3.2 Prices

For most distinct products the mean prices are decreasing over time. A minimum of 75.2% and on average 79.1% of the products exported in a certain year were also exported the following year. For these products yearly price trends can be calculated. Figure 2.9 shows the percentage of continuing products (i.e. products that are exported in consecutive years) that have a mean price that increases or decreases in constant terms. Apart from the years 2007, 2010-2012 the trend has been that the average product gross kilo price decreases for more continuing products than that it increases. The striking aspect is that in recent years this trend is being reversed as an increasing amount of product categories are facing increasing average prices. Figure 2.9 also shows the number of distinct products exported by the Philippines over time. The Philippines shows a clear increasing trend in the number of distinct products exported over time.

Individual product unit values (prices) contain very little information unless they are put into a context. One way prices can be compared is by comparing export prices to that of import prices for the same distinct product. This places the export prices in an international context in terms of competitors. For 54.8% of the products the mean import price is higher than the mean export price. Indicating that for most export products the Philippine exports product that have a lower average export price that the average import price of the same product. There are however distinct products which do not have any corresponding imports. For these products the prices cannot be compared,

Figure 2.9: Mean Price Change and Number of Distinct Products Trend for Exports Over Time

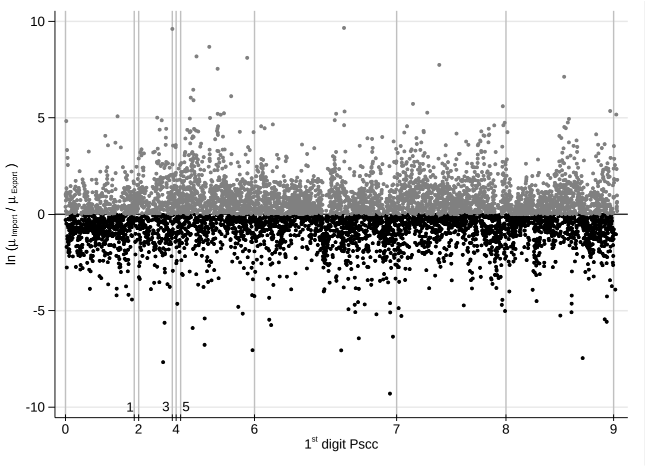


Notes: This figure summarizes the mean $ln(price)$ change over time. The mean is taken by product for all firm-product-destination prices (transaction level) deflated by the CPI (base year 2005). A price increase indicates that the mean price of the respective product that is exported in both years (a continuing product) increased. The bars denote the percentage of continuing products of which the mean price increased or decreased over time. The line in the figure indicates the number of distinct products exported in the respective year.

which leads to a slight bias. There are for example 16 distinct product in the top 100 export product list that have no corresponding imports.[12] The median deviation between the import and export price for goods of which the import price is higher is $7.3 per kilo. While the median deviation for goods of which the export price is higher is $6.1 per kilo. The distribution of deviations shows that a deviation for products where the import price is higher is greater than for products where the export price is higher. Only at the end of the right tail of the deviation distribution do deviations in products of which export prices are higher than import prices become higher than the reverse. This is why in Figure 2.10 the deviations for goods of which the export price is higher are more often closer to the value zero than when the reverse is true. Indicating that, apart from the fact that the mean import price is often higher than the corresponding mean export price of a product, the differences are also often greater when import prices are higher.

[12]Thirteen of these products comprise of consignment based products exported by the Philippines.

Figure 2.10: Import/Export Mean Price Ratio



Notes: This figure summarizes the ratio of the mean import price and the mean export price over 22 years in constant prices (deflated by the 2005 CPI). The natural logarithm is taken in order to scale the results. Therefore values smaller than zero indicate that the mean export price of a distinct product is higher than the mean import prices. The horizontal axis contains the rank of distinct product from lowest PSCC 7-digit code to highest digit code. The values on the axis indicate the value of the highest digit. Therefore it can be observed that relatively few product are exported from the 1st digit sections 1, 3 and 4. Products that have no corresponding import price are omitted from the graph. In 54.8% of the cases was the mean import price higher than the mean export price of a distinct product.

2.3.3 Concentration

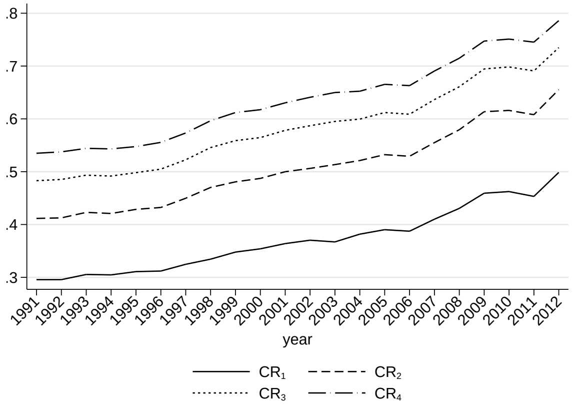
Over time the mean concentration ratio of firms per product category has increased. A smaller number of firms have started to dominate the exports of the Philippines. In 1991 the single largest firm within an average export product accounted for 29.6% of total export sales while in 2012 it was 49.9%. The concentration ratio of the largest firm (C_1) therefore shows a clear upward trend. (See Figure 2.11)

The product firm concentration ratio is dependent on the number of firms that export the respective product. On average 30.9% of the distinct export products only have one firm exporting it in a respective year.[13] The percentage is relatively stable over time and achieves its maximum in 1993 (34.8%) and its minimum in 2000 (28.2%). In 58.9% of the distinct export products there are 4 or less firms that export the product in a respective year. This partly explains why the product concentration ratio is high as there are many products that are exported by relatively few firms. The lowest firm concentration ratio of 3.2% is obtained in one of the largest export sectors in terms of firms, furniture of rattan (8217903). When a large number of firms export a certain product the concentration ratio also tends to be lower. The firm concentration ratio for an distinct export product with a 100 or more firms exporting it in a certain year has a median C_1 of 14.4%; while distinct products with 5-10 firms exporting it have a median C_1 of 64.4%.

These concentration statistics partially explain why there are many short durations in trade product spells found in the trade literature survival (e.g. Besedes and Pursa (2006)); as many products are exported by notoriously few firms and therefore more likely to have shorter spells. Product categories that have only one firm in it per year over the whole period that it is exported have an average spell duration of 1.3 years after discarding left censored spells. While product categories with, on average, more than 1 firm and up to an average of 2 firms in it per year have an average (median) duration of

[13]On average 12.5% and 9.4% of the distinct export products only have 2 and 3 firms exporting the product in a respective year.

Figure 2.11: Firm Export Concentration Ratio per Product Category



Notes: This figure summarizes the average firm concentration ratio per export product category.

2.9 (2). The average and median duration rise as the average number of firms within a specific product rise.[14] The 299 products that constitute the top 100 export products in terms of value have product spells of 12.4 years while products that never enter the top 100 have average product spells durations of 3.7 years if left censored observations are not discarded. If left censored observations are discarded then 54.1% of the spells of the top 100 export products remain and the average duration drops to 7.3; while for other products the duration drops to 2.6 years and 14.3% of the spells are discarded. The difficulty of the comparison of non-left censored spells is that many of the main export products are left censored and therefore only new main products are compared. Nonetheless the duration spells of the top 100 products are longer more importantly it are these products that constitute the export of the Philippines.

After corrections there are 269 destinations to which the Philippines exports.[15] There are 156 destinations to which, at least in one year, only 1 Philippine firm exports.[16] There are 188 destinations to which, at least in one period, 4 or less firms exported to.[17] To these 188 destinations the Philippines exports on average 12.9 years. Of the periods that the Philippines export to these destinations there are, on average, 4 or less firms exporting to the respective destination in 65.6% of the years. The 188 destinations consist mainly of small (island) economies and relatively poor countries and account only for 0.9% of total export value. There are 81 destinations which can be considered important destinations in terms of the number of firms that export to it. The top 10 destinations, however, dominate the exports as they account for 83.5% of total export revenue.[18]

Even within the main destinations a relatively small number of firms account for the majority of export revenue per year. The concentration ratios for the largest export markets, USA and Japan, are the lowest. However even then the largest Philippine firm account for respectively 9.7% and 10.9% of total export revenue in a respective year.

[14] Product categories with on average (2-3] firms in it have an average (median) spell length of 4.8 (3), with (3-4] firms it is 6.9 (5.5), with (4-5] firms it is 8.6 (8) and for products with 5 or more firms it is 10.7 (12) years.

[15] Observations without a corresponding destination name are deleted.

[16] There are 25 destinations to which, over the whole period, only 1 firm exports per year.

[17] There are 68 destinations to which over the whole period 4 or less firms export to per year.

[18] These calculations are made without adding the destinations Alaska, Hawaii and other smaller islands belonging to the USA (e.g. Guam and Puerto Rico) to the USA, Okinawa to Japan and the Sabah and Sarawak districts to Malaysia. As they are denoted as separate destinations in the data.

Table 2.1: Concentration Ratio of Firms per Destination for Top 11 Destinations

Classification	C_1	C_2	C_3	C_4
USA	9.7	16.2	20.1	23.2
JPN	10.9	17.5	22.4	26.4
NLD	38.8	53.6	61.1	66.2
HKG	20.1	31.1	37.8	42.5
SGP	24.5	36.4	44.3	50.0
CHN	30.7	45.4	53.1	58.4
TWN	27.4	38.4	45.8	51.6
MYS	34.9	50.5	58.1	62.5
DEU	25.2	41.3	50.7	57.0
KOR	23.3	34.4	40.5	45.2
THA	30.6	40.8	47.5	52.5

Notes: This figure summarizes the yearly average firm concentration ratio per export destination. Therefore if the lead firm changes then the concentration ratio of that respective firms is taken to calculate C_1. The countries in this list are the main destinations for Philippine exports. These concentration ratios are averages over the whole time period. The top 11 firms account for 86.7% of total exports.

The Herfindahl index, which is the sum of the squared market ratios, is an indicator of concentration. If the Philippines would only export to 1 destination then the destination Herfindahl index would obtain a maximum value of 1. The more concentrated the exports of the Philippines are in terms of destinations the higher the value of the destination Herfindahl index will be. The Herfindahl index is calculated for destinations, products and firms. What can be seen is that the concentration of export destinations has decreased over time. (See Figure 2.12) This is mainly due to the decrease in the importance of the USA as export market over time. For products the importance of semi-conductors basically drives the product Herfindahl index. On average 19.6% of total export value is accounted for by semi-conductors, in 1999 it accounted for a maximum percentage of 38.0% of total export value. After 1999 the importance of semi-conductors slowly decreases to a minimum of 3.6% of total export value in 2012. The firm concentration is closely related to the product concentration ratio.

Figure 2.12: Herfindahl Indexes

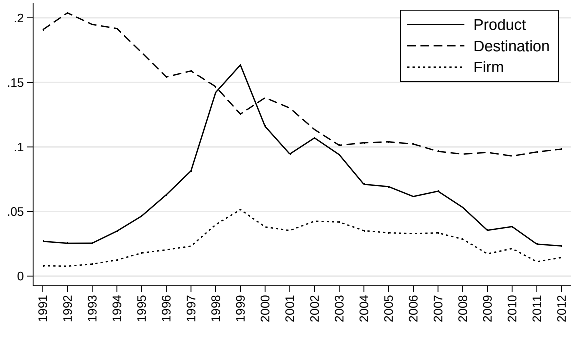
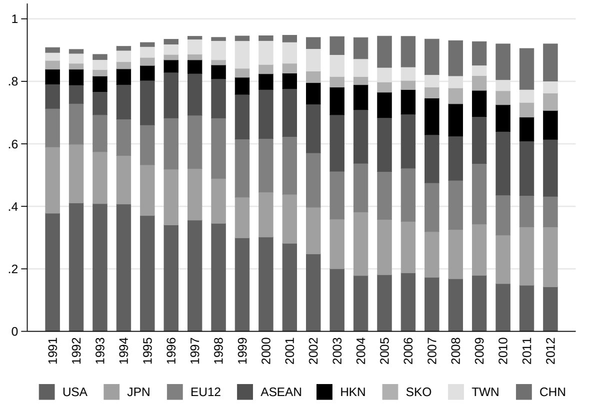


Figure 2.13 shows the export revenue accounted for by destination. These destinations account for, on average, 92.9% of total exports. The figure clearly shows the decreasing importance of the USA and EU12 and the increase of importance of regional trade partners mainly China and countries

that are part of ASEAN. [19]

Figure 2.13: Export Concentration



Notes: This figure summarizes the percentage of total revenue accounted for by destination. For these calculation destinations are combined. For the USA the states Alaska and Hawaii, Japan the island Okinawa and Malaysia the districts Sabah and Sarawak are added. ASEAN consist of Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Singapore, Thailand and Vietnam. The EU12 consist of Belgium, Germany, Denmark, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and the UK.

2.4 Top 100 Export Products

This part of the paper focuses on the 299 export products that constitute the top 100 export products in the sample. One of the questions that arises when the number of high and medium skill goods export increases is the value that these Philippine firms add to these products. It is therefore insightful to link the imports to the exports in order to unravel the import content of the exports. The imports and exports of a firm are linked through a unique trader code that each firm has. Firms are classified on basis of main export product, in terms of value, that a firm exports in a respective year. For this part of the paper only firms that export a main product that is in the top 100 list will be included in the analysis. By focusing on the main export product not too much information is lost. For the firms that produce a main export product that is in the top 100 list the main export product for the median firm accounts for 86.8% of total yearly export revenue. (See figure 2.14) [20]

The number of firms that export a certain main product per year is on average 12.8 firms. The median however is 4 firms per year per main export product. There are a couple of main export products that have a large number of firms exporting the product. Most of these products are basic manufacturing products which are relatively easy to produce.[21]

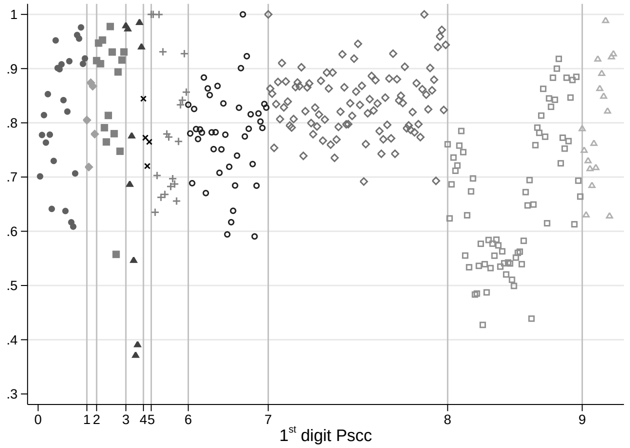
The median (mean) total number of distinct products imported by the firm within a main export product is 637 (773). Figure 2.16 displays the total number of distinct import products imported by firms exporting in a main product. Most of these import products, however, only appear once or twice

[19]The results of ASEAN are mainly driven by Thailand and Singapore.

[20]The minimum total yearly value that the main product in the 100 list accounts for is 7.7% however the 1st percentile is already 19.6% and the 10th percentile 39.0% clearly indicating that the main product in almost all cases accounts for a large majority of the total yearly export revenue.

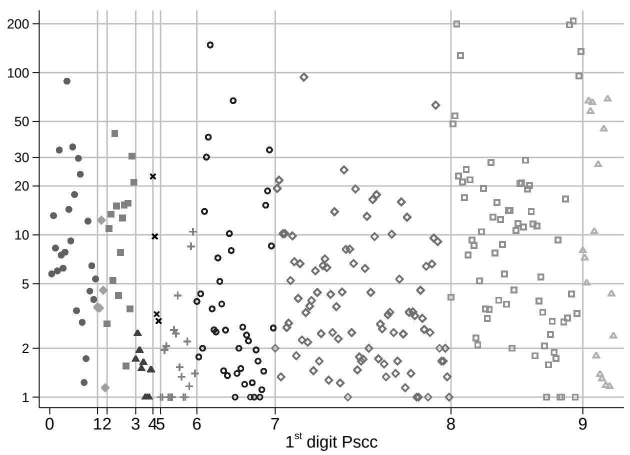
[21]Statuettes and other Ornaments (6354903), furniture of wood or of rattan (8215909 and 8217903), Articles for Christmas Festivities (8944500), Imitation Jewelery (8972909) and Other basket work (8997119).

Figure 2.14: Percentage Firm Yearly Revenue Accounted for Main Product



Notes: This figure summarizes the average percentage of firm yearly revenue accounted for by the main product. The minimum is obtained for product category 3344002 (other fuel oils — bunker oils)

Figure 2.15: Average Number of Firms per Year

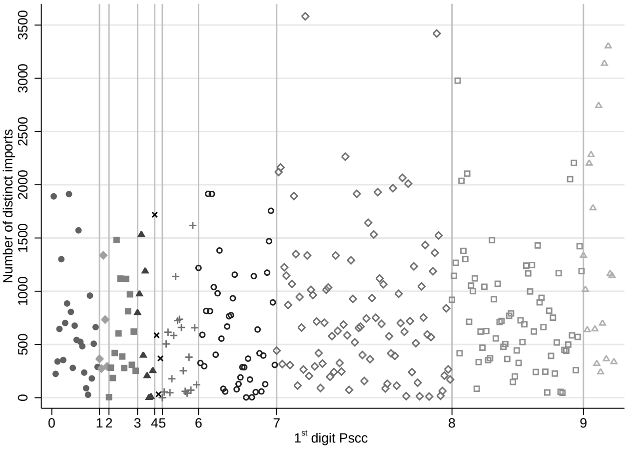


Notes: This figure summarizes the average number of firms per year that export the respective main export product as main product. The vertical axis is in logarithmic scale however the value labels give the exponentiated values in order to make the graph more comprehensible.

in the data. The median number of times the product was imported is 1 in 59.9% and 2 in 38.4% of the cases. Indicating that in most cases one firm imports the product for one year and sometimes two years or two different firms import the product once. Nonetheless it does show the diversity of products that firms within a main export product import. Of course not all of these imported products are inputs for the main export product.

Many of the firms that export a certain main export product also import. This is even more the case for products that start with a 5, 7 or 9 digit. Firms in the consignment based export products have the highest percentage, 85.7%, of firms importing every year. For most medium and high skill

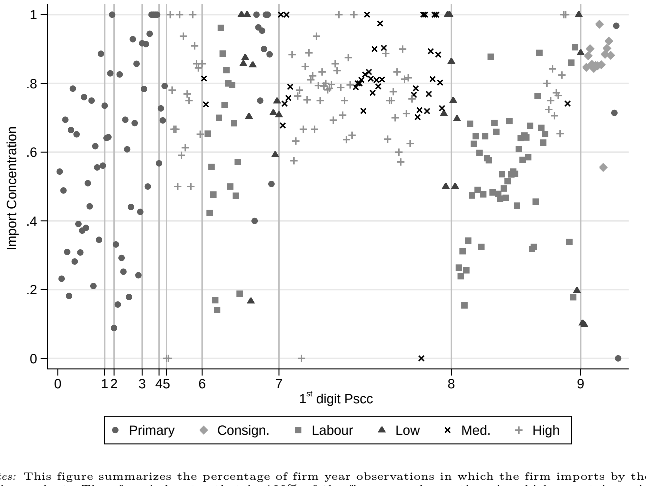
Figure 2.16: Number of Distinct Imports Imported by Firm by Main Export Product



Notes: This figure summarizes the total number of distinct products imported by the main export product.

products the percentage of firms that import per year is also high, respectively 81.0% and 74.8%. The percentage of importing firms seems to correspond with the skill needed to produce the product. Hinting on a high import content and the possibly that the consignment based, high and medium skill products are only assembled in the Philippines. The lowest average percentage of firm-year observations of firms that import is observed for labor intensive products where, on average, in 55.1% of the firm-years observations firms also import when they export.

Figure 2.17: Percentage of Total Firm Year Observations in Which the Firm also Imports by UNCTAD Classification



Notes: This figure summarizes the percentage of firm year observations in which the firm imports by the main product. Therefore 1 denotes that in 100% of the firm-year observations in which a certain main product is exported the firms always import. Many electronic products located in the 7 digit sector have firms that always import indicating the probability of import content.

The main import product input per main export product is analyzed. There are two ways in which the main input product is selected. The first method is by calculating the percentage of firms that import the respective product every year. The import product that is most frequently imported is linked to the main export product as input. The second method is to take the main import product in terms of import value per firm per year and then take the most frequently appearing main import product of all firms that export the same main export product. In 42.2% of the cases the two methods lead to the same main input. The second method is the one used in the analysis. This method has the advantage that it uses both the frequency and the value in order to identify main inputs. Firms that make large capital investments can have these imports enter as main inputs in some years. However by taking the mode of all firms in all years the main input product is filtered out. Both methods nonetheless indicate that most of the medium skill, high skill and consignment based products have relatively high skilled imported input content. In most cases there are strong indications that at least part of the value added is imported by these product categories. The clearest case for imported value added and possibly final assembly is observed for products produced with consignment based materials. The main imported inputs are materials needed to produce the goods. For example Watches manufactured from materials from consignment basis has as major input watch parts. Firms with a consignment based product as main export often have as main imported input a corresponding part for the production of the product. This combined with the high yearly import percentage indicates that consignment based producing firms are possibly specialized in product assembly and at the very least import part of the value added.

For high skilled products the case is less clear cut. First of all there are 3 main high skill export products for which the firms never import.[22] Of the 77 high skilled export products in which firms also import 77.9% have a high skill product as main imported input. However another 18.2% of the main imported inputs are medium skill and (often high skilled) consignment material inputs. Therefore most of the main imported inputs have a high skill content. More than 61% of the high skilled products are located in the Machinery and transport equipment section (section 7). In this section the high skill export products attains the highest percentage of high skilled main inputs of 85.7%. Indicating that for 42 of 49 high skilled export products the main input product is also a high skilled imported input. The remaining main imported inputs are medium skilled products and (high skilled) consignment based materials. Most of the imported inputs being parts and components for the respective export product. For the other two sections, 5 and 8, in which high skilled products are produced firms also often import a high skilled input. For Chemicals and related products, n.e.s. (section 5) 11 of the 20 and for Miscellaneous manufactured articles (section 8) 7 of the 11 main export products have high skilled inputs as main import product.

For medium skilled products it is the same as for high skilled products. In 72.5% of the medium skill exporting products import as main input a medium skilled product. In fact in 90% of the medium skill exporting products have medium or high skill imported inputs. Also indicating that for medium skilled exports the skill of the imported main input is relatively high. Philippine firms therefore add less value to these products then than would appear at first sight. The data indicates that there are clear signs that the increased skill content in the Philippine exports is at least in part due to skill-biased imported inputs.

[22] These products are Propene (5111200), Toluene (5112300) and other particle accelerators (7787109).

2.5 Conclusion

This chapter summarizes stylized facts on Philippine trade. There are more Philippine importers than exporters. However it are the firms that both export and import that dominate the trade data as they are much larger. Philippine trade has remained relatively stable as 299 (310) products constitute, on average, 91.0% (75.9%) of the yearly total export (import) value. There are many destinations to which and products that are exported sporadically. The majority of trade is concentrated in relatively few destinations, products and firms. There is, also, tentative evidence of a transition over time in terms of exported products, as the Philippines exports more medium and high skilled products. However part of this upgrade is due to higher and medium skilled inputs that are imported by these same firms. Suggesting the possibility that at least part of this so called upgrading of products cannot be attributed to upgrading of skills in the Philippines.

2.A Product Classification

Table 2.A.1: Product Classification*

	SITC rev3
Primary commodities	$0 + 1 + 2 + 3 + 4 + 68 + 667 + 971$
Consignment Basis	$931 - 93103 - 93104 - 93105 - 93106 - 93107 - 93108 - 93109$
Labor-/resource-intensive products	$61 + 63 + 64 + 65 + 66 + 82 + 83 + 85 + 894$
Low-skill/ low-tech/ low capital intensive products	$67 + 69 + 785 + 786 + 791 + 703 + 895 + 899 + 892 + 897 + 898 + 896$
Medium-skill/ medium-tech/ medium capital intensive products	$62 + 71 + 72 + 73 + 74 + 77 - 776 + 781 + 782 + 783 + 784 + 893$
High-skill/ high-tech/ high capital intensive products	$5 + 75 + 776 + 76 + 87 + 88 + 891 + 792$

*Based on UNCTAD product classification

2.B Top 10 Exported and Imported Products

Table 2.B.1: Top 10 Export Products 1991-2012 in Terms of Revenue

PSCC 7	# of years	Description
0361100	1	Shrimps & Prawns, Frozen
4223100	7	Coconut (Copra) Oil, Crude
6353909	3	Other builders' joinery and carpentry of wood, n.e.s.
6821201	9	Cathodes & sections of cathodes, of refined copper
7285507	1	Parts, n.e.s., of other machines and mech'l. appliances having individual functions
7523002	10	Portable digital automatic data processing machines, weighing not more than 10 kg, consisting of at l.
7526000	6	Input or output units for automatic data processing machines, whether or not presented w/the rest of
7527000	12	Storage units, whether or not presented w/the rest of a system
7529009	2	Other data processing equipment, n.e.s
7599700	16	Parts & accessories of machines of 752
7641100	2	Telephone sets
7731300	3	Ignition wiring sets and other wiring sets of a kind used in vehicles, aircraft or ships
7731301	14	Electrical wiring harness for motor vehicles
7763200	2	Transistors(excluding Photosensitive) w/dissipation rate of less thn 1 watt
7763900	12	Oth semi-conductor devices
7764100	5	Digital monolithic integrated units
7764109	12	Other monolithic digital integrated circuits
7764300	1	Non-digital monolithic integrated [units] circuits
7764900	21	[Other] electronic [integrated circuits and] micro-assemblies
7768900	1	Parts of electronic integrated circuits & micro-assemblies
7843919	3	Oth parts & accessories, nes, of motor vehicles of groups 722, 781, 782 & 783
9310205	8	Women's wear, manuf from mat'l on consign basis
9310206	9	Men's wear, manuf from mat'l on consign basis
9310207	5	Children's & infants'wear, manuf from mat'l on sinsign basis
9310221	22	Semi-conductor devices, manuf from mat'l on consign basis
9310222	4	Diodes, manuf from mat'l on consign basis
9310229	22	Finished elect'l & electronic machinery & parts, manuf fr mat'l consign basis
9310299	7	Oth products manuf from mat'l on consign basis, nes

Notes: This table shows the list of product that have at least in one year is a top 10 export product, in terms of revenue, for the Philippines. Column (1) shows the 7-digit code for the product group. Column (2) shows the number of year the product is in the top 10. Column (3) gives the definition of the product.

Table 2.B.2: Top 10 Import Products 1991-2012 in Terms of Revenue

PSCC 7	# of years	Description
0412000	4	Other wheat (including spelt), unmilled
0412009	8	Meslin
0423102	5	Rice, Semi/Wholly-milled, Excldg broken rice
2831002	8	Copper concentrates
3330000	22	Petroleum oils & oils from bituminous minerals, crude
3341102	8	Motor spirit (gasoline)
3343003	9	Other fuel oils or Gas oils
3343009	1	Gas oils
6726900	1	Semi-finished products of iron/non-alloy steel contg less thn 0.25% carbon, nes
7128000	1	Parts for parts for steam turbines & oth vapor turbines
7284919	1	Other machinery and mech'l. Appliances, having individual functions, n.e.s.
7599700	18	Parts & accessories of machines of 752
7643204	4	Other cellular phones
7649109	7	Parts and accessories suitable for use solely or principally with the apparatus of division 76.1;
7649332	1	Parts & accesrs of apparatus & equipment of subgr 7643 & 7648 (excldg tv camera p/a)
7722009	1	Oth printed circuits
7764109	12	Digital monolithic integrated units; Other | Other
7764300	7	Wafers and discs, electrically circuit-programmed, whether or not coated on one side with gold or aluminum
7764900	3	[Other] Electronic [integrated circuits and] microassemblies
7768900	17	Frames or lead frames, being part of integrated circuits, composed of substances of any following characters
7812021	1	Passenger cars w/spark ignition combustion engine, exceeding 1,500 not 3,000 cc, new
7812071	4	Components, parts &/or accessories imported from one or more countries for assembly of [Passenger cars]
7924000	6	Aeroplanes and other aircraft, mechanically-propelled (other than helicopters), of an unladen weight exceeding 15,000 kg;
7935909	1	Oth light vessel, fire-float, floating crane & oth vessel, n.e.s
9310103	4	Frabrics consignment basis for embroidery/manuf of outer garments
9310111	22	Dice of any material
9310119	21	- - Other
9310191	21	Mat'l & accesrs, consign, for manuf of elect'l & electronic machinery, & parts
9310199	2	Oth mat'l, accesrs & supplies, consign basis for manuf of products, n.e.s

Notes: This table shows the list of product that have at least in one year is a top 10 import product, in terms of revenue, for the Philippines. Column (1) shows the 7-digit code for the product group. Column (2) shows the number of year the product is in the top 10. Column (3) gives the definition of the product.

Chapter 3

Formalizing the Middle–Income Trap

3.1 Introduction

Generally speaking there are three groups of countries in terms of income per capita. There are high income countries that according to the World Bank (WB) classification have a Gross National Income (GNI) per capita of above $12,275 in 2010. Then there are poor countries that have a GNI per capita below $995 in 2010. Stuck in between these two categories there are also countries, they are called middle–income countries. The countries that have been dubbed middle–income countries have had a hard time moving up from this income group. A term was created to label the middle–income countries that experienced difficulties in making the transition to the next income group. These countries were stuck in the so called Middle–Income Trap (MIT).

The exact definition of the MIT, however, is still ambiguous and often fails to provide a clear distinction between the countries that are stuck and those that avoid the trap, an aspect which of course is crucial. Often when asked what a MIT is many words follow but a satisfying answer is not given. The person posing the question is often more puzzled after the answer than before posing his question. This is not strange as the MIT is one of the development topics on which there is still a lot of debate. The term MIT is therefore still subject to a great deal of skepticism.

There are two main aspects of the MIT that have not yet been sufficiently addressed and thereby contribute to the skepticism. The first aspect is the development of a thorough theoretical framework for the trap. The second aspect is a clear definition which separates the transition from the trap. Considering the fact that since 1987 more countries have been dubbed middle–income the relevance of the MIT discussion is of increasing importance.[1] This paper is an attempt to tackle the second aspect. This paper searches to quantify a duration definition of the MIT that will enable individuals to distinguish between the time needed to make the transition and actually being stuck in the MIT. It must be stressed that in order for the discussion on the MIT to progress this distinction must be made.

[1] In 1987 the WB classified 45% (74 of the 164 countries classified) of the countries lower or upper middle–income while in 2010 51% (110 of the 216 countries classified) were dubbed lower or upper middle–income countries.

3.2 Literature Review

3.2.1 Traps and Development: a Short Introduction

Let us, as a starting point, use the notion of a low income (poverty) trap, which has been less debated and more generally accepted, in order to comprehend the phenomenon trap. The low income (or poverty) trap is based on the notion that poverty itself is a trap. In order to break out of this poverty trap capital is needed. However this capital cannot be accumulated because of, for example, disease, malnutrition, physical isolation and extreme poverty itself. Sachs (2006) describes development as a ladder that needs to be climbed. Individuals stuck in the poverty trap are, according to Sachs (2006), not even on this ladder. The poverty trap is in essence that the struggle for survival now is often more important than the future.[2] The notion of a trap therefore constitutes the inability or failure of individuals (countries) to take the necessary steps to break out of an undesirable circumstance they are stuck in. The analogy of a ladder for development is very misleading, as it implies a linear relationship for development. If only the individual (or country) would grab hold of the ladder then development itself will follow. However, if anything, the MIT discussion has shown that there is a kink, a large kink, in this development ladder. After breaking out of the poverty trap and escaping the lower income classification development does not become any easier. The MIT is basically a concept for the notion that it is difficult for a middle–income country to become a high income country. In fact it can be argued that it is easier for low–income countries to become middle–income countries than for middle income countries to become high–income countries. Thereby implying that the development of a country is not a linear process. So why would the transition from low to middle–income, theoretically speaking, be easier than the transition from middle to high income?

The basis of the answer lays in the fact that low–income countries can basically use their current state, poverty and technological backwardness, to their advantage in order to grow quickly. In early stages developing countries primarily rely on subsistence employment. Subsistence employment is a synonym for an ‘unlimited’ supply of labor existing in this country relative to its capital and natural resources. Lewis (1954) called this subsistence sector the unproductive sector as individuals could switch to another sector without losing any productivity within the respective sector. In these early stages of development this relatively inefficient sector constitutes the largest share of employment and output. Therefore a country can quickly increase its productivity by reallocating labor from the subsistence sector (highly inefficient sector) to the other sectors (more efficient sectors) of the economy. These more efficient sectors use (more) capital thereby quickly enhancing the productivity.

Late-developing countries also have the capacity to grow more rapidly than early developers. The catch up hypothesis asserts the idea that being backward in the level of productivity carries a potential for a rapid advance. Instead of inventing new technologies these countries can import know-how from abroad. They can therefore exploit the gains from these imported technologies by shifting workers from the subsistence sectors to manufacturing sectors. Thereby rapidly increasing their productivity. However this pool of underemployed (rural) labor will eventually be drained. At a certain point the share of manufacturing employment peaks and growth will start to depend more on raising the productivity in the service sector, generally speaking a more difficult process. Also as the country approaches the technological frontier it will have to make the transition from depending on imported technology to home grown innovation. Implying that the labor-intensive sectors are being replaced by

[2]However it must be noted that when enabling conditions are in place (e.g. property rights and access to finance) the entrepreneurship and ingenuity of the worlds poor is often impressive and plentiful. Read for example Muhammad Yunus book “Banker to the poor”.

a new set of industries that are in the way they produce more human capital, capital and knowledge intensive. This last transition is exceptionally difficult and explains why so few countries break into the high income class.

3.2.2 The Middle–Income Trap

Kharas and Kohli (2011) define the MIT as follows: *"unable to compete with either low-wage economies or highly skilled advanced economies"*. This is why the term trapped is used because these countries are trapped in between. Basically what the countries did to achieve middle–income status, usually some form of labor intensive production, becomes less competitive as wages start to rise. At the same time these countries are often not equipped with the needed know-how, capital and human capital needed to break into the markets of rich-country innovators and hence they are stuck. Kharas and Kohli (2011) use an analogy of golf to explain that even though not all countries fall into a trap all middle–income countries are influenced by the presence of this trap.

"Both the poverty trap and the middle–income trap can be best understood by analogy to golf. Not everyone falls into a trap, but everyone's play is influenced by the presence of traps. Successful economies avoid falling into traps or escape rapidly, while unsuccessful (or unlucky) economies can get stuck for many years. Page 281

Ohno (2009) describes the MIT as an invisible glass ceiling that prohibits countries to move from the second to the third stage of development. In the second stage the country has just begun with the initial stages of industrialization. It receives FDI and simple manufacturing production under foreign guidance is set up. At this stage the fact that wages are low is important for the foreign owned and controlled manufactures. Wages can therefore not increase greatly and most of the important tasks remain in the hands of foreigners. In the third stage management and technology is mastered by locals and domestic firms can produce high quality goods. Clearly there is a big gap between the second and third stage. In order to attain the third stage the country must "absorb technology". What does Ohno (2009) imply with this term?

" Internalize skill and knowledge by accumulating industrial human capital, locals must replace foreigners in all areas of production including management, technology, design, factory operation, logistics, quality control and marketing. As foreign dependency is reduced internal value rises dramatically" Pages 28-29

Basically the locals must master the skills needed to produce high quality goods and start replacing foreigners at all levels. Clearly more value will be added by the locals and productivity will therefore increase drastically allowing local wages to rise. As long as wages rise faster than productivity the country will be losing its competitive edge. However if wages rise due to higher productivity the country will remain competitive. The absorption of technology, that according to Ohno (2009) is needed to break the"glass ceiling", will take years if not decades to attain. In the mean while rising wages due to labor shortages without an increase in productivity can deteriorate the countries competitive advantage as a low cost manufacturer.

The previous definitions and explanations of the MIT describe the problem that middle–income countries face when making a transition to high income status. However they do not provide us with a way to distinguish between countries that are stuck and countries that avoid the MIT. There is, nevertheless, one feature that all factors required to move past the middle–income stage have in common and that is that they take a long time to develop. However a distinction should be made between the transition which by definition takes a long time, as the factors needed to make the transition take time to acquire, and actually being stuck in the MIT. Kharas and Kohli (2011) hint on a duration based definition for the MIT with the golf analogy. Abdon et al. (2012) pursue the quest to quantify the MIT duration definition. Abdon et al. (2012) uses a similar approach adopted by this paper; using an income classification which approximates that of the WB they create a middle–income definition based on spell durations. Abdon et al. (2012) defines countries that have middle–income spells that last longer than the median estimated transition time of countries that escaped as stuck in the MIT. The paper by Abdon et al. (2012) is, to my knowledge, the only paper that tries to quantify the MIT duration definition. This paper is a continuation of that quest.

3.3 Data

Moving past the middle–income segment requires time. Abdon et al. (2012) estimate that the median time it took for middle–income countries to move past the lower (upper) middle–income segment is 28 (14) years. The WB classifies countries into income groups since 1989 when it started with classifying the countries beginning with the year 1987. Given the expected long transition time it should be clear that the range of the WB classification is not sufficiently long enough to create a duration definition. Therefore creating an income classification that spans a longer time period is the first step that needs to be taken.

In order to obtain a greater timespan the author of this paper uses GDP per capita instead of GNI, which the WB uses. Using GDP per capita enables the author to research a significantly longer timespan and a greater amount of countries. Thereby increasing both the length and scope of the sample. In order to make the income classification comparable over time the income per capita or thresholds should be adjusted for inflation, which is what the WB does. However there is no purchasing power parity (PPP) correction applied to the GNI. Which to a certain extent is logical as GNI is ownership based and not location based as GDP. Therefore applying a PPP correction to the GNI would involve adjusting the income for the PPP of the location where the income is earned. A very difficult and cumbersome calculation if at all possible. Nevertheless PPP adjustments bring the income per capita much closer to differences in real income and real consumption between countries. Therefore when making an income classification based on GDP both inflation and PPP corrections are desirable. Therefore GDP per capita should be specified in so called International dollars which is an inflation and PPP adjusted currency.

There are two possible sources of data that give the author a long and wide sample of GDP per capita in international dollars. These two datasets are the Penn World Table (PWT) and the Maddison GPD per capita. The PWT are the result of a careful study to construct internationally comparable price indices and estimates of income per capita. The Maddison GDP per capita estimates are a collection of historical data from Maddison's various works, in particular, (Maddison, 2001, 2003).

The Maddison data estimates the GDP of at most 161 countries for a time period from 1 AD till 2008, although many estimates start in 1950. The PWT 7.1 provides GDP per capita data of at most 189 countries for a time period from 1950 till 2010. However there are many countries for which the PWT series only starts in 1970 or even later. Although the Maddison estimates are often deemed not as reliable as PWT 7.1 they are typically consistent with evidence from a variety of different sources. The Maddison estimates provide the longest estimates for the most countries. It is therefore decided that the Maddison GDP data should be used in the analysis as timespan is of the essence.[3] Most of the continuous observations start in 1950 for the Maddison data. Therefore it was decided to start

[3]Although the same analysis but then with Penn World Table 7.1 data is also applied for robustness checks.

the analysis in 1950. The Maddison GDP data is expanded till 2010 using IMF growth rates of GDP per capita (in local currency) measured in constant prices.

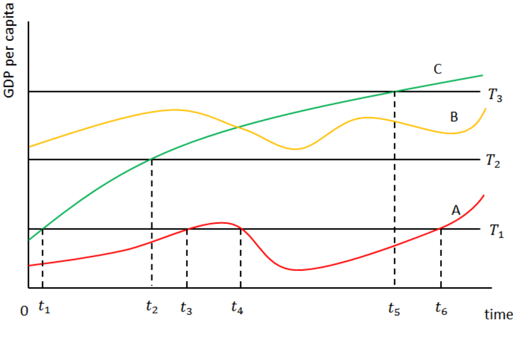
Although the Maddison GDP per capita provides national income accounts in 1990 international Geary-Khamis dollars for 161 countries 37 of these countries are discarded. Seven are discarded because they have populations below 1 million thereby making them less relevant.[4] Also 24 former Soviet, Yugoslavian and Czechoslovakian countries are discarded because their continuous observations start in 1990.[5] Also 6 countries whose GDP per capita are not reported in the IMF database are also discarded.[6] Leaving the author with a sample of 124 countries. (See Appendix 3.B)

3.4 Method

3.4.1 The Basic Approach

The first step is that of creating an (income) classification. Using Figure 3.1 as illustration the notion of a classification will be explained. A classification is based on thresholds, if countries are classified into four categories (Lower, Lower-Middle, Upper-Middle and High) then three thresholds ($\mathbf{T_1}$,$\mathbf{T_2}$ and $\mathbf{T_3}$) are needed. Let's take an income classification as an example. Then countries with an income per capita below or equal to the first threshold ($\mathbf{T_1}$) are classified as low income. Therefore country A is classified as a low income country from date 0 till t_3 and from time period t_4 till t_6. Countries with an income per capita above threshold $\mathbf{T_1}$ and below or equal to threshold $\mathbf{T_2}$ are classified as lower middle–income. Countries with an income per capita above $\mathbf{T_2}$ and below or equal to $\mathbf{T_3}$ are classified as upper middle–income. Countries with an income per capita above $\mathbf{T_3}$ are classified as high income.

Figure 3.1: Income Classification



After defining the thresholds the second step, calculation of middle–income spells, can be made. A middle–income spell is the uninterrupted length of time that a country is classified as middle–income. Therefore the middle–income spell of country C lasts from t_1 till t_5. Due to data availability (60

[4]Countries with population below 1 million: Bahrain, Comoros, Cape Verde, Djibouti, Equatorial Guinea, Sao Tome and Principe, and the Seychelles. Smaller countries are also more prone to discrepancies between GNI and GDP per capita.

[5]Ex-Soviet states (15): Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. Former Yugoslavia (5): Bosnia, Croatia, Macedonia, Slovenia and Serbia/Montenegro/Kosovo. Former Czechoslovakia (2): Czech Republic and Slovakia.

[6]Not in IMF data base: Cuba, Democratic republic of Korea, Puerto Rico, Somalia, West Bank and Gaza, and Trinidad and Tobago.

years) the MIT duration definition will be split up into two parts. The logic is as follows. Abdon et al. (2012) estimates that the median time needed to move past the middle–income segment without falling into the MIT is 42 years. Given the relatively short sample period the probability of observing such a spell is low. Therefore defining the MIT into two parts will allow us to split up the transition and thereby enable the author to observe part of the progress or lack of it. There will be a lower middle–income trap (LMIT) and a upper middle–income trap (UMIT). For example country B could potentially be stuck in the UMIT as over a given time period, in which it has been classified as upper middle, it has been unable to move up to the next (high) income status. The LMIT will refer to a lower middle–income country that over a given time period has been unable to move up to the next (Upper middle) income group.

However whether or not a country is stuck in the respective trap depends on the length of the Lower (Upper) middle–income spell. If the spell is longer than the estimated transition time needed to move past the middle–income segment then the country will be classified as stuck. Due to the fact that there is a lower middle and a upper middle–income segment there will be an estimated lower middle transition time (T_L) and an estimated upper middle transition time (T_U). The respective duration definitions are the corresponding values of the estimated lower and upper middle–income transitions times. For example country C that does eventually reach upper middle (high) income status can potentially be classified as previously stuck in the LMIT (UMIT) if the Lower (Upper) middle–income spell lasts longer than T_L (T_U).

3.4.2 The Classifications

The first step is finding values for the thresholds in order to make a classification. There is always a certain degree of uncertainty when classifying countries on the basis of development. Nonetheless there are large differences in the standard of living enjoyed by citizens of different countries.[7] Therefore there have been many attempts made to classify countries on the basis of these differences. The most common indicators that are used for comparing the standard of living between countries are income per capita, life expectancy and education. Although of these three income per capita is by far the most frequently used.

Classifying countries that have a high or low level of development is often not difficult. For example, in 2009 a citizen of Benin had a life expectancy of 55 years an income per capita of 2005 Int$ 1186 and 42 percent of the adult population were literate. While citizens in the Netherlands had a life expectancy of 81 years an income of 2005 Int$ 37,644 and virtually all adults were literate. Therefore most economist will classify Benin as a developing country and the Netherlands as developed in 2009, irrespective of the indicator used. However classification becomes more difficult when looking at the middle. How do we classify countries as the Philippines, China or Mexico?

What one ultimately wants with a classification system is that countries belonging to the same category are considered alike and countries belonging to different categories are different. For example the World Bank, IMF and United Nation's Development Program (UNDP) all have different ways in which they classify countries. However these methods of classification are prone to a certain degree of subjectivity. The UNDPs classification system is built around the Human Development Index (HDI), a composite indices measuring a country's achievement in life expectancy, education and income. The UNDP uses thresholds in HDI to classify countries into levels of development. However

[7]In all fairness even within countries there can be large differences in standard of living enjoyed by citizens. But most differences can be observed between countries.

no explanations for the choices of these thresholds are provided in either the 1990 or 2009 human development report.(Nielsen (2011))

The availability of income data makes the use of income classifications an obvious choice. Probably the most well-known income classification, also used in this paper as a benchmark, is that of the WB. The WB uses thresholds to classify countries as Low (L), Lower Middle (LM), Upper Middle (UM), and High (H) income using the current GNI per capita (Atlas methodology).[8] The initial value of the threshold that separates the upper middle from the high income countries ($\mathbf{T_3}$) was set at 12.5 times the low-income threshold and about double of that of average world income. The World Bank, however, provides no reason or rational as to why the initial value of $\mathbf{T_3}$ is set at this level.(Nielsen (2011)) A division between lower and upper middle–income countries (threshold $\mathbf{T_2}$) was established by using the income cut-off between softer and harder IBRD borrowing terms.(Nielsen (2011)) Therefore objections can easily be made.

The thresholds of the WB have since then been corrected yearly for international inflation (average inflation of Japan, Euro Zone, United Kingdom and the United States) so that the thresholds remain constant over time in real terms. The WB classification is therefore absolute, implying for example that at an certain point in time all countries can be classified as high income countries. This in contrast to a relative classification that is time dependent. If one wants to compare the progress in terms of development over time then an absolute classification makes more sense, as it provides a reference point in time. Setting relative thresholds would not enable the author to catch part of the development made by a country over time. For example the lowest life expectancy of the sampled countries in 1960 was Mali with 30 years while in 2009 it was Lesotho with 47 years. Even though citizens in Lesotho have the lowest life expectancy in 2009 they still have an higher life expectancy than the citizens in Mali had in 1960. This progress in development would be completely missed if relative thresholds are used.

Of course the thresholds of the WB cannot be applied directly to the PWT or the Maddison GDP per capita data. Firstly because the threshold start in 1987 and secondly because the author of this paper uses GDP per capita in international dollars instead of current GNI. Therefore two methods will be used to find classifications. The first method will be to approach the WB classification and therefore obtain a similar classification of countries for the Maddison GDP per capita data. However given the fact that the WB classification has drawbacks the second method will be to create a new classification based on the method discussed by Nielsen (2011).

3.4.3 First classification Method: Approaching the World Bank (WB)

The Approach

Instead of creating a whole new classification the first method tries to grasp the essence of the WB classification in a new classification for the GDP per capita data.[9] The closer the new classification will come to recreating the WB classification the better it is. The method, however, can never be equal to the WB classification as the range of GDP per capita data overlaps given the different

[8]The Atlas methodology reduces the impact of exchange rate fluctuation in cross country comparisons of incomes. The Atlas conversion factor is the average of a countries exchange rate for the year that one wants to convert and its exchange rate for the 2 preceding years. However these exchange rates are adjusted for the differences between the rate of inflation in the country and that in Japan, UK, US and the EU.

[9]The official historical classification is however fixed during the World Bank's fiscal year. After the fiscal year economies will then remain in the category in which they are classified irrespective of later revisions in the GNI per capita. Therefore 125 corrections in classification will take place when the World Bank thresholds and up-to-date World Bank GNI data are used to reclassify the selected sample during 1987-2010.

WB classifications. (See Table 3.1) Nevertheless the means, medians and standard deviations clearly indicate that the GDP per capita differs by WB classification.

Table 3.1: Summary Statistics of Maddison's GDP per Capita Data by WB classification

WB classification	min	max	p50	mean	sd
1	207	3456	944	1,065	562
2	579	8953	3343	3,636	1,639
3	2,367	15424	7048	7,056	2,522
4	7,727	32,434	18,871	18,950	4,756

Notes: Using the WB classification and Maddison's GDP per capita data.

A classification like the WB, which contains of four categories, consist of three thresholds. ($\mathbf{T_1}$, $\mathbf{T_2}$ and $\mathbf{T_3}$ given that $\mathbf{T_1} < \mathbf{T_2} < \mathbf{T_3}$). For given values of the three thresholds a classification can be made. Therefore the search is for the optimal values for the three thresholds that creates a classification that comes nearest to recreating the respective benchmark.

In this search each threshold is allowed to fluctuate within a range by interval steps of n. (e.g n=$250) The range within which the threshold fluctuates is higher than the median Maddison's GDP per capita of the lower income group and includes the median Maddison's GDP per capita of the higher income group. (See Table 3.1) There is however one restriction and that is that the upper bound of each threshold must be at least $n below the lower bound of the next threshold. The range of $\mathbf{T_1}$ is from $ 1,000 to $ 5,000, for $\mathbf{T_2}$ from $ 3,500 to $10,000 and for $\mathbf{T_3}$ from $7,250 to $19,000. Due to the restriction that $\mathbf{T_1} < \mathbf{T_2} < \mathbf{T_3}$ certain combinations are excluded from the analysis.

Given the range a grid search is applied in order to find the optimal thresholds. The optimal thresholds are the thresholds that lead to a classification that comes closest to recreating the classification of the WB. The search starts with interval steps of $250. Then with smaller ranges intervals of $50 are taken around the thresholds with the highest correlation coefficients.[10]

In order to compare the similarity between a given threshold and the WB classification a correlation coefficient is calculated. The classifications are ordinal variables and ordinal variables have their own measures of association that researchers can use. These methods include Spearman's ρ, Kendall's τ and polychoric correlation. The optimal thresholds are therefore the thresholds for which the correlation coefficient between the classification obtained with the thresholds and that of the WB is the highest. This paper starts the analysis with all three methods and a weighted Spearman method when searching for the optimal thresholds. Due to the fact that a certain degree of uncertainty always exists when constructing a classification caution in choosing the appropriate/best method should be warranted. As will be shown in Section 3.5 the polychoric method used by Abdon et al. (2012) has notable drawbacks, such as clear indications of violation of underlying assumptions and frequent misclassification of the middle–income countries.[11]

Methods of Association

Spearman's ρ and Kendall's τ are both rank correlation coefficients that measure the degree of similarity between two rankings. The Spearman's ρ is a nonparametric measure that assesses the association using the differences between ranked scores of two ordinal variables. Take for example a certain classification X that predicts that country j is a low income country (ranked 1) while the World Bank

[10] Around the optimal values of the threshold a range is created that is $500 higher and lower than the optimal value. Then a grid search with steps of $50 is made to search for a more precise optimal threshold

[11] As can be seen in Appendix 3.C.1 the optimal results reported in Abdon et al. (2012) are obtained due to their restrictions on the range of their thresholds.

classification indicated that this country is an upper middle–income country (ranked 3) then the difference will be -2. Spearman's ρ uses these differences between rankings to calculate the correlation coefficient. If rankings are tied then the average of the tied rankings is taken. Spearman's ρ basically measures the extent to which, when one variable increases, the other variable tends to increase as well. Spearman's ρ does, however, not require this increase to be represented by a linear relationship, this in contrast to the polychoric correlation method. When a certain classification is a monotonic increasing transformation of a World Bank classification then Spearman's ρ will attain its upper boundary value of 1. It assumes implicitly an underlying joint distribution that is discrete. (Ekström (2010)) Spearman's ρ can be best interpreted as the proportion of variability accounted for within rank data.

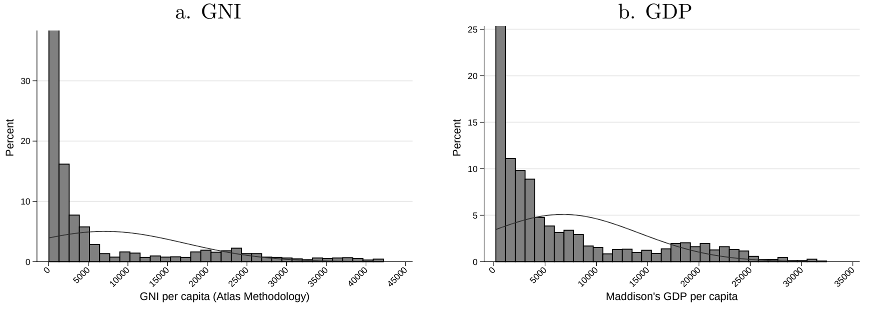
Conventional ordinal correlation methods have the tendency to misclassify middle–income countries. Therefore a weighted Spearman method is also used. Weighted Spearman is similar to the method just described, however importance weights are added to the calculations. WB classified Lower and Upper income countries receive a weight of 1 while WB classified Lower and Upper middle–income countries receive a weight of 3. The fewer errors made, especially for middle–income countries, the higher the correlation. This will ensure that less mistakes will be made for the middle–income group.

Kendall's τ uses a different approach to measure the rank correlation. Instead of measuring the differences between two observations it measures the similarity between two sets of ranked ordered data. It computes the number of concordant pairs and discordant pairs. Take for example a certain classification X that predicts that country j at time t is a low income country (ranked 1) and this same country j is classified an lower middle–income country (ranked 2) at time t+1. Then if the WB Classification indicates that this country j is an lower middle–income country (ranked 2) at time t and a upper middle–income country (ranked 3) at time t+1 then this is a concordant pair. If however the classification of the WB drops while classification X rises, or vice versa, then this is a discordant pair. If the classification does not change when the other classification does change or both do not change then it is a tied pair. Kendall's τ_A does not use tied pairs in its calculations of the rank correlation. However Kendall's τ_B does make adjustments to use tied pairs in its calculations of the rank correlation. Which is why the author uses Kendall's τ_B as there are tied pairs present in the data. Kendall's τ_B can be best interpreted as the difference between the probability of observing discordant pairs versus the probability of observing concordant pairs. The ability of this method to deal with ties is of the essences are there are only 4 possible categories and therefore the number of (potential) ties is extremely high.

The polychoric correlation is different from the rank correlation methods previously discussed. The polychoric correlation of two ordinal variables is derived as follows. Assume that each of the ordinal variables are obtained by categorizing a continuous underlying variable. In our case the WB classification is obtained by categorizing GNI per capita and the other classifications are obtained by categorizing GDP per capita, both continuous variables. Then assume that these two underlying variables follow a bivariate normal distribution. In this paper the underlying bivariate distribution can possibly be identified as well-being or level of development. If both assumptions hold then the maximum likelihood estimate of the correlation is the polychoric correlation coefficient.

Polychoric correlation is a more appropriate method when the underlying variable that forms the basis for the ordinal variable can be viewed as continuous. The WB classification is based on GNI which is a continuous variable and the other classifications are based on GDP per capita also a continuous variable. Therefore the income classifications can be seen as a discretized variable, as it is a continuous variable that is transformed into a discrete variable. This to a certain extent seems to favor the use of polychoric correlation. However polychoric correlation assumes an underlying bivariate normal distribution. The initial thresholds were set in such a manner, a combination of wellbeing and economic indicators, that it is unclear what precisely the underlying variable is. If one thinks of well-being, which can be viewed as the underlying bivariate variable, as a variable with a normal distribution then indeed polychoric correlation coefficients will theoretically be more appropriate. The truth remains that the bivariate underlying distribution is unknown and even though it could be a normal distribution it is an assumption nonetheless. What is important to note is that GNI and GDP per capita have highly left skewed distributions. (see Figure 3.2) There is therefore no reason to assume that GNI and GDP share some form of bivariate normal distribution.

Figure 3.2: The Distribution of GNI and GDP per Capita from 1990 till 2010



Notes: The GNI per capita data is from the WB. The sample used in the figure are the 124 countries that are included in the analysis.

The distributional assumption of the polychoric correlation is of importance for the calculations. Ekström (2008) point out that the polychoric correlation coefficients are not statistically robust as changes in the distributional assumption can lead to large fluctuations in the calculated polychoric correlation coefficients. As can be seen in figure 3 both GNI and GDP per capita seem to follow a highly left skewed distribution. Therefore the assumption of an underlying bivariate normal distribution is probably violated.

3.4.4 Second Classification Method: Creating a New Classification

The second method involves creating a new classification based on the method proposed by Nielsen (2011). After having chosen the respective variable, GDP per capita in our case, the next step is to sort the data from lowest to highest in terms of this variable.[12] Then a Lorenz curve with equal weights per country is created.[13] The Lorenz curve is a function showing the cumulative outcome ($L(x)$), income in our case, of the lowest x percentile of the total population. Therefore both the domain and the range of the function is closed between zero and one. If income per capita would be equal for all countries then the Lorenz curve would be equal to the 45-degree line. The area between the 45-degree line and the Lorenz curve (i.e actual development) is the measure of the inequality of the distribution/development (Also referred to as the Gini-coefficient).

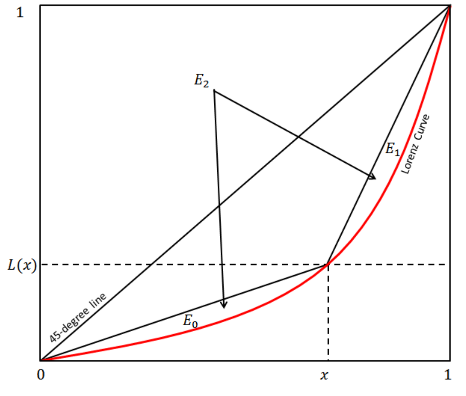
The method can most easily be understood when creating a dichotomous classification in which only 1 threshold has to be chosen. Figure 3 displays the intuition of the method. However keep in mind that, in line with the WB, this paper uses an extension of this method to create a classification

[12]However as a robustness check the author will also experiment with HDI and life expectancy classification.

[13]Although one could choose to weigh the Lorenz curve by population this was not done. As then China and India would dominate the results. Considering the fact that it is the development of countries that this paper is interested in equal weights make more sense.

which consist of four possible categories in which a country can be classified. The idea is that a certain threshold is chosen that splits the two categories, in the case of figure 3 this threshold is equal to L(x). Therefore all countries with an income above $L(x)$ are classified as developed and all countries with an income below or equal to $L(x)$ are classified as developing. Classifying countries as developing and developed implies that we assume that countries within each group are equal in terms of development. The difference between the real inequality of development (i.e the Lorenz curve) and the classification is given by the areas E_0 and E_1. Therefore shifting the value of the threshold will lead to different errors. The goal of the method is to search for the threshold that minimizes the total error, which are represented by the two areas (E_0 and E_1) which combined are called E_2.

Figure 3.3: A Dichotomous Development Classification



Algebraically minimizing the error means minimizing the following equation:

$$E_2 = \frac{1}{2}xL(x) + \frac{1}{2}(1-x)(1-L(x)) + (1-x)L(x) - \int_0^1 L(x)dx \tag{3.1}$$

Which when simplified boils down to:

$$E_2 = \frac{1}{2} + \frac{1}{2}(L(x) - x) - \int_0^1 L(x)dx \tag{3.2}$$

However in the paper the author searches for a classification with four categories and therefore three thresholds. This implies that the following error expression shall be minimized:

$$E_4 = \frac{1}{2}\sum_{i=1}^{2}(x_{i+1}L(x_i)) - \sum_{i=1}^{2}(x_i L(x_{i+1})) + \frac{1}{2}L(x_1) - \frac{1}{2}x_1 + \frac{1}{2} - \int_0^1 L(x)dx \tag{3.3}$$

The three thresholds of the classification that minimize the error between the classification and actual development for a respective year are the thresholds used. The problem with setting an absolute classification is that the classification of a certain reverence year has to be chosen. If the classification of 2010 would be chosen then more countries will be classified as low income and only a very few as high income. As the thresholds are higher in 2010 than in 1950 as average development is higher.[14] However choosing a year could be seen as a subjective choice. In order to avoid this the thresholds are

[14]The author has used 1950, 1980, 1990 and 2010 as reference years in order to display the sensitivity of the result with respect to the chosen classification. See robustness section for results.

calculated for every year from 1950 till 2010. Then the average of each threshold over time is taken as the value of the threshold for the final classification.

3.4.5 Duration of Middle–Income Spells

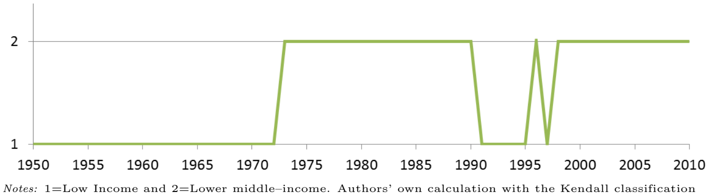
The corrections

After obtaining the thresholds for the classification middle–income spells can be calculated. When looking to quantify the definition of the MIT the durations of the middle–income spells is important. However the duration of these spells have to be corrected in order to obtain a working definition for the MIT. The following section discusses the four corrections made to respective middle–income spells.

The first correction involves the separation of censored and non-censored observations in the analysis. A distinction should be made between left censored observations, basically countries that are already lower (upper) middle–income countries at the start of the sample period, and countries that became lower (upper) middle–income countries in the sample period. Left censored observations will give a distorted picture of the true duration time of the transition. For example many European countries after the second world war still had many assets in place, e.g. an educated workforce and institutions. This made their left censored transitions to the high income status a lot easier. Therefore left censored observations will be separated from non-left censored observations for the rest of the analysis. A working definition of the trap should be based on non-left censored observations only.

The second correction involves temporary setbacks. A temporary setback is when a country that previously was a lower (upper) middle–income country falls back an income class for a relatively short period of time. Therefore temporary setback spells shorter than or equal to 5 years are dropped in order to measure the real transition time. A lower (upper) middle transition is defined as the point in time when a country that is previously defined as lower (upper) middle–income reaches upper-middle (high) income status. Lower (upper) middle transition time is therefore defined as the first point in time that a country becomes an lower (upper) middle–income country until the year in which the country attains upper-middle (high) income status irrespective of temporary setback spells shorter than 6 years. Therefore for Albania the period from 1972 till 2010, in which Albania experiences two temporary setbacks into lower income status after obtaining lower middle–income status, depending on the classification used, will be seen as one time period in which it fails to attain upper middle–income status. (see Figure 3.4)

Figure 3.4: Classification of Albania



Notes: 1=Low Income and 2=Lower middle–income. Authors' own calculation with the Kendall classification

The fact that in the process Albania has dropped back twice into lower income status for a brief period of time will be disregarded. As the goal is to find how long it takes for an middle–income country to transition to the next income class. Setbacks though important can be seen as a deterioration of the development process and a failure of the previously lower (upper) middle–income country to make a transition. Only if the country remains in the lower income spell for a longer period of time, 6 years or longer, will it be regarded as a permanent drop. The spell will then therefore end without an transition having taken place.

The third correction involves cleaning the duration data from quick fall backs in order to ensure the robustness of the transition. Contrary to temporary setbacks a fall back refers to the transition itself. If a lower (upper) middle–income country obtains upper-middle (high) income status and then falls back into the previous state within 2 years then this transition point will be disregarded. A second transition time period, if robust, instead of the first time period will be taken as the real transition point. The transition out of the MIT has to be robust. (i.e last longer than 2 years) This fall back mechanism is also applied to the start of the spell. If a country falls back within 2 years then the start is not robust and the next time period, if robust, will be taken. [15]

The fourth correction was the exclusion of transitions spells after the first transition has taken place. The question that arises is this: should the first and second or later transitions all be used to calculate the real transition time? Both positions could be taken depending on what one wants to measure. The goal of this paper is to find the time it takes for a country to escape the MIT. If every transition after the first transition would be seen as the start of a new spell then the transition time would be notably shorter. However the transition time would not be representative of the real time it took for a country to escape the MIT.

In order to understand this an distinction should be made between tangible and intangible assets. Tangible assets are physical and measurable objects: incomes, highways, ports and industrial plants. The tangible assets reflect the growth and the development of a country. However there are also intangible assets which are much harder to measure. These intangible assets can be reflected as the accumulation of embedded knowledge. For example knowledge embedded in people, institutions and processes and how they interact. An extreme event (e.g hyperinflation, war or post-communism transitions) destroy a lot of the tangible assets, as can be seen by the large drop in GDP per capita, and to a certain extent, sometimes a lot of, the intangible assets of the country. However a country which was previously an upper middle (high) income country and a through an extreme event was pushed back an income class will most likely have an easier time climbing back up an income status. This because often the accumulated intangible and to the lesser extent tangible assets are still in place. So too are extreme event induced second transitions often easier than the first transitions, this can also be seen by the notable shorter spells. For Hungary, Mexico and Syria the second transition spell were respectively 5, 9 and 9 years. While the first transition periods lasted at least 30 years.[16] Also the average GDP per capita was higher at the start of the second transition spell than at the start of the first transition spell. [17] Clearly indicating that the tangible and possibly intangible assets are higher at the start of the second spell. Thereby questioning the comparability of first and second or even later transitions. Therefore second and even later transitions are discarded from the analysis due to comparability issues.

Therefore the duration definition of the lower (upper) middle–income trap (LMIT (UMIT)) only takes the first robust time a non-left censored country achieves lower (upper) middle–income status until the time that it obtains a robust upper-middle (high) income status irrespective of temporary

[15]These corrections were applied because spells shorter than 3 years are indicating an extreme event. Kuwait 1990 is the only year in which Kuwait is estimated to be a lower middle–income country clearly indicating the effect of the first gulf war. Also Turkey in 1999-2000 and 2001-2003 fell back an income class due to hyperinflation and so did Thailand in 1998-2000 due to the Asian crises.

[16]For Syria data before 1950 is missing. However for Hungary and Mexico it took respectively 32 and 36 years to make the first transition. (Using the Kendall (WB benchmark) classification)

[17]At the start of the first transition spell the GDP per capita of Hungary, Mexico and Syria was respectively 2200, 2159 and 2409. However at the start of the second transition the GDP per capita of these countries was 5694, 6001 and 6143. (Using the Kendall (WB benchmark) classification)

set backs.

Mean or Median

The countries that transition into upper middle–income or high income status are the countries that are successful, basically the winners. It is similar to comparing all the students to the 5 smartest students of the school. This is of course not entirely fair. In the sample of 124 countries 75 countries were at least once classified as lower middle–income of these 75 countries 43 became an upper middle–income country at least once.

On the basis of 9 uncensored countries Abdon et al. (2012) takes the median amount of years that the countries took to escape from the lower middle–income group as a working definition for the LMIT. On the basis of these nine countries the median of 28 years is taken. However the average amount of time these countries spent in the lower middle–income group was 33 years. Considering the fact that there are only 9 countries it is understandable that the median is taken. As the weight of outliers will play an extra-large role when calculating the mean in such a small sample. However with the newly created thresholds the number of uncensored countries that escaped the middle–income trap increases in most cases. For example for the Kendall classification it increased to 35. Although after applying robustness, second transition and temporary setbacks controls only 20 observations remain. Nevertheless with more certainty the median and mean number of years that a country is in a middle–income segment before moving to up an income class can be calculated. The problem with taking the median is that there are more countries with short time periods that avoided the MIT than countries that took a relatively longer time. It would be fair to state that it is more likely that multiple short periods will be observed in the sample than multiple long periods. This because in the sample there is the possibility of being left or right censored or both. In our case the non-left censored sample contains more right censored spells longer (18 observations) than median time it took to escape than shorter (8 observations). Clearly indicating that if anything the median will be an underestimation of the definition.

The mean is sensitive to extreme spell lengths especially when the sample is small. Given the fact that longer successful transitions are less likely to be observed in our sample this aspect of the mean might actually come in handy. Our goal is to find a working definition for the LMIT and UMIT. The problem is that taking the median will most likely lead to an underestimation of the LMIT and UMIT. In my opinion taking the average number of years would be an better approach. As then countries that have remained longer in the middle–income group will no longer be under represented as they bare a greater weight. Giving a clearer and a more unbiased definition. All in all the difference between the median and the mean is often not large. However in this paper countries that stay longer in the middle–income spell than the mean amount of years that it took the countries in the sample to escape will be defined as stuck in the MIT.

3.5 Results

3.5.1 Testing the correlation methods

In order to test/compare the performance of the different methods of correlation used for the WB approximation classification a test is constructed. A small part of the WB classification sample, 10 years to be exact, will be used to find optimal thresholds with the respective method using different methods of correlation. These thresholds will then be used to classify the countries in the years for which there is a WB classification. Then the performance of these constructed classifications will be compared in and out of sample. Of course the methods that makes the least errors cannot be seen as superior in comparison to the other methods as the test is only an initial indication. However it will give an preliminary estimate of the bias and allows for comparison.

The test will be performed on two different samples. In the first case the first 10 years of the data, 1987 till 1996, will be used to find an optimal classification which will then be used to classify the countries in 1987 till 2010. In the second case the last 10 years of the sample, 2001 till 2010, will be used to find an optimal classification which will then be used to classify the countries form 1987 till 2010.

Table 3.2: Optimal Thresholds

	1987-1996			2001-2010		
	$\mathbf{T_1}$	$\mathbf{T_2}$	$\mathbf{T_3}$	$\mathbf{T_1}$	$\mathbf{T_2}$	$\mathbf{T_3}$
Spearman	$2,000	$6,200	$10,500	$2,750	$6,500	$11,500
Kendall	$2,000	$6,250	$10,500	$2,750	$6,500	$11,750
Spearman Weighted	$1,250	$6,250	$11,500	$1,500	$3,500	$9,250
Polychoric	$2,000	$7,000	$11,250	$2,250	$9,250	$13,750

Notes: The Benchmark is the WB Classification and steps of $250 are initially taken. However steps of $50 are taken around the optimal values of the thresholds.

The method used for the tests are more or less the same as previously explained.(See Method section) The ranges of the threshold are the same as previously discussed and interval steps of $250 (n) in between the ranges are taken. Then the different methods will calculate the correlation between the different classifications and the respective benchmarks. Depending on the method the classification with the highest correlation is chosen. The optimal classifications can be seen in Table 3.2.

Using the 1987-1996 sample leads to slightly lower optimal thresholds for most methods used than when using the 2001-2010 sample, with the notable exception of the $\mathbf{T_2}$ and $\mathbf{T_3}$ weighted Spearman thresholds.(see Table 3.2) The optimal thresholds of Spearman's ρ and Kendall' s τ are closely related. It is important to note that the tests do not provide a clear winner more a clear looser.(see Tables 3.3 and 3.4) Kendall's τ and Spearman's ρ perform better than the polychoric correlation in and out of sample. The rank correlation therefore performs better than the polychoric correlation. The Weighted Spearman classification often performs better in sample and out of sample than the other methods in terms of middle income country classification. This method however performs worse than the other methods with respect to other classification groups. There are therefore basically three winners in terms of minimal total error and those are the Kendall, Spearman and Weighted Spearman method. However in terms of minimal middle–income error the Weighted Spearman method performs by far the best. The test indicates that the Polychoric correlation performs the worst. The tests therefore hint on a preference for weighted Spearman classification in order to limit middle–income error and the Spearman and Kendall classification to limit total error in the sample.

The main critique on the Spearman' s ρ seems to be that it attains its boundary values faster when a continuous variable has been made discreet.(Ekström, 2010) However none of the variables attain the boundary values under the calculations made. There is however critique on the polychoric correlation coefficient. As pointed out by Ekström (2008) the polychoric correlation is sensitive to changes of its underlying distributional assumptions. There are goodness of fit tests that indicate if the two ordinal variables do indeed have an underlying bivariate normal distribution, these test are Pearsons χ^2 and the Likelihood ratio G^2 tests. When calculating the correlation coefficient for the thresholds of Abdon et al. (2012), for example, a Pearsons χ^2 value of 51.8 is obtained. The

Table 3.3: Percentage of Total (middle–income) Error When Using the 1987-1996 Sample

	In sample error				Out of sample error			
	Spearman	Kendall	Spearman Weighted	Polychoric	Spearman	Kendall	Spearman Weighted	Polychoric
-2	0.0 (0.0)	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.1 (0.0)
-1	11.5 (27.8)	11.7 (29.2)	9.8 (25.4)	14.0 (35.5)	11.3 (26.7)	11.7 (28.0)	10.0 (23.8)	13.8 (33.8)
0	83.2 (64.6)	83.3 (64.0)	81.5 (69.8)	82.3 (61.1)	81.2 (64.2)	81.2 (63.8)	77.1 (69.8)	80.5 (61.4)
1	5.4 (7.9)	4.9 (6.8)	8.6 (4.8)	3.6 (3.4)	7.6 (9.2)	7.1 (8.2)	12.9 (6.4)	5.7 (4.9)

Table 3.4: Percentage of Total (middle–income) Error When Using the 2001-2010 Sample

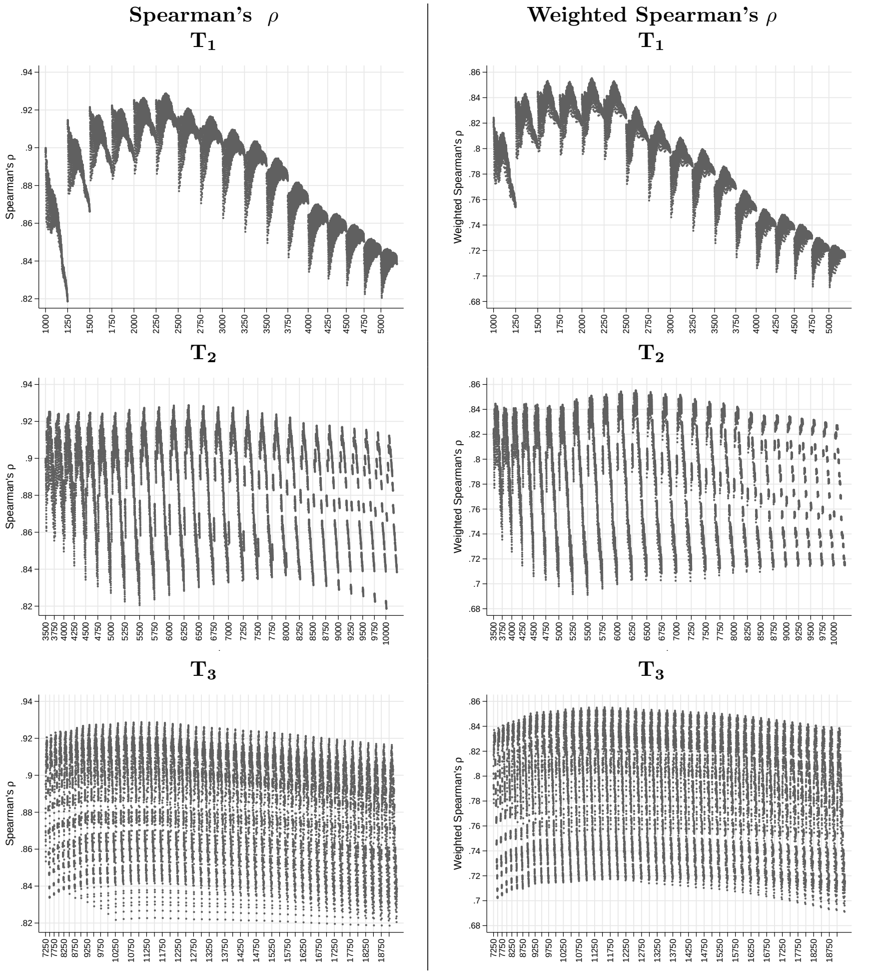
	In sample error				Out of sample error			
	Spearman	Kendall	Spearman Weighted	Polychoric	Spearman	Kendall	Spearman Weighted	Polychoric
-2	0.4 (2.1)	0.4 (2.1)	0 (0.0)	1.1 (0.0)	0.7 (1.8)	0.7 (1.8)	0 (0.0)	1.3 (0.0)
-1	16.2 (36.2)	16.3 (36.2)	4.5 (9.3)	21.5 (57.7)	17.7 (38.7)	18.0 (38.7)	5.5 (9.3)	20.4 (49.3)
0	79.5 (55.9)	79.5 (56.1)	73.9 (60.7)	74.8 (41.8)	79.6 (55.1)	79.3 (55.2)	75.5 (59.8)	76.3 (50.2)
1	3.9 (5.7)	3.8 (5.6)	21.6 (30.0)	2.7 (0.5)	2.0 (4.4)	2.0 (4.3)	19.1 (30.9)	2.0 (0.4)

corresponding p-value is a lot smaller than 0.01 suggesting a poor model fit and implausibility of the polychoric model assumptions. The optimal polychoric correlations classifications in this paper all have Pearsons χ^2 and the Likelihood ratio G^2 values that suggest a poor model fit and implausibility of the polychoric model assumptions. Which is of course troublesome and probably due to the highly left skewed distributions of GNI and GDP per capita.(see Figure 3.2) Also the range taken in Abdon et al. (2012) is smaller. When this range is taken polychoric correlations often obtain reasonable results. However when the range is increased, as in this paper, the polychoric optimal results are often obtained by making large errors for the smallest group (upper middle income countries) in order to predict the other groups correctly.

3.5.2 Optimization

In Figure 3.5 the optimization process for the correlation coefficients for the whole sample (1987-2010) when using Spearman and Weighted Spearman rank correlation are shown.(See Appendix 3.C.1 for Kendall and Polychoric correlation figures) The figures denoted $\mathbf{T_1}$ in Figure 3.5 show the corresponding correlation coefficients for different values of the first threshold ($\mathbf{T_1}$). The variation in the value of the correlation coefficient within a given value of the threshold $\mathbf{T_1}$ happens due to the changes in the other two thresholds ($\mathbf{T_2}$ and $\mathbf{T_3}$). The highest correlation coefficient corresponds to the optimal threshold. The results are more clear for the first threshold than the second and third threshold. Finding an optimal value for $\mathbf{T_2}$ and $\mathbf{T_3}$ is more difficult. This is especially true for $\mathbf{T_2}$ as it only shows slight differences between the highest correlation coefficient for each threshold value of $\mathbf{T_2}$.

Figure 3.5: Distribution of Correlation Coefficients across Threshold Values



Notes: The correlation coefficient for the whole sample (1987-2010) when using Spearman and Weighted Spearman rank correlation. The figures denoted $\mathbf{T_1}$ show the corresponding correlation for different values of the first threshold $\mathbf{T_1}$. The range of $\mathbf{T_1}$ is from \$1,000 to \$5,000, for $\mathbf{T_2}$ from \$3,500 to \$10,000 and for $\mathbf{T_3}$ from \$7,250 to \$19,000. The thresholds increase by increments of \$250. Due to the restriction that $\mathbf{T_1} < \mathbf{T_2} < \mathbf{T_3}$ certain combinations are excluded from the analysis.

3.5.3 Approaching the WB

Table 3.5 gives the values of the thresholds found that create an optimal classification according to the different methods used.

Table 3.5: Optimal Classification Thresholds

Classification	$\mathbf{T_1}$	$\mathbf{T_2}$	$\mathbf{T_3}$
Approaching the WB			
Spearman	\$2,200	\$6,300	\$11,150
Kendall	\$2,200	\$6,300	\$11,150
Weighted Spearman	\$2,050	\$6,300	\$11,550
Polychoric	\$2,300	\$9,650	\$11,650
New Classification			
New-Mean	\$1,781	\$4,782	\$11,594

Notes: The optimal values of the thresholds for the different methods. For **Approaching the WB** this implies the value of the threshold that lead to the highest correlation with the WB classification. The grid search starts with steps of \$250 but takes smaller steps of \$50 around the optimal threshold to refine the results. For the **New Classification** a new method based on Nielsen (2011) is applied.

Spearman classification are the thresholds for which the Spearman's rank correlation with the WB benchmark is the highest; Weighted Spearman classification are the thresholds for which the Weighted Spearman's rank correlation is the highest when middle–income countries receive a weight of 3; Kendall classification are the thresholds for which the Kendall's τ_B rank correlation with the WB benchmark is the highest; Polychoric classification are the thresholds for which the polychoric correlation with the WB benchmark is the highest; The New-mean classification are the thresholds obtained when taking the average value of the minimal error threshold over time when applying the new classification method. However only the methods that are trying to approach the WB are compared to the respective benchmark.

The thresholds of the Spearman and Kendall method are exactly the same for the WB benchmark. Due to the fact that the Spearman and Kendall classification are the same for the WB threshold they will be referred to as the Kendall classification. Thereby confirming the similarity between the two rank correlation methods. The percentage of errors made by the optimal classifications in comparison to the WB are shown in table 6. The percentage of errors made for middle–income countries are denoted in brackets. The error refers to the differences between the respective classification and its benchmark, the WB. When the Weighted Spearman classification classifies country j in 1987 as a low income country (coded 1) while the WB classifies this country j as an upper middle–income country (coded 3) in 1987 then the error made will be -2. This -2 indicates that the respective classification classifies the country j two income groups lower than the WB does. Therefore, for the Weighted Spearman classification, 12.3% of the classifications made from 1987-2010 are cases of countries classified in an income group that are one class lower than the corresponding WB classification. Most classification mistakes are made for the middle–income groups as the middle–income group is the most volatile.[18] Unfortunately this is exactly the income group which is researched in this paper.

Table 3.6 clearly shows that the errors made mostly concern middle–income countries, the group the analysis is indeed about. For example the Kendall classification predicts incorrectly the income classification of a upper or lower middle–income country 28.9 % of the time. Applying the weighted Spearman method leads to a slightly lower T_1 and higher T_3 threshold and therefore less middle–income misclassification. Even though this comes at the expense of misclassifying lower and upper

[18] Ranging from a minimum of 76.1 till a maximum of 84 percent of the errors made involved a misclassification of an lower or upper middle–income country for the different optimal classifications.

Table 3.6: Percentage of Total (Middle–Income) Error Made When Compared to the WB

	Spearman & Kendall	Weighted Spearman	Polychoric
-2	0.0 (0.0)	0.0 (0.0)	1.4 (0.1)
-1	12.9 (26.6)	12.3 (24.6)	19.1 (43.9)
0	82.3 (67.3)	82.4 (69.7)	77.0 (54.5)
1	4.7 (6.2)	5.2 (5.7)	2.6 (1.5)

Notes: This table display the errors made between the respective optimal classification and that of the WB between 1987–2010. The value -2 implies that the respective optimal classification classifies the country 2 categories lower than the WB does.

income countries the cost are not that high. The Weighted Spearman classification makes in total 0.1% more errors than the Spearman/Kendall classification but 2.4% less errors in classifying middle–income countries, a slight improvement. Of course the greater the weight given to middle–income countries the less errors will be made for lower and upper middle–income countries at the expense of the other income groups. In the process the Weighted Spearman leads to a improvement in the number of middle–income countries correctly classified.

What we see in Table 3.7 is the percentage of middle–income countries misclassified per income group for the different optimal classifications. A notable difference between the Polychoric thresholds and the other thresholds for classifications can be observed. The Polychoric classification makes very few over prediction at the expense of quite frequent under prediction of classification. For example the Kendall classification predict a larger upper middle–income group and a smaller lower middle–income group than the Polychoric thresholds. Polychoric thresholds incorrectly classify upper middle–income countries more often as lower middle–income countries than any other classification. The Kendall and Weighted Spearman make less mistakes in classifying middle–income countries. The weighted Spearman classification performs the best especially in relation to upper middle–income countries. However even the Weighted Spearman classification still misclassified upper middle–income countries 44.5% of the time. This volatile income group is very hard to classify correctly.

Table 3.7: Percentage of Total (Middle–Income) Error Made when Compared to the WB

	Kendall		Weighted Spearman		Polychoric	
	LM	UM	LM	UM	LM	UM
-2	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
-1	18.6%	40.5%	16.2%	40.5%	20.6%	85.0%
1	6.7%	5.2%	6.7%	4.0%	0.0%	4.1%

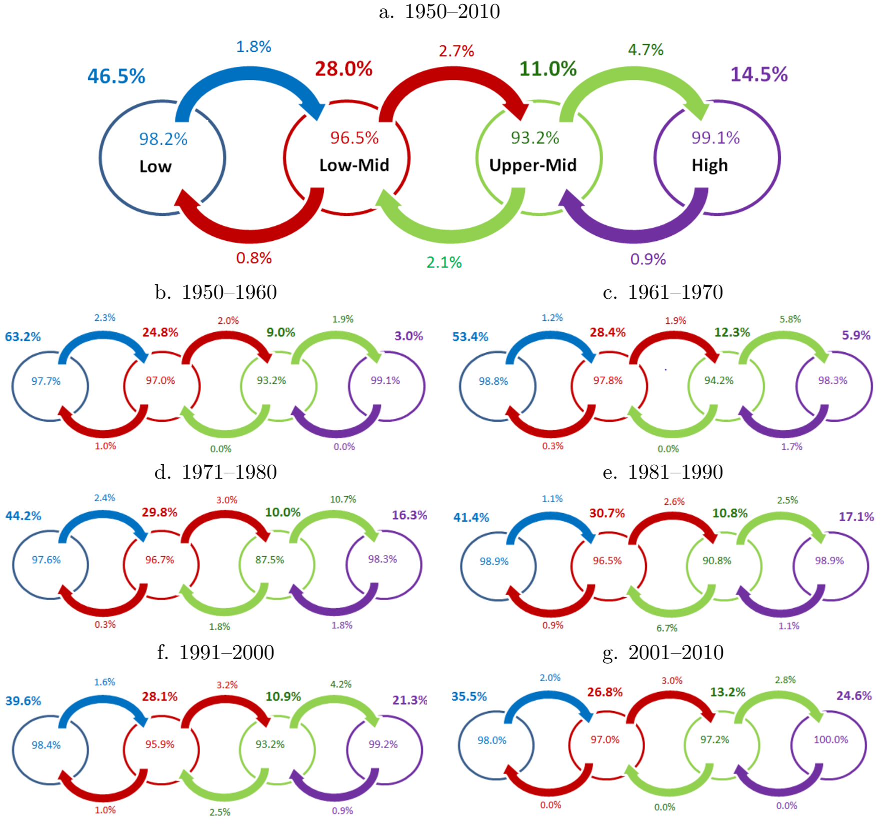
Notes: This table displays the errors made between the respective optimal classification and that of the WB for middle income countries between 1987–2010. The value -1 implies that the respective optimal classification classifies the a middle–income country 1 category lower than the WB does.

The main problem of the Polychoric classification is the misclassification of middle–income countries especially the upper middle–income group. The optimal Polychoric thresholds have the tendency to minimize the error in the three largest WB groups at the expense of increasing error in the smallest group (upper middle income countries). In only 10.8% of the cases does this classification identify upper-middle income countries correctly. The other classifications constructed in this paper perform better.

3.5.4 Transition diagrams

Transition diagrams of Figure 3.6 demonstrate how resilient over time countries are to income classification change. Most of the countries stay in the same income classification every year. The transition probability is the probability that a country, given that it is located in a certain income group, moves to the next income group the following year. Therefore a lower income country, which makes up 46.5% of the sample during the whole time period, has a probability of 1.8% that it will move up to the lower middle–income class the next year. Therefore in 98.2% of the cases will a low income country remain a low income country the following year. Which to a certain extent is logical as income classification change often takes a long period of time. Over time only a relatively small portion of countries change income group.

Figure 3.6: Transition Diagrams for the Kendall Classification



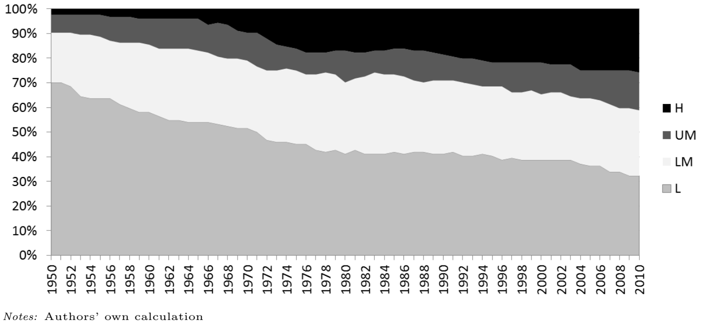
Notes: The figures above displays the transition probabilities in and out of the Kendall income classification every year. Figure 3.6a shows the transition probabilities over the whole sample period. The number in bold outside the circle indicates the percentage of countries that belong to the respective group in a certain year. Therefore in the sample used 46.5% of the countries are classified low income. The upper arrows out of the circle denotes the probability of moving up an income class in a certain year and the lower arrows denotes the probability of moving down an income class. The percentage within the circle denotes the percentage of countries that remain within the same income classification when going from one year to the next.

The Kendall/Spearman classification from 1950 till 2010 for the sampled countries shows an upward transition probability of 1.8, 2.7 and 4.7 percent while the backward transition probabilities are respectively 0.8, 2.1 and 0.9 percent. Over time the upper income classification is the most stable followed by the lower income classification. Around 99.1% (98.2%) of the countries classified as high (low) income countries remained a high (low) income country the following year. The middle–income countries have the highest transition probabilities. This is of course partly due to the definition of the income classification. For example a lower middle–income country can drop an income level and become a lower income country or rise an income level and become a upper middle–income country.

Therefore unlike the high and low classification the middle–income class has both an upper and a lower bound. From 1950 till 2010 46.5% of the countries are classified as low income while only 11% are classified as upper middle–income. Over time more countries have been classified as lower middle, upper middle and high income while the number of low income countries has declined.

The backward flows, flows into a lower income class, are always lower than the upward flows, flows into a higher income class. This with the notable exception of the period 1981 till 1990 when more countries move to a lower income classification than a higher. Therefore over time there has been a trend towards higher incomes. Between 1961 till 1980 the highest transition probability of countries into the high income status is observed. Also from 1991 till 2000 a relatively large percentage of the middle–income countries also joined the high income group. The number of countries classified as upper income countries increases over time. From an estimated 3% in 1950-1960 to an estimated 24.6% in 2001-2010. Also the number of low income countries decreases over time. Therefore Figure 3.7 and the transition diagrams (Figure 3.6) can potentially be seen as support that the middle–income country trap, when put into an 'historical' perspective, does not exist. As countries do go from upper middle–income to high income and from lower middle–income to upper middle–income. However the fallacy of this argument is that the fact that some countries successfully avoid a trap does not imply that there is no trap. Over time most countries have never been able to break into higher income group and some have taken a very long time to do so. Therefore the fact that there is movement only implies that countries can achieve high income status.

Figure 3.7: The Change of the Income Classification Structure



Notes: Authors' own calculation

Table 3.8 shows the mean and standard deviation of the different income groups (defined by the Kendall thresholds) over time. The world income has risen as also the dispersion (inequality) over time. In 1970 Lower, Lower-middle and upper-middle–income countries attain their highest mean income. This corresponds with the high transition that follows between 1970 and 1980 out of these groups. In 1950, basically, most countries were poor and only a few rich, over time this has changed. For all income classifications the mean income is higher in 2010 than in 1950 with the notable exception of the highest income group. However the mean value and standard deviation has remained relatively stable for the first three income groups when comparing the years after 1970.

Table 3.8: World Income Development over Time

	Mean* *(st. deviation)*						
	1950	1960	1970	1980	1990	2000	2010
Lower	**1,017**	**1,022**	**1,147**	**1,052**	**1,043**	**1,006**	**1,060**
	(538)	*(461)*	*(504)*	*(437)*	*(454)*	*(437)*	*(417)*
Lower Middle	**3,450**	**3,363**	**3,947**	**3,762**	**3,778**	**3,669**	**3,777**
	(1,218)	*(1,076)*	*(1,131)*	*(1,113)*	*(1,184)*	*(1,022)*	*(1,007)*
Upper Middle	**7,766**	**8,228**	**9,295**	**8,110**	**7,968**	**8,161**	**8,398**
	(1,011)	*(980)*	*(1,426)*	*(1,426)*	*(1,594)*	*(1,366)*	*(1,380)*
Upper	**25,021**	**21,568**	**17,008**	**15,850**	**16,744**	**19,704**	**21,331**
	(8,023)	*(9,585)*	*(7,776)*	*(4,445)*	*(2,748)*	*(3,867)*	*(5,337)*
Total	**2,578**	**3,248**	**4,370**	**5,255**	**5,497**	**6,709**	**8,139**
	(4211)	*(4,763)*	*(5,467)*	*(5,671)*	*(5,959)*	*(7,500)*	*(8,629)*

Notes: Authors' own calculation using the classification obtained by the Kendall thresholds.

3.5.5 The Lower Middle–Income Trap (LMIT)

The estimated average transition time for countries to move past the lower income segment is 28 years using the Kendall classification; countries that have a lower middle–income spell that are longer than 28 years will be defined as stuck in the Lower middle–income Trap (LMIT). The robustness of this definition is confirmed when calculating the same definition for the different methods. Table 3.9 shows that the average transition time estimates for the different classifications do not differ greatly.

Countries that have been a lower income country for longer than respective estimated transition time will be dubbed as stuck in the LMIT. This estimated transition time, of course, depends on the classification used and cannot be applied without using the respective classification. Therefore countries that have been classified lower middle–income according to the weighted spearman classification that have a lower middle–income spell that last longer than 28 years will be dubbed as stuck in the LMIT. However countries that have been classified lower middle according to the New-mean classification only have to have a lower middle–income spell for a period longer than 22 years before it is classified as stuck. The definition therefore depends on the respective classification and the corresponding estimated transition time.

Table 3.9: LMIT definition obtained using the Kendall classification

	Spell 1*			Spell 2**			Spell 3***		
Country	Mean	Med.	N	Mean	Med.	N	Mean	Med.	N
Spearman/ Kendall	17.8	15.0	35	25.2	18.0	23	28.4	19.0	19
Spearman Weighted	17.3	15.0	31	25.5	18.0	20	28.5	20.0	17
New-Mean	15.5	14.5	32	19.3	18.0	20	22.0	20.0	19
Total	**16.9**	**14.8**	**33**	**23.3**	**18.0**	**21**	**26.3**	**19.7**	**18**

Notes: * Spell duration of non-censored observations for the classification; ** Same as above however spell durations are corrected for robustness, temporary setbacks and fall backs; *** Same as spell sample 2 however now also corrected for second transition spells

When looking at the countries that have been classified as stuck in the lower middle–income trap differences can be observed for the different thresholds. The New-mean classification classify the greatest amount of countries as stuck in the LMIT. This classification indicate that 38 countries have been or are stuck in the LMIT. This in contrast to the Kendall classification that only indicate that 33 countries have been or are stuck in the LMIT.

Table 3.10 displays the countries classified as stuck in the LMIT using the mean transition definition per classification as previously explained. Therefore for the Kendall classification countries that have lower middle–income spells, after the necessary corrections, longer than 28 years are dubbed stuck in the LMIT. The labels in Tables 3.10 and 3.12 denote the extent or severity of entrapment. Label A denotes that a country has been stuck in the LMIT for a period that is longer that the estimated mean transition time and less than or equal to the estimated mean transition time plus 25%. Label B denotes that the country has been in the lower middle–income spell that is longer than the mean transition time plus 25%, but less than or equal to the mean transition time plus 50%. Those with label C have spells longer than the mean transition time plus 50%. The label therefore indicates the degree of certainty with which a country can be classified as being trapped; C labeled countries can be said to be trapped with a greater amount of certainty than A labeled countries. Therefore countries labeled A are possibly stuck, countries labeled B are probably stuck and countries labeled C are definitely stuck. In addition, countries of which the spell was right censored in 2010 are denoted by a star (*). Albania is therefore still stuck in the LMIT in 2010, while Chile was probably trapped but already escaped.

Table 3.10: Countries Classified as Stuck in the LMIT

	Spearman/ Kendall	**Spearman Weighted**	**New-mean**
Albania	B*	B*	C*
Algeria	B*	B*	C*
Bolivia	-	B*	C*
Botswana	-	-	B*
Brazil	C	C	A*
Bulgaria	A	A	-
Chile	B	B	-
Colombia	C	C	C
Congo, Rep. of	-	-	C*
Costa Rica	C	C	B
Dominican Republic	A	A*	C*
Ecuador	C*	C*	C*
Egypt	-	-	B*
El Salvador	-	C*	C*
Guatemala	C	C*	C*
Honduras	-	-	C*
Hungary	A	A	-
Indonesia	-	-	B*
Iran	C	C	A
Iraq	B	B	-
Jamaica	C*	C*	C*
Jordan	C*	C*	C
Lebanon	C*	C*	C*
Libya	A*	A	A*
Malaysia	-	-	A
Mauritius	B	B	C

Continued on next page

	Spearman/ Kendall	**Spearman Weighted**	**New-mean**
Mexico	A	A	A
Morocco	A*	A*	C*
Namibia	C*	C*	C*
Nicaragua	-	-	C
Panama	C*	C	B
Paraguay	A*	B*	C*
Peru	C*	C*	C
Philippines	-	A*	C*
Poland	C	C	-
Romania	C*	C*	C*
South Africa	C*	C*	C*
Sri Lanka	-	-	B
Swaziland	B*	B*	C*
Syria	A	A	A
Tunisia	B*	B*	B
Turkey	C	C	C
Uruguay	B	B	-
Yemen	A*	A*	C*
Total	**33**	**36**	**38**

If the average of the mean transitions time of the different classifications is taken then countries with lower middle–income spells longer than 27 years will be classified as stuck in the LMIT. However as stated before the definition is classification dependent and cannot be randomly applied. Nevertheless the average of the mean transition time can be used as a rule of thumb as most transition times do not deviate greatly.

Using the Kendall classification around 39% of the lower middle–income countries are or have been stuck in the LMIT. When taking the median definition of the LMIT (spells longer than 19 years) 49% of the lower middle–income countries are of have been stuck in the LMIT. It is interesting to note that the different optimal threshold do not lead to very different results. This is partly due to the fact that the optimal thresholds found are relatively close to each other. The results obtained by the different classifications are often very similar. Paraguay for example is denoted as stuck by all classifications and their respective transition time. However the classifications differ in the degree of certainty with which can be said that Paraguay is stuck. The New-mean indicates that Paraguay is definitely stuck (Labeled C) while Kendall indicates that Paraguay is possibly stuck. (Labelled A) Albania, Algeria, Ecuador, Guatemala, Jamaica, Jordan, Lebanon, Namibia, Peru, Romania, South Africa, Swaziland and Tunisia are indicated by all classifications as currently probably (Labeled B) or definitely (Labeled C) stuck. With a great amount of certainty these countries can be classified as currently stuck in the LMIT. With a little less certainty Yemen, Paraguay, Philippines, Morocco and Bolivia can be added to this list.

3.5.6 The Upper middle–income Trap (UMIT)

For the UMIT the same approach is used. All methods perform better than the Abdon et al. (2012) classification in predicting upper middle–income countries correctly. Nonetheless there are still quite frequent mistakes made by the respective classifications. Using Kendall classification 45% of the upper middle–income countries are misclassified when compared to the WB. The weighted Spearman methods perform the best in classifying upper middle–income countries correctly. But even the Weighted Spearman classification predicts upper middle–income countries incorrectly 44.5% of the time. Therefore the UMIT results should be interpreted with more caution. The New-mean classification method does not have this problem as it has no benchmark. It can be rather strongly argued that this classification does a better job of grasping the development differences between countries than the WB, as it is based on actual development inequality. Therefore the New-mean result should bear greater weight in the UMIT analysis. The sample of countries that escaped the UMIT is highly biased as it is not a so called representative sample of the world. For the Kendall sample it consist mostly of European (12) and Asian countries (5). There are 2 Middle Eastern, 2 Latin American and only 1 African (Mauritius) country. Therefore escaping the upper middle–income country trap (UMIT) might also have a geographical component. Nevertheless escaping the UMIT requires less time than escaping the LMIT. Using the Kendall classification countries that had upper middle–income spells that lasted longer than 16 years, the estimated transition time, are stuck in the UMIT.

Table 3.11: The Estimated Transition Times of the Upper Middle–Income Class

	Spell 1*			Spell 2**			Spell 3***		
Country	Mean	Med.	N	Mean	Med.	N	Mean	Med.	N
Spearman/ Kendall	13.0	13.0	29	15.3	14.0	25	15.7	14.0	22
Spearman Weighted	14.4	15.0	28	16.4	16.0	25	16.8	16.0	22
New-Mean	20.0	19.0	23	19.4	19.5	20	20.5	20.0	17
Total	**15,8**	**15,7**	**27**	**17,4**	**16,5**	**23**	**17,7**	**16,7**	**17**

Notes: * Spell duration of non-censored observations for the Kendall classification; ** Same as above however spell durations are corrected for robustness, temporary setbacks and fall backs; *** Same as spell sample 2 however now also corrected for second transition spells

According to the Kendall classification an upper middle–income country with GDP per capita of \$6301 has to less than double its income to attain high income status (\$11151). While a lower middle–income country with GDP per capita of \$2201 has to nearly triple its income in order to attain upper middle–income status. Therefore it is not so strange that the second transition takes more time. It however does take more than half of the average time it takes for countries to enter upper middle–income status while the income does not even double. Indicating that it becomes increasingly difficult to increase the income of the country as the GDP per capita rises. This can also be seen in the number of countries that have successfully transitioned into the high income group. The transition diagrams already displayed that there is a low probability for a country to escape to the lower or upper middle–income class. These transition probabilities remain low over time for different income classes. Evidently there is some form of rat race to the top in which only a few reach the highest goal, high income. The table 12 lists the countries that are classified as stuck in the UMIT according to the mean transition definition obtained per classification. As can be seen in the table below most thresholds classify similar countries as stuck in the UMIT. The classifications raise questions. For example why should Norway and Canada be on the list of countries that were previously stuck? The first comment that should be made is that these countries did take a longer time to transition past the upper middle–income segment. Therefore they are denoted as possibly previously stuck in the UMIT. The second comment that should be made is that these countries only took a slightly longer time than the mean time it took to escape. (therefore labeled A) The countries denoted by label C are the more clear UMIT examples. These countries are Argentina, Greece, Oman, Saudi Arabia and Venezuela. Although the New-mean classification also denotes Bulgaria, Hungary, Mexico, Poland

and Syria as definitely stuck in the UMIT.

Table 3.12: Countries Classified as Stuck in the UMIT

	Spearman/ Kendall	**Spearman Weighted**	**New-mean**
Argentina	C*	C*	C*
Australia	A	A	-
Belgium	-	-	A
Brazil	-	-	A*
Bulgaria	-	-	C*
Canada	A	A	-
Chile	-	-	B
Denmark	-	A	-
Finland	-	-	A
France	-	-	A
Gabon	-	-	A
Greece	C	C	C
Hungary	-	-	C*
Ireland	A	A	B
Israel	-	-	A
Italy	-	-	A
Malaysia	-	-	A*
Mexico	A*	A*	C*
New Zealand	A	A	A
Norway	A	A	A
Oman	C*	B*	B*
Poland	-	-	C*
Portugal	B	B	B
Qatar	A	A	-
Saudi Arabia	C*	C*	B*
Spain	A	A	A
Syria	A*	-	C*
Turkey	-	-	A*
UK	B	B	A
Uruguay	B*	B*	C*
Venezuela	C*	C*	C*
Total	**17**	**17**	**27**

3.6 Robustness

3.6.1 Other Possible Development Classifications

The method applied in this paper can also be applied to different samples, data and indicators of development. Especially when referring to the new classification method. The results obtained when applying the new classification method to different indicators will of course not lead to identical results. One must realize that the middle–income trap is named the middle–income trap because it refers to a phenomenon observed in income differences. In the following section the author will give a demonstration of classifications using other indicators.

The alternative indicators of development which will be used are HDI and life expectancy. For this paper the author has constructed an HDI index for 1960 till 2010. The HDI data is available from 1980 till 2012. However the original HDI series are not long enough for the duration approach adopted by the paper. Therefore the author creates an HDI index. The author replaced GNI per capita with Maddison's GDP per capita and education data with the Barro and Lee (2013) estimates of adult attained female education. Due to the fact the Barro and Lee (2013) estimates are only made for every 5 years the data points in between are estimated through interpolation. Life expectancy remains the same variable as the UNDP uses and is obtained from the WB. This allows the author to create an HDI index from 1960 till 2010.[19] The author then creates an new classification by taking the same steps as taken when creating a new classification for the income data. The classifications depends on the distribution of the inequality of the respective indicator (i.e the shape of the Lorenz curve).

Therefore there is no guarantee that when taking HDI or life expectancy instead of income that the groups represent a similar attainments of development. The classification do indeed differ greatly. The HDI and life expectancy classifications have a smaller low class and a lager high class then when making a classification based on Income alone. Using the same indicator over time ensures that, to a certain extent, the classifications are comparable over time as the shape of the distribution is often very constant over time. However comparing the classification obtained by using different indicators is more difficult. Figure 3.8 displays the differences in classification for the respective indicators. In Figure 3.8 HDI-1960 shows the percentage of countries classified per category in 1960 when the new-mean classification method is applied to the HDI data. This implies that the classification thresholds are the average of all the minimizing error thresholds for the different years. The same is done for the indicator life expectancy (Life) and income per capita. The HDI and Life expectancy indicators show a greater advancement in development over time as more countries are classified in the highest category in 2010. Whereas the advancement in terms of income classification is more conservative.

The HDI and life expectancy indicator seems to make an extra distinction in the lowest income group and combine the upper middle income group with the high income group when compared to the classification based on income alone. This to a certain extent is logical as income can increase without limits while life expectancy and education are bound. If you have educated 100% of the adult population than you cannot educate more individuals. Therefore the respective high class is attained faster. Which strengthens the argument that income is possibly the single best indicator of development especially when referring to development classification.

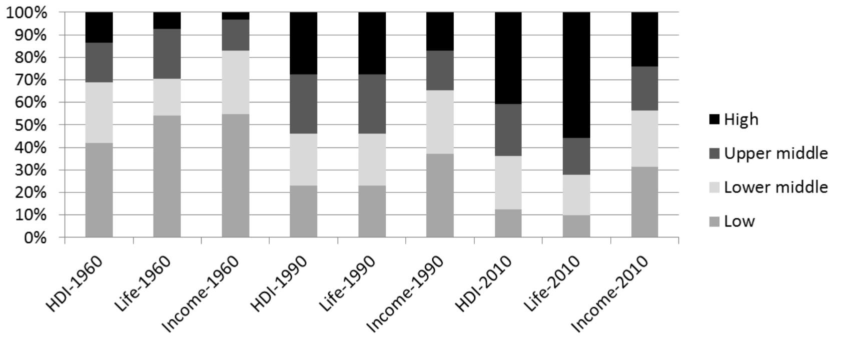
The respective categories obtained through the new classification method with different develop-

[19] The sample of countries for which the HDI index could be constructed is 113 of the 124 countries in the original sample. For the life expectancy classification only Taiwan is missing.

ment indicators, though optimal, do not correspond to the classifications obtained when classifying income. However one must remember that the new classification method depends on the inequality observed in terms of development. The Lorenz curves obtained when using HDI and life expectancy are flatter than that of income. This explains the difference obtained in classifications.

Using the HDI classification to identify the countries that are stuck in a Lower Middle trap or Upper Middle trap will lead to notable different results then when using an classification based on income alone. This because the respective groups differ. For example the high group of HDI is larger than that of income. The upper middle trap results of HDI identify similar countries as the lower middle–income trap results of income. However the lower middle trap results identify countries that the income classification still identifies as low income countries. The results of HDI are therefore incompatible with the income results.

Figure 3.8: New-mean classifications for different indicator



3.6.2 PWT Data Alternative

In order to test the robustness of the results obtained with the Maddison data the method of approaching the WB is also be applied to the PWT 7.1 data. The series are however often notably shorter for many countries. There are 995 observations missing between 1950-2010 which are available for the Maddison GDP data. The smaller samples of available data lead to slightly different estimated transition times. The estimated transition time for the lower middle–income segment ranges from 31-25 years according to the different rank classifications (i.e Spearman, Weighted Spearman and Kendall) and an estimated 24-22 years for the upper middle–income segment. These estimated transition times are often higher than that of the Maddison data, especially when referring to the upper middle–income segment.

Also the new classification method is applied to the PWT data. However as the sample of countries changes not the average of the average transition time is taken as that would increase the importance of countries with more data points in the calculation. Therefore the year 1990 is taken to calculate a respective absolute new classification. Then given the classification the transition time can be calculated and used to denote countries as stuck.

Many of the countries classified as stuck when using the Maddison data are also classified as stuck when using the PWT. Of the countries indicated as stuck or previously in the LMIT by the different methods using the PWT data 74% were also denoted as stuck or previously stuck when using Maddison data. Of the countries indicated as stuck or previously in the UMIT by the different methods using the PWT data 65% were also denoted as stuck or previously stuck when using Maddison data. There is therefore a high correspondence between the two data sets. Although there are differences which can mostly be attributed to the missing data. Nevertheless this test confirms the robustness of the results and the methods used in this paper.

3.7 Conclusions

Classifying countries on the basis of development is challenging. All classifications had difficulty classifying middle–income countries. It seems that this income group is hard to grasp and a certain degree of ambiguity surrounds it. This is not so strange, as it is often not difficult to distinguish between the rich and the poor, the two extremes, however categorizing the income group in the middle often requires more effort. This paper proposes two methods of classifying countries over time. The first method is that of approaching an appropriate benchmark, in our case the WB. The second method involves using the inequality observed between countries for a respective development indicator to construct an absolute classification. Both methods have their strength and weaknesses.

The first approach allows a classification to approach that of the respective benchmark which is probably well know and frequently used. Therefore making the results comparable. However the first method can, at most, only be as good as the respective benchmark it seeks to approach. The classifications of large institution, although frequently used, have certain aspects of subjectivity surrounding their choices of thresholds. Which are often left unexplained and unsubstantiated.

The new classification method creates a completely new classification based on inequality differences observed in a certain development indicator. Therefore the thresholds are not just set at a certain level for some subjective reason but are determined by the distribution which the thresholds try to approach. However with this method there is no guarantee that the obtained classification is the same as that of the WB or another benchmark. The classification groups might therefore not have a one to one correspondence to other classifications. Nevertheless in terms of a classification based on real differences of development the new classification method should be preferred.

This paper shows that escaping the middle–income group is difficult. Few countries have been able to make this transition. The common denominator behind the factors that a country needs to accumulate in order to escape the middle–income segment is time. This paper uses time to create an historical benchmark to which countries can be compared and classified as stuck in the MIT. Using absolute classifications obtained through various methods this paper classifies countries into income groups. Irrespective of the method used similar time definitions for the MIT are obtained. The average lower middle transition time is estimated at 22-28 years depending on the respective classification. While the average upper middle transition time is an estimated 16-22 years depending on the respective classification. The highest lower middle transition time corresponds to the lowest upper middle transition time and vice versa. Therefore the lowest average estimated transition time needed to move past the whole middle–income segment is 43 years. While the estimated highest total transition time is an estimated 44 years. This implies that the different methods lead to a similar estimated transition time of around 43-44 years. Countries that have middle–income spells that last longer than this estimated time can be classified as stuck in the middle–income trap.

Therefore based on the methods discussed it is possible to identify the countries that are currently trapped. Countries that are identified by at least two different classifications as currently trapped will be denoted as trapped. Based on this definition the following countries will be classified as currently stuck in the LMIT: Albania, Algeria, Ecuador, Guatemala, Jamaica, Jordan, Lebanon, Namibia, Peru, Romania, South Africa, Swaziland and Tunisia. All these countries are indicated by all classifications as currently probably (Labeled B) or definitely (Labeled C) stuck in the LMIT. Therefore with a great amount of certainty these countries can be classified as currently stuck in the LMIT. With a little less certainty Yemen, Paraguay, Philippines, Morocco and Bolivia can be added to this list. Countries in the UMIT are the following: Argentina, Oman, Saudi Arabia, Uruguay, Venezuela and Mexico. With less certainty Syria and Hungary can be added to this list.

3.A Example of the LMIT Definition

Table 3.A.1: LMIT definition obtained using the Kendall classification

	Spell 1*			Spell 2**			Spell 3***		
Country	Mean	Med.	N	Mean	Med.	N	Mean	Med.	N
Brazil	49	49	1	49	49	1	49	49	1
Bulgaria	10.5	8	4	22	22	2	29	29	1
China	14	14	1	14	14	1	14	14	1
Colombia	56	56	1	56	56	1	56	56	1
Costa Rica	50	50	1	50	50	1	50	50	1
Greece	18	18	1	18	18	1	18	18	1
Hungary	7	7	1	7	7	1	-	-	-
Iran	21.5	21.5	2	45	45	1	45	45	1
Iraq	25	25	1	-	-	-	-	-	-
Japan	14	14	1	14	14	1	14	14	1
Kuwait	1	1	1	-	-	-	-	-	-
Libya	3.5	3.5	2	5	5	1	5	5	1
Malaysia	22	22	1	22	22	1	22	22	1
Mexico	5.5	5.5	2	9	9	1	-	-	-
Oman	17	17	1	17	17	1	17	17	1
Panama	50	50	1	50	50	1	50	50	1
Portugal	19	19	1	19	19	1	19	19	1
South Korea	16	16	1	16	16	1	16	16	1
Singapore	15	15	1	-	-	-	-	-	-
Spain	19	19	1	19	19	1	19	19	1
Syria	9	9	1	9	9	1	-	-	-
Taiwan	15	15	1	15	15	1	15	15	1
Thailand	10	10	2	18	18	1	18	18	1
Tunisia	38	38	1	38	38	1	38	38	1
Turkey	14	2	3	45	45	1	45	45	1
Uruguay	5	5	1	-	-	-	-	-	-
Total	17.8	15	35	25.2	18	23	28.4	19	19

Notes: * Spell duration of non-censored observations for the Kendall classification; ** Same as above however spell durations are corrected for robustness, temporary setbacks and fall backs; *** Same as spell sample 2 however now also corrected for second transition spells

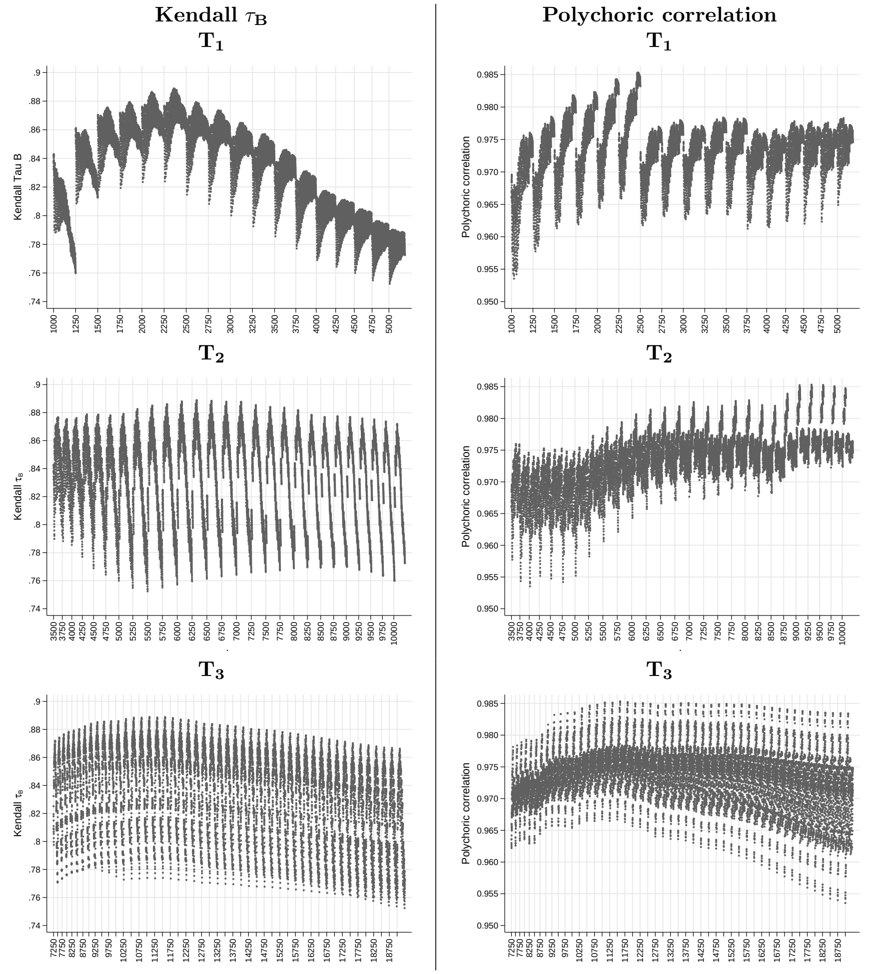
3.B List of Countries that are Included in the Analysis

Afghanistan, Albania, Algeria, Angola, Argentina, Australia, Austria, Bangladesh, Belgium, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Congo, Dem. Rep, Congo, Rep. of, Costa Rica, Côte d'Ivoire, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Finland, France, Gabon, Gambia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea Bissau, Hati, Honduras, Hong Kong, Hungary, India, Indonesia (including Timor until 1999), Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Kuwait, Laos, Lebanon, Lesotho, Liberia, Libya, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Rep. of Korea, Romania, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, Syria, Taiwan, Tanzania, Thailand, Togo, Tunisia, Turkey, Uganda, United

Arab Emirates, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Yemen, Zambia and Zimbabwe.

3.C Distribution of Correlation Coefficients Across Threshold Values

Figure 3.C.1: Distribution of Correlation Coefficient Across Threshold Values



Notes: The correlation coefficient for the whole sample (1987-2010) when using Kendall τ **b** and Polychoric correlation. The figures denoted $\mathbf{T_1}$ show the corresponding correlation for different values of the first threshold $\mathbf{T_1}$. The thresholds increase by increments of \$250. The variation within the value of a certain threshold happens due to the changes in the other two thresholds ($\mathbf{T_2}$ and $\mathbf{T_3}$). The highest correlation coefficient corresponds to the threshold chosen.

Chapter 4

Firm Export Survival: Micro-Evidence from the Philippines

Joint work with Jean-Marie Viaene and Edylinda Annette Pelkmans-Balaoing

4.1 Introduction

Export or perish is a public utterance commonly repeated by influential leaders in active support of a country's exports. For firms, it is important to look for more foreign markets as trade allows them to spread R&D expenditure across markets. For policymakers of developing countries, a presence in foreign markets contributes to macroeconomic stability when negative shocks hit the domestic economy. Besides, trade contributes to increased production efficiency through reallocations across firms and/or sectors. However, firm data reveal a different picture in that low survival rates are observed in terms of both exported products and destinations. Given this, the following questions are often raised: (i) Which are the factors that explain a firm's export dynamics in the global economy? (ii) Particularly what factors keep a firm exporting once it starts to export? (iii) What determinants explain export spells, exit and re-entrance of exporters? The objective of this paper is to address these issues empirically and see how governments of developing countries can design policies to promote firms' export success.

To that end, we use a rich and new firm-level database for the Philippines which has been collected by the Philippine Statistical Authority (PSA) over the years 1996-2007. The data set matches the firm-coded trade transactions data (7 digits) of Philippine manufacturing firms with their corresponding firm survey data that are available for that period. In total, the sample includes 5,472 firm names, 5,048 different products and 250 destinations to which firms export. Using discrete survival analysis, we empirically analyse firms' exporting spells and explore the determinants of Philippine exporting firms' survival abroad, including proxies for product quality. The case of the Philippines is important since the country is classified as a lower-middle income economy in World Bank's 2015 country groups while other countries in the region like South Korea but also China, Malaysia and Thailand moved to a higher country grouping years ago. As the Philippines have been in this position for 5 decades, the questions of this paper assume considerable importance.

Discrete survival analysis links the duration of export spells to a number of explanatory variables. The estimation techniques have been developed and used in many areas, particularly health and labor economics (e.g., Kelly and Lim, 2000; van den Berg, 2001; Skrondal and Rabe-Hesketh, 2012). In the trade literature, a first application of these techniques is contained in Besedes and Prusa (2006) who find that the duration of bilateral trade relationships is generally short-lived due to various reasons, in particular destination market characteristics. Other applications are found in Görg et al. (2007), Nitsch (2009), Vandenbussche and Zanardi (2008), Fugazza and Molina (2009) and Brenton et al. (2009). Most trade literature has used Cox models and discrete-time equivalent Cox models, namely the complementary log-log model to analyze these export spells. In reaction to Besedes and Prusa (2006), Hess and Persson (2012) formulate a number of objections regarding the application of this method to trade data. For example, given that most samples consists of yearly observations, there is interval censoring which requires a discrete survival approach. Finally, the estimation technique should include random effects to correct for unobserved heterogeneity of exporting firms. Our estimation techniques encompass these methodological changes.

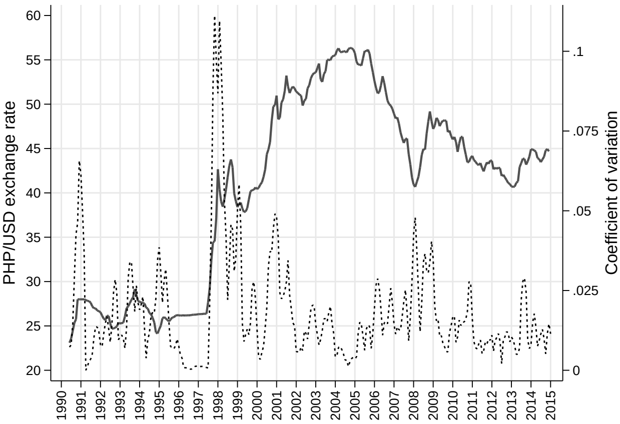
In our search for a theoretical foundation for our empirical analysis, we found models of vertical product differentiation to be well suited to take up the task of explaining firms' export survival. These models stress the importance of differences in income per capita across countries and of differences in the number of potential consumers. Product quality is a strategic variable and firms' incentives to enter and exit bilateral trade relationships are part of stable Nash equilibria. The heterogeneous-firms trade theory was another prime candidate in our search as it draws a distinction between exporting and non-exporting firms by theorizing that only the most productive ones export (Eaton and Kortum, 2002; Melitz, 2003). However, though productivity draws may explain firms export behavior in the long- run they seem insufficient to explain the firm's export dynamics in the transition periods. This view is shared by Bernard et al. (2009) who look at the sources of US export growth and conclude that findings are at odd with the conventional view that export growth is the result of domestic firms becoming more productive. That is true only in the long-run. In the short-run, almost all growth comes from higher demand for products that existing firms already made.

If product quality is indeed important for export performance then we should find that high-quality exporting firms perform better than non-upgrading exporting counterparts. Probably the single best indicator of export performance is the length of time that an exporter is able to sell his goods to foreign markets. If higher product quality leads to better export performance, then high-quality firms will remain exporters for longer time periods. This is indirectly another testable hypothesis that derives from the theoretical foundation.

In this vein, we analyze an international trade game between two firms located in two different countries (developed vs. developing) that produce quality-differentiated products. Several asymmetries characterize the model: (i) domestic and foreign consumers have heterogeneous preferences for quality and different income levels; (ii) markets are asymmetric in that both size and distribution of consumer tastes differ; and (iii) firms in developing countries face higher quality development costs to achieve any given quality level. Both firms operate under two constraints. Firstly, firms avoid dumping their products and the associated financial penalties by complying with the standard rules of the WTO. Hence, the f.o.b price of exports cannot be lower than the local price, both expressed in the same currency units. Secondly, as there is a time gap between the production date and the payment date for goods, exporting firms face multiple uncertainties and exhibit a forward-looking behavior regarding their entry-exit decisions in foreign markets. Prime sources of uncertainty include government policies, transport costs and fluctuations in exchange rates. Given these, firms play a two-stage game. In the first stage, firms select qualities to be produced and possibly exported, and incur the fixed costs; in the second stage, firms engage in a price competition game. Once the market equilibrium is obtained uncertainty is resolved.

There is increasing empirical evidence supporting the main features of our analysis. Of the 2966 anti-dumping measures reported by the WTO between January 1995 and June 2014, remarkably few concerned the Philippines: only 11 were imposed by Philippine authorities and 7 against Philippine export firms. Also, Rauch's (1999) classification of goods (revised July 2007) codes internationally traded commodities according to three possible types: differentiated, reference priced, or homogeneous good. Based on this classification, 85% of Philippine manufacturing firms produced products that are differentiated.[1]

Figure 4.1: The Philippine Peso/US$ exchange rate



Notes: (i) The bold line displays the monthly Philippine Peso / US$ exchange rate over the period January 1990 to December 2014 (monthly averages); (ii) The broken line shows the rolling coefficient of variation with a rolling window of 5 months.

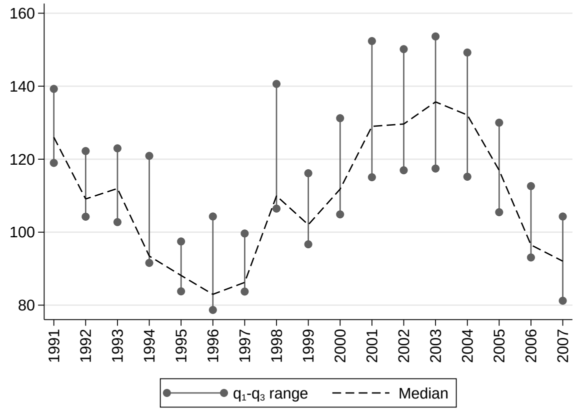
Source: Own calculations based on exchange rate data from Bangko Sentral NG Philipinas.

Another important factor affecting firms' foreign trade is the volatility of major currencies of the world. For example in Figure 4.1, the Philippine Peso / US$ rate and its volatility (approximated by the coefficient of variation) are displayed for the period January 1990 to December 2014. The figure shows large swings in the level of the currency where a period of depreciations (151% up to October 2004) is followed by a period of appreciations (20.7% till December 2014). The volatility fluctuates as well, particularly during the Asian crisis of 1997-1998 and the financial crisis of 2008-2009. Likewise, freight costs that are important for island economies are also volatile. This is shown in Figure 2 which displays the real freight costs of exporting a single 7 digit product, semi-conductors, to a single destination, namely Singapore. Besides the time variation in the median transport costs, there is a substantial dispersion of these costs across Philippine exporters. Finally, Handley (2014) shows that trade policies can be a contributor to background uncertainties firms face when making their export decisions. Altogether these fluctuations subject firms to both "level" and "risk" effects.

Given this framework, we derive the following main results: (i) We show the existence of a unique (risk-dominant) free trade equilibrium where the foreign firm, being more efficient, produces a good

[1]Using Rauch's (1999) liberal classification

Figure 4.2: Median transport costs for semi-conductors to Singapore



Notes: (i) This graph reproduces firms real transport cost in pesos of exporting semi-conductors to Singapore over the period 1991 to 2007; (ii) Units are expressed in pesos per kg, deflated by the Filipino CPI (2005=100); (iii) The product code is Pscc 9310221, formally called Semi-conductors manufactured using materials by consignment basis; (iv) The dotted line displays the median transport cost across exporting firms; the vertical bar shows the 25th-75th percentile range as a proxy of variation across firms.

Source: Own calculations based on data from the PSA.

of higher quality than the domestic firm. Though conditional on prices different quality levels are observed, relative prices are log–linear in relative qualities. The latter results extend to models with higher dimensions. (ii) Under some parameter configurations, the domestic firm exits strategically the export market. (iii) The estimated discrete–time hazard function reveals that export spells have a short duration, the mean being 20 months. Particularly in year one, 72.2% of trade relationships do not survive to year two. (iv) The Philippine exporting firms with a higher survival rate are those that price their exports between the median and mean of the international distribution of prices. In contrast, firms charging prices located at both ends of the distribution have the lowest survival rates. (v) Product quality matters as well. In order to sell in markets like South Korea, Thailand and the USA, Philippine firms decreased the relative quality of their products over time. (vi) Though uncertainty negatively affects the exporting firm survival, a real depreciation of the Philippine pesos explains longer export duration, together with learning by exporting and network effects.

The rest of the paper is organized as follows. The next section reviews and interprets the related literature. Section 3 presents the details of our theoretical model and discusses the results in light of the related literature. Section 4 describes the data, the econometric methods and the variable constructions. Section 5 provides empirical results and explores the quantitative implications of our results. Finally, Section 6 concludes. The Appendix contains the proofs of our theoretical model, a detailed description of data sources and methods, and the variable definitions.

4.2 Related Literature

There is also substantial empirical evidence that product quality matters in the global economy. Bastos and Silva (2010) use micro-data from Portugal to uncover the quality of exports and their drivers. In a sample of 60 countries Hallack (2006) shows that there are large differences in the quality of products that are exported. Using a novel method to account for variation in trade balances induced by horizontal and vertical differentiation, Hallack and Scott (2011) substantiate the importance of product quality by tracing the evolution of manufacturing quality for the world's top exporters. Khandewal (2010) questions the standard assumption that a product quality is related to its unit value and proceeds to estimate quality for highly disaggregated US import data by focusing on properties of consumer demands. In contrast, Di Comite et al. (2014) stress the importance of separately accounting for product quality and production costs when using these unit values. Like in Khandelwal (2010), we show that conditional on prices, different quality levels are observed for different combinations of parameter values and realization of uncertain variables. Like in Di Comite et al. (2014), we obtain the result that quality is a relative concept, in that ratio of qualities is proportional to the ratio of prices.

Models of vertical product differentiation are particularly suited to understand firms' export dynamics. The oligopoly problem starts with Shaked and Sutton (1984) who establish the well-known result that firms have generally an incentive to choose distinct quality levels in order to relax competition in a market. Other versions of this model include Krishna (1987) who compares trade policy instruments and Motta et al. (1997) who analyze the sustainability of quality leadership once countries open up to trade. More recently, Kugler and Verhoogen (2012) extend Melitz's (2003) framework to include the endogenous selection of input and output quality. Moraga-Gonzalez and Viaene (2015) is the contribution most closely related to our theoretical framework. They give a complete characterization of the export game between firms and derive conditions for reversals in quality leadership in developing economies. In our framework, we extend derivations of market equilibria by introducing multiple uncertainties in bilateral trade relationships together with a more thorough application of WTO rules.

More empirical evidence supports the main features of our analysis. For example, empirical estimates of Bastos and Silva (2010), Crozet et al. (2012) and Manova and Zhang (2012) provide support to characteristics of our market equilibria namely, that producers of high quality have higher outputs and charge higher prices. In addition, they find that firms adjust optimally the quality of their products to countries with a higher economic development. In addition, a key feature of sectors with a high degree of vertical product differentiation is the low price elasticity of demand, result empirically supported by Anderton (1999). Econometric studies by Crozet and Erkel-Rousse (2004) establish a tight link between quality and innovation, justifying a convex cost function of quality development that is typical of models of vertical product differentiation.

4.3 The Theoretical Framework

Two firms sell goods that are vertically differentiated. These two firms, located in two different countries, home and foreign, produce goods for their own market and, eventually, for exports. The firm located in the foreign (home) country is referred to as the foreign (home) firm and all foreign variables are denoted by an asterisk "$*$". We index destination countries by $i = 1, 2$ where subscript 1 refers to the home country and subscript 2 to the foreign country. We assume there are future transport costs unknown at the decision date, denoted by $\tilde{r}$, associated to the bilateral shipment of goods between countries. For convenience, we suppose transport costs are of the "iceberg" type. The unknown exchange rate, denoted by $\tilde{e}$, is defined as the units of domestic currency per unit of foreign currency. Also future ad valorem import tariffs are denoted $\tilde{\tau}$ and $\tilde{\tau}^*$ respectively.

Product quality may be one of two types: high-quality q_h and low-quality q_l, with $q_h > q_l$. As in Shaked and Sutton (1984), Motta et al. (1997) and Moraga-Gonzalez and Viaene (2015) we adopt the cost specification of pure vertical product differentiation models, where the costs of quality mainly fall on fixed costs and involve only a small or no increase in unit variable costs. Particularly, once the home and foreign firm pick the quality of the good, they pay an own-currency fixed cost $C(q) = cq^2/2, q = \{q_h, q_l\}$ and $C^*(q) = c^*q^2/2$ respectively; they produce at a marginal cost that is normalized to zero.[2] The functions are increasing in q so that high-quality is more expensive to produce.

Assume there is a population of measure m at home, of measure 1 abroad, with $0 < m \leq 1$. Consumers will purchase at most one unit of the product from one of the two firms according to preferences given by the following quasi-linear (indirect) utility function: $V = \theta q - p$, if one unit of a good of quality q is bought at price p, and 0 otherwise. Parameter θ is consumer specific and measures the utility a consumer derives from consuming a unit of quality. Assume θ is uniformly distributed over $\left[0, \lambda\bar{\theta}\right]$ at home, and over $\left[0, \bar{\theta}\right]$ abroad, with $0 < \lambda \leq 1, \bar{\theta} > 0$. Let p_l and p_h be the prices for low- and high-quality products in the domestic country. Suppose, for a moment, that $p_h > p_l$, i.e., high quality is sold at a higher price, an assumption that will be verified later.

To aggregate individual demand into firms demand functions, the first step is to identify marginal consumers. A first consumer, denoted $\tilde{\theta}$, is indifferent between buying high quality or low quality. Using the utility function, one obtains $\tilde{\theta} = (p_h - p_l)/(q_h - q_l)$. Likewise, let $\hat{\theta}$ denote the consumer marginal to the market who is indifferent between acquiring the low-quality good or nothing at all, that is, $\hat{\theta} = p_l/q_l$. As the latter varies, market sizes are endogenous and, in equilibrium, both markets will not be fully served. Given this, the high-quality good is demanded by those consumers belonging to the interval $\tilde{\theta} \leq \theta \leq \lambda\bar{\theta}$ and the low-quality variant is demanded by those buyers such that $\hat{\theta} \leq \theta < \tilde{\theta}$. Therefore, with θ being uniformly distributed on $\left[0, \lambda\bar{\theta}\right]$ and, as previously assumed, measure m being home population, demands for high- and low-quality products by the domestic market are:

$$
\begin{aligned}
D_h(.) &= m\int_{(p_h-p_l)/(q_h-q_l)}^{\lambda\bar{\theta}} f(\theta)d\theta = \frac{m}{\lambda\bar{\theta}}\left(\lambda\bar{\theta} - \frac{p_h - p_l}{(q_h - q_l)}\right) \\
D_l(.) &= m\int_{p_l/q_l}^{(p_h-p_l)/(q_h-q_l)} f(\theta)d\theta = \frac{m}{\lambda\bar{\theta}}\left(\frac{p_h - p_l}{(q_h - q_l)} - \frac{p_l}{q_l}\right)
\end{aligned}
\tag{4.1}
$$

where $f(\theta)$ is the density function. Proceeding in the same way we can compute the foreign demands for high- and low-quality goods:

$$
D_l^*(.) = \frac{1}{\bar{\theta}}\left(\frac{p_h^* - p_l^*}{(q_h - q_l)} - \frac{p_l^*}{q_l}\right), D_h^*(.) = \frac{1}{\bar{\theta}}\left(\bar{\theta} - \frac{p_h - p_l}{(q_h - q_l)}\right) \tag{4.2}
$$

where p_l^* and p_h^* are foreign prices of low- and high-quality, $p_h^* > p_l^*$. Note that one of the demands in (1) and (2) is met by imports. Using the pair of demands (1) and (2), the problem of the risk neutral domestic firm when it produces low quality is to find p_l and p_l^* so as to maximize the expected value of the following random profits:

$$
\tilde{\pi} = p_l D_l + \tilde{e}(1 - \tilde{\tau}^*)(1 - \tilde{r})p_l^* D_l^* - \frac{c}{2}q_l^2 \tag{4.3}
$$

Likewise the risk neutral foreign rival chooses p_h and p_h^* so as to maximize the expected value of its profits:

$$
\tilde{\pi}^* = \frac{(1 - \tilde{\tau})(1 - \tilde{r})}{\tilde{e}} p_h D_h + p_h^* D_h^* - \frac{c^*}{2}q_h^2 \tag{4.4}
$$

[2] Adding small marginal costs of production makes computations cumbersome and obscures the presentation of the results substantially without adding further insights. The specification of the cost function could be more general without affecting results qualitatively.

Taking the first order conditions and solving for the Nash equilibrium yields the following prices in the domestic country:

$$p_l = \frac{\lambda\bar{\theta}(q_h - q_l)q_l}{(4q_h - q_l)}, p_h = \frac{2\lambda\bar{\theta}(q_h - q_l)q_h}{(4q_h - q_l)} \tag{4.5}$$

In the foreign country we have $p_l^* = p_l/\lambda, p_h^* = p_h/\lambda$. Equilibrium prices thus depend upon all qualities and not directly upon random variables. Inserting the solution for prices in the respective profit functions lead to the following expected revenues and profits:

$$\begin{aligned} E\tilde{\pi} &= \frac{\bar{\theta}q_h q_l(q_h - q_l)}{(4q_h - q_l)^2}(m\lambda + E\tilde{e}(1-\tilde{r})(1-\tilde{\tau}^*)) - \frac{c}{2}q_l^2 \equiv E\tilde{R}_l - \frac{c}{2}q_l^2 \\ E\tilde{\pi}^* &= \frac{4\bar{\theta}q_h^2(q_h - q_l)}{(4q_h - q_l)^2}(1 + \lambda m E\frac{(1-\tilde{r})(1-\tilde{\tau})}{\tilde{e}}) - \frac{c^*}{2}q_h^2 \equiv E\tilde{R}_h - \frac{c^*}{2}q_h^2 \end{aligned} \tag{4.6}$$

where $E(.)$ is the expectation operator, $\tilde{R}_l$ and $\tilde{R}_h^*$ represent domestic and foreign revenues.[3]

4.3.1 Risk-dominant Nash Equilibrium.

Since there are two quality levels available for choice, q_l and q_h, there is an export game where the domestic and foreign firms can freely pick which of the two qualities to offer and which prices to set in the two different countries. There are four relevant continuation games, each of them ensuing after the firms have picked a quality-and-export strategy profile. The quality-and-export strategy set of a firm i is $S_i = \{\{q_l \ \& \ X\}, \{q_h \ \& \ X\}\}$ for $i = 1, 2$ where X stands for export to the other market. But we can exclude two of these strategies, namely when firms choose to produce similar quality levels. With Bertrand competition, it is clear that competition will drive prices down to zero and firm will make losses equivalent to quality developments costs.

This game has therefore two Nash equilibria. In one equilibrium, $\{q_l \ \& \ X, q_h \ \& \ X\}$, the domestic firm produces the low-quality product and in the alternative equilibrium, $\{q_h \ \& \ X, q_l \ \& \ X\}$, it is the home firm that produces high quality. As discussed in detail in Motta et al. (1997), Cabrales et al. (2000), and Moraga-Gonzalez and Viaene (2015), the selection of equilibria in this type of games requires to use the Harsany-Selten risk-dominance criterion. Applying this criterion to our game, the next proposition characterizes the assignment of qualities across firms under free trade.

Proposition 1 *In the unique risk-dominant free trade equilibrium, the foreign firm produces high quality and the domestic firm chooses low quality as long as* $c > c^* E\tilde{e}$.

The proof of this proposition is contained in the Appendix to facilitate the reading. From Proposition 1 it is clear that quality leadership is obtained by computing cost differences whence these costs are expressed in similar currency units. The quality leader is thus the most efficient firm in terms of development costs. This important result indicates that the sustainability of quality leadership under

[3]It is possible to be more specific about the quality cost $C(q) = cq^2/2, q = \{q_h, q_l\}$ by specifying, like in Verhoogen (2008) and Kugler and Verhoogen (2012), a Cobb-Douglas production function for quality that includes foreign inputs. Consider a production function that combines skilled labor S and foreign inputs I^*: $q = S^{\alpha}I^{*\beta}$. The corresponding long-run cost function for quality is indeed $cq^2/2$ with $\alpha = \beta = .25$ and $c = 4\sqrt{wr}$ where w is skilled labor wage and r the domestic price of foreign inputs (thus including the exchange rate and any import tariff). Being $q = S^{.25}I^{*.25}$, the underlying production function implies large decreasing returns to scale in quality production. Since skilled labor is generally in short supply in developing economies, home exporters seeking quality upgrading are likely to be large importers of foreign inputs as well. This is one of the channels: (i) through which trade liberalization matters (see e.g. Goldberg et al., 2009; Khandelwal et al., 2013; Bas and Strauss-Kahn, 2015); (ii) that affect the pass-through of exchange rates (Amity et al., 2014) and; (iii) that lead to the equivalence between exchange rate depreciations and increased import tariffs (Feenstra, 1989).

free trade hinges on firms' cost asymmetries, thus also on the expected exchange rate but neither on market size m nor on income difference λ.

4.3.2 Trade Equilibrium

The free maximization of profits (3) and (4) with respect to prices may not obey WTO rules on dumping. For example dumping by the foreign firm into the domestic market does not occur if the expected international foreign currency price of high-quality exports is not less than the local price:

$$p_h U^* \geq p_h^* \tag{4.7}$$

where $U^* = E\left[(1-\tilde{\tau})(1-\tilde{r})/\tilde{e}\,\right]$ is the expectation of multiple uncertainties faced by the foreign firm. Vice versa, dumping by the local firm abroad takes place if the international foreign currency price of low-quality exports is not less than the home price:

$$p_l^* U \geq p_l \tag{4.8}$$

where $U = E\left[\tilde{e}(1-\tilde{r})(1-\tilde{\tau}^*)\right]$ is the expectation term of the home firm. Both U and U^* represent the expectation of destination-specific bilateral export uncertainties, the latter for the home firm that exports to the richer country, the former for the foreign firm. They are equal to unity in a world of fixed exchange rates (specifically, $e = 1$), no transport cost ($r = 0$) and no tariff ($\tau = \tau^* = 0$). Let us define $\mu = q_h/q_l$ with $\mu > 1$ since $q_h > q_l$. It is now possible to characterize the trade equilibrium resulting from the allocation of qualities given by Proposition 1 and after imposing constraints (7) and (8). The different steps of the derivations of the trade equilibrium are contained in the Appendix.

With endogenous qualities, the constrained trade equilibrium involves two-way trade with the domestic firm picking q_l and the foreign firm q_h. These goods sell at prices:

$$p_l = \left(\frac{m+1}{m+(\lambda/U)}\right)\frac{\lambda\bar{\theta}(\mu-1)}{(4\mu-1)}q_l; p_h^* = 2\left(\frac{m+1}{(m/U^*)+\lambda}\right)\frac{\lambda\bar{\theta}(\mu-1)}{(4\mu-1)}q_h \tag{4.9}$$

in the two countries. World demands for each firm are:

$$D_l(.) + D_l^*(.) = \frac{(1+m)\mu}{4\mu-1} \tag{4.10}$$

and

$$D_h(.) + D_h^*(.) = \frac{2(1+m)\mu}{4\mu-1} \tag{4.11}$$

The quality gap between the variants μ is the solution to:

$$\frac{4(4\mu^2-3\mu+2)}{\mu^2(4\mu-7)} = \frac{c^*}{c}\left[\frac{(m/U^*)+\lambda}{m+(\lambda/U)}\right] \tag{4.12}$$

The home firm produces a good of quality

$$q_l = \frac{1}{c}\frac{\lambda\bar{\theta}(m+1)^2}{[m+(\lambda/U)]}\frac{\mu^2(4\mu-7)}{(4\mu-1)^3} \tag{4.13}$$

that is sold locally and exported to the foreign country. The foreign firm produces a good of higher quality:

$$q_h = \frac{1}{c^*}\frac{\lambda\bar{\theta}(m+1)^2}{[(m/U^*)+\lambda]}\frac{4\mu(4\mu^2-3\mu+2)}{(4\mu-1)^3} \tag{4.14}$$

for its own market and for exports. Obviously μ is important in the model since it represents the quality gap between firms' variants and measures the degree of product differentiation. Observe that μ is the unique solution to the third degree polynomial in (12). It depends on λ, m, firms' development costs and bilateral trade uncertainties.

This trade equilibrium has a number of implications. Tirole (1988) shows that $\bar{\theta}$ is the inverse of the marginal utility of income. Hence, our assumption $0 < \lambda \leq 1$ implies that foreign consumers have higher incomes on average and more sophisticated tastes. Using Khandelwal's (2010) terminology, parameter $\bar{\theta}$ reflects the foreign consumers largest valuation for quality and is therefore related to the concept of long quality ladder, $\lambda\bar{\theta}$ to that of short quality ladder. There are similarities with other parts of the empirical literature as well. Like in Bastos and Silva (2010), Manova and Zhang (2012), a direct comparison of (10) and (11) shows that producers of high quality have higher outputs, more precisely twice as high. From (9), it turns out that high-quality products command higher prices as long as the gap between U and U^* is not extreme. Producers vary their prices across export destinations for various $((\lambda, \bar{\theta}, m)$ combinations. Clearly from (9), export prices p_h^* and p_l do not measure absolute qualities. Conditional on prices, different combinations of parameter values lead to different quality levels. In contrast, the ratio of prices is proportional to relative quality levels:

Proposition 2 *With endogenous qualities, the ratio of high quality to low quality is:*

$$\frac{q_l}{q_h} = \frac{p_l}{p_h^*}\left\{\frac{2(m+(\lambda/U))}{(m/U^*)+\lambda}\right\} < 1 \tag{4.15}$$

Specifically, relative product qualities in the trade equilibrium are log-linear in relative export prices.

Thus, controlling for m, λ, U and U^* which are variables and parameters that can be constructed, measures of relative product quality can be obtained from relative export prices which are readily available. Note that when $U = U^* = 1$, $q_l/q_h = 2p_l/p_h^* < 1$.

4.3.3 Entry-Exit Conditions

Surprisingly total world demands for both goods in (10) and (11) do not depend on country uncertainties, only indirectly via the extent of product differentiation. There is intra-industry trade in vertically differentiated goods as long as individual export volumes D_l^* and D_h remain positive. Particularly:

$$D_l^* = \lambda(m+1)\left(\frac{\mu}{4\mu-1}\right)\left\{\frac{2U^*}{m+\lambda U^*} - \frac{1}{mU+\lambda}\right\} \geq 0 \tag{4.16}$$

$$D_h = \left(\frac{2m\mu}{4\mu-1}\right) - \left(\frac{m}{4\mu-1}\right)\left\{\frac{2\mu(1-\lambda U^*)}{m+\lambda U^*} + \frac{\lambda-U}{mU+\lambda}\right\} \geq 0 \tag{4.17}$$

Clearly these expressions can be non-positive for reasons related to U, U^*, λ, m and μ. There are thus incentives for firms to exit and re-enter their export markets. More formally, there are two other Nash equilibria where one of the two firms stops exporting. For example the next proposition gives conditions under which the firm of the poorer country exits its export market:

Proposition 3 *There exists a Nash equilibrium with the following characteristics: (i) it is optimal for the home firm to produce the low-quality variant but to stop exporting when the following condition is satisfied:*

$$U < \frac{\lambda m}{2m+1} \tag{4.18}$$

(ii) in the same equilibrium, the foreign firm continues to produce high quality and export to the home country if:

$$\frac{1}{\lambda}\frac{(4\mu-1)}{4(\mu-1)} \leq U^* \tag{4.19}$$

The proof of Proposition 3 is outlined in the Appendix, together with additional insights.[4] Conditions (18) and (19) state the necessary conditions for a stable Nash equilibrium when the home firm exits its export market. They establish bounds for expected uncertainty in terms of model parameters and variables. The former states an upper limit for the expected uncertainty faced by local exporters. When the home firm exits its export market, it avoids the anti-dumping price constraint imposed by the WTO and the bilateral uncertainties involved in trade. Condition (18) in Proposition 3 differs from (16), though they are observationally equivalent. They determine a timing of exits that may arrive sooner based on expected profits. Condition (19) compares U^* to a combination of parameters involving λ and the degree of competition μ. This condition is always satisfied with $U^* \to \infty$. More specifically, with $U^* > 1$, the foreign firm derives higher profits than in a monopoly when expectations are favorable to foreign exports into the home economy.

Some monotonicity results that can be verified from these two conditions are reported in Table 4.1 and should be interpreted as follows. Suppose that an increase occurs in one of the model parameters of the first row, then the sign of the comparative statics of this change on either condition (18) or condition (19) is given in each relevant cell. A positive sign (negative) indicates that the condition is more (less) likely to hold. Given this, the third row shows the expected sign of each variable in the empirical analysis of the likelihood of exporting firm exits.

Table 4.1: Monotonicity Results for Conditions (18) and (19)$^{(i)}$

	m	λ	$E\tilde{e}$	$E\tilde{r}$	$E\tilde{\tau}$	$E\tilde{\tau}^*$	σ_e^2	σ_r^2	$\sigma_{\tau^*}^2$	σ_τ^2
$Cond(18)$	+	+	-	+	0	+	0	0	0	0
$Cond(19)^{(ii)}$	0	+	-	-	-	0	+	0	0	0
$Exit$	+	+	-	?	-	+	+	0	0	0

Notes: (i) Signs are obtained by computing the first and second derivative of U and U^* while assuming independence of random variables; (ii) Changes in model parameters of the first row are assumed to be larger that U^* than the indirect effects on competition variable μ in (12).

Regarding the task of finding proxies for expected uncertainties U and U^*, we approach this problem from the perspective of independent random shocks. We compute first and second derivatives of function U and U^* whose results are reproduced in Table 4.1 while assuming zero co-movement of stochastic variables. For example, U^* is convex in $\tilde{e}$ as its second derivative is positive everywhere. In contrast, the volatility of other variables are zero as both U and U^* are linear functions of these three variables. For $E\tilde{r}$ the sign is ambiguous and thus becomes an empirical question.

[4]The Appendix describes also the parameter space of the third Nash equilibrium of the export game, namely when the foreign firm produces high quality but stop exporting while the home firm produces low quality and exports.

4.3.4 Higher Dimensions

The theoretical framework thus far describes the market for a vertically differentiated product where a domestic firm, located in a developing country with less and poorer potential buyers, supplies its own market while facing import competition from a foreign firm. It also exports to a larger and richer country where it faces competition from the same foreign firm. Because of the WTO's antidumping constraint, the local firm's foreign price depends on that at home.

The transition to our data analysis gives rise to the dimensionality issue: can the results of our simple theoretical framework serve as a suitable tool to interpret the high-dimensional data of our sample? In our empirical work, Philippine exporters face about the same foreign competitors at home and abroad, a feature of the global economy. At this level of disaggregation, most entry-exit decisions are bilateral, namely destination-specific. Regarding quality measures, the logic of proposition 2 stays valid with higher dimensions. The reason is that the two-stage maximization of the model includes two sets of best response functions, in prices and in qualities. As expressions for aggregate demands in (1) include qualities, best response functions in prices contain qualities as well. Even with more firms (hence products and destinations) prices are function of qualities and relative prices are a function of relative qualities though the relationship might be non-linear. Regarding exit conditions, deviations are analytically more difficult to compute as the number of firms increases and remain an empirical question.

4.4 Data Sources and Methods

In the next section we investigate the empirical determinants of the survival of Philippine exporters to numerous foreign destinations using the model outlined above as guide. We first describe the data, outline our estimation techniques and define the explanatory variables. Later we present empirical results.

4.4.1 Data Description

Our dataset consists of the universe of import and export data from 1991–2012 matched with 13 annual manufacturing surveys spanning the period 1996–2012. However we restrict our data to the period 1996–2007.[5] The period before 1995 firm names are sometimes missing and temporary trader code are given therefore the first 5 five years are dropped. Due to missing data on transportation cost after 2007 they are left out of the analysis. But most importantly the majority (9 surveys) and the most important surveys in terms of observations are covered in this period. The trade commodity classification is detailed as the PSCC (Philippine Standard Commodity Classification) is at the 7-digit level and corresponds until the $5th$ digit with the SITC (Standard International Trade Classification) Rev. 3. Three main corrections are applied to the data before use. Firstly, firms that are not directly involved with the production of the product they export are dropped.[6] Secondly, observations that in real terms had a value worth less than $1000 were dropped from the sample. Lastly, Product categories that cannot be linked directly to firms or domestic production are also deleted from the

[5] The data of other periods also used. For example unlike most survival regression our data can determine whether a spell truly starts in 1996 or is left censored but also whether a spell stops in 2007 or is right censored. Therefore unlike most survival regressions we have two extra years in terms of information.

[6] Similar to Manova and Zhang (2012) firms that had in their name the following words Export, Import, Trader, Trading, Logistic, Shipping and Moving are deleted from the sample

analysis.[7]

After the necessary corrections our data consist of 390,859 firm-product-destination (FPD) observations and a total of 244,533 spells. These spells come from a total of 5,472 firms of which 2,561 firms are present on average every year in the sample. However due to difficulties of obtaining extra data for certain products and destinations the data sample differs per model specification. In the dataset there are a total of 250 destinations to which firms export. However due to data constraints we analyze 181 destinations of which the most are countries (See Appendix 4.B for list of destinations in data). On average the manufacturing firms export to 117 destinations per year. A large portion of these spells have as destination the USA (18.6%), EU (16.8%) or Japan (9.2%). Besides Japan, regional trade is also of importance as countries such as South Korea (2.6%), Hong Kong (4.7%), Taiwan (3.4%), China (2.7%) and ASEAN (11.8%) member countries (especially Singapore, Thailand and Malaysia) have become increasingly important destinations for firm export spells. The firms in the sample export 5,048 different products and on average 2,308 products per year.[8] Altogether the firms in the sample export 6.8 products to 5.6 destinations on average per year.[9] Therefore the sample consists mostly of relatively large firms.

4.4.2 Econometric Methods

Survival analysis models the waiting time to the occurrence of an event. In our framework an event is firm exit, namely when firm f stops exporting product p to destination d at date t. This event is observed if one of the following three conditions arises: (1) a firm ceases to export a product to a destination; (2) it stops exporting the product; (3) the firm quits exporting altogether. The analysis attempts to answer questions of the type: What is the proportion of manufacturing firms that will keep exporting to foreign destinations past a certain time? At what rate will they exit? What is the contribution of explanatory variables to the probability of exits?

Specifically we employ the discrete-time survival method which among others specifies a discrete-time hazard function h_t. It is the conditional probability that a firm stops exporting a product to a destination at time t, given that it has not occurred before. Denote by T the time it takes before an export spell stops, which in our sample can take the values t = 1, 2,, 12. Formally:

$$h_t = P(T = t | T \geq t - 1) \tag{4.20}$$

Figure 3 displays the estimated exit rate for each year based on the entire population of firms. In contrast to the existing literature exit rates are high in the first three years but low thereafter. In year one, 72.2% of trade relationships do not survive to the second year. In year two, from those firms that survive, 45.6% stop in the second year. By year four about 20% of trade transactions do not survive to the next year, implying high survival rates from then on. Clearly export spells have a short duration, the mean being 20 months.[10]

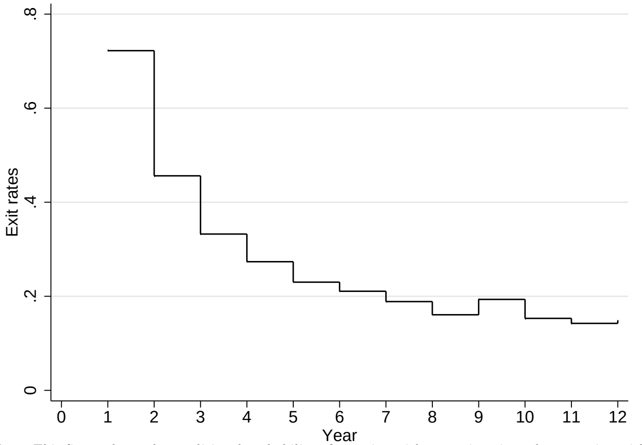
[7] Product categories Good returned to the country whence exported, other commodities temporarily imported/exported, personal and household effects of travel and replacement of returned good are examples of product categories that should not appear in the analysis. These product categories comprise most of the products that form the category 93 in the PSCC classification. Therefore all observations that are linked to Pscc division 93 (with the notable exception of PSCC items 93101 till 93102 which contains products built on consignment basis).

[8] For the first regression the total number of exported products drop to 4,846 and on average 2,204 products per year

[9] This calculation includes firm observations of products and destinations that are left censored

[10] A comparison with the existing literature is difficult to make as Besedes and Prusa (2006) consider product survival spells (thus not firm specific as in our study) and Cadot et al. (2013) consider one–period survivals. For example, product survival rates for differentiated products in Besedes and Prusa (2006) are quite high in the first three years to drop to about 50% thereafter.

Figure 4.3: Discrete-time hazard



Notes: This figure shows the conditional probability of stopping with exporting given that stopping with exporting has not yet occurred.

Source: Own calculations based on PSA data

The dependent variable of our empirical method is binary and indicates whether an exporting firm is present in a foreign market or not. Particularly, the observed outcome for each firm-product-destination-year is coded 1 if the firm exits the market in that year; otherwise it is coded 0. For simplicity, let $g = (f, p, d)$ group the subscripts of the model except for time t and let y_{gt} define the observed outcome. The probabilities can be confined between 0 and 1 by using a non-linear model of the type: $P[y_{gt} = 1] = F(\mathbf{D}_{gt}\alpha + \mathbf{X}_{gt}\beta)$ where the function $F(.)$ has values ranging between 0 and 1 and is monotonically non-decreasing. A popular choice for $F(.)$ is the logistic function:

$$P[y_{gt} = 1] = \frac{1}{1 + e^{-(\mathbf{D}_{gt}\alpha + \mathbf{X}_{gt}\beta)}} \tag{4.21}$$

The independent variables consists of several groups: matrix $\mathbf{G}_{gt}$ contains duration dummies (2, 3,..., 12) that transform the logistic model into a discrete logistic survival model; matrix $\mathbf{X}_{gt}$ includes the constant and independent variables that may be continuous or categorical; α and β are the corresponding vectors of unknown parameters. A transformation of (21) leads to the Logit regression equation:

$$\ln\left\{\frac{P[y_{gt} = 1]}{1 - P[y_{gt} = 1]}\right\} = \mathbf{D}_{gt}\alpha + \mathbf{X}_{gt}\beta + \varepsilon_{gt} \tag{4.22}$$

where ε_{gt} is a vector of unobserved disturbances.

The coding of observations into ones and zeros gives rises to a number of remarks regarding the construction and interpretation of the left-hand side of (21) and (22). A first issue is related to the arbitrariness in the selection of any sample, 1996-2007 in our case. Observations are right-censored because though some firms might have entered new export markets at some date our study ends before their exit is observed. We partially cope with censoring by checking firms export status in 2008 and modify the 2007 codes accordingly. In contrast, our observations are not left-censored as the study only considers export spells from 1996 onward. Secondly, exports are recorded on a yearly basis while exit time is continuous. By using discrete survival data we thus deal with fewer integer survival times that are shared by many. This is a case of interval censoring where the timing of events is partially known. Finally, in the data some firms experience discontinuous exporting spells of the same product to the same destination. Given this, the analysis uses gap time formulation in which case the clock is reset to zero for a firm every time an exporting spell ends. The data coding gives thus limited credit for the experience that has been gained by exporting.[11]

A number of methodological issues have guided our choice of estimation technique. First, we deviate from the proportionality assumption imposed by Cox models, where the effect of the explanatory variables is deemed constant over time. As Hess and Persson (2012) and Brenton et al. (2009) argue, such an assumption does not hold for trade data. We therefore opt for Logit regressions because such strict proportionality assumption is not imposed. Second, our estimation method has to account for unmeasured heterogeneity, a stylized fact linked to a selection process that is typical of firm micro-data. In the presence of such heterogeneity survival patterns for the entire population of firms are entirely different from those of an individual firm. If firms differ in unobserved ways in their inherent probability of failure (some firms being more robust than others), then a selection process takes place. This is the so-called frailty effect which our estimation method will account for.[12] Specifically, we use a random effects model where frailties are no longer observation specific but instead are shared across groups of observations, thus causing those variables to be correlated. This is captured by a firm specific random intercept $\zeta_f \sim \tilde{N}(0, \psi)$, identically distributed across firms and independent of covariates.[13]

4.4.3 Construction of Variables

In our econometric specifications, the dependent variable is binary, where it can take a value 1 if the Philippine exporter f of a product p at date t stops exporting to a destination d, a value 0 if the same exports survive. The probability of the binary response is based on a first set of independent variables that are described in Table 2. The purpose of this table is to specify a central equation that derives from our main theoretical results. Expected signs are shown in the last row of Table 1.

The first independent variable is relative export prices of Philippine firms. As can be derived from (15) in Proposition 2, relative prices(p_l/p_h^*) are related to relative quality (q_l/q_h). Thus besides measuring the relative competitiveness of firms in destination markets, relative prices are at the same time an imperfect proxy for relative quality. Export prices are computed in two ways: (1) relative to the average export price of foreign exporters to the Philippines within the same product category; (2) relative to the median export price of the same foreign exporters to the Philippines. In the estimation equations, we define relative export prices both in logs($\ln p_l/p_h^*$) and in quintiles on the ranked set of relative export prices ($rlxprice(.)$). The latter specification is intended to capture the nonlinearity of the effects on survival but also to mitigate issues related to the endogeneity of prices and/or co-movement with other explanatory variables. The relative number of potential consumers m for any product is proxied by the Philippine population divided by destination population ($rlipc$). The relative income parameter λ is proxied by relative real incomes per capita, that of the Philippines relative to destination ($rlpop$).

Expected uncertainties of our random variables enter regressions in two ways, through a level effect and a risk effect. The level effect of exchange rates is captured by the real bilateral exchange rate of

[11] One could have chosen the counting process formulation instead. However, we obtain results similar to those using gap time formulation. Moreover explanatory variables capturing experience and learning by exporting are introduced in our estimated models.

[12] The frailty effect ensures that regardless of the shape of individual hazards, the population hazard declines over time.

[13] For a more complete review of random effects in survival models, see Skrondal and Rabe-Hesketh (2012).

the pesos with respect to destination currency. To abstract from currency units, the real exchange rate is expressed as the expected depreciation rate of the pesos ($reer$). The risk effect is proxied by the rolling coefficient of variation of the bilateral exchange rates with a rolling window of 5 years (($unc(\tilde{e})$). Transport costs are measured by iceberg rates (iceberg). Transport cost uncertainty is proxied by the median of percentage changes in transport costs of all products a firm exports between date t and date t-1($uncr(\tilde{r})$). Regarding trade policy uncertainty, the level effect is captured by the simple average of applied tariffs. As most independent variables are expressed in relative terms, we include the difference between the destination average and the Philippine average ($tariff^{*} - tariff$). The risk effect is approximated by the normalized difference in the rule of law scores between destination and the Philippines($unc(\tilde{\tau})$). [14] Finally, Consign stands for consignment trade.[15] It is a popular trade practice in the Philippines whereby payments to the exporters are sent only after goods are sold by the foreign distributor. This activity is recorded in SITC–93 (special transactions) categories.

Table 4.2 defines explanatory variables that further control for other firm-, destination-, and industry-specific characteristics or attributes. Though it is a model variable R&D is included here because its inclusion is very costly in terms of observations. R&D expenditures at the firm level give an approximation of product quality development cost, namely the extent to which firms are able to reduce the marginal cost of quality development c. Firm data are only available for the small subset of Philippine firms, namely those sampled in surveys. However, this loss in observations is limited if we aggregate yes/no responses to 5-digits ISIC . Another explanatory variable is distance ($Dist$) and the interaction term with a quintile measure of transport costs($Trans(.)$). We expect the sign of transport costs and distance, measured separately, to be positive and thus adding to the probability of exit. However, the interaction terms should produce the opposite sign: higher transport costs due to longer distance travelled should increase the duration of exports.[16]

Besides destination characteristics, firm characteristics are added to test for size and learning by exporting. Size is represented by a binary variable that takes value 1 when a firm has 200 or more employees ($Emp200$). Learning by exporting is represented by the dummy variable $Experience(.)$that reflects the number of export spells a firm experienced prior to any date t. The inexperience of firms is characterized by two variables, namely $FirstTimeProduct$ and $FirstTimeDestination$. The former indicates that the firm just started to export a new product p. The latter characterizes a firm exporting an existing product to a new destination. Finally the covariate $Networkeffect$ measures the extent by which Philippine firms abroad benefit from each other, and proxied by the number of firms active in any particular market.[17] See the Appendix 4.C for further details regarding the definition, construction and sources of data.

[14] As firms are forward looking, they develop expectations regarding the conditional distribution of each random variable. To proxy this distribution, we assume perfect foresight and lead the level and risk variables by one-period (date t+1). Particularly, this is done for exchange rates as data are year averages. In contrast, this is not necessary for transport costs and tariffs as they are end-of-year observations.

[15] The various payment techniques are listed in www.export.gov, whose main goal is to help U.S. companies export.

[16] This expectation is derived from the premise that the longevity of firms is proxied by their ability to supply destinations that are farther away, and typically with higher quality goods (Hallack, 2006).

[17] The notion that export firms of a particular nation can gain from exchanging information about destination markets is contained in the theoretical contribution by Krautheim (2012).

Table 4.2: Central estimation variables

Variable Name	Description
	Relative export price (p_l/p_h^*)
$lnrlxprice_{md,fpdt}$	log of the US$ price of firm f exporting product p to destination d at time t relative to the *median* US$ price of the same product imported into the Philippines.$^{(i)(ii)}$
$lnrlxprice_{m,fpdt}$	log of the US$ price of firm f exporting product p to destination d at time t relative to the *mean* US$ price of the same product imported into the Philippines.$^{(i)(ii)}$
$rlxprice(0)_{md,fpdt}$	1 when the US$ price of firm f exporting product p to destination d at time t relative to the *median* US$ price of the same product imported into the Philippines falls within the interval [0, 0.6]; 0 otherwise.$^{(i)(ii)}$
$rlxprice(1)_{md,fpdt}$	1 when the same relative export price falls within (0.6, 1]; 0 otherwise
$rlxprice(2)_{md,fpdt}$	1 when the same relative export price falls within (1 , 1.6]; 0 otherwise
$rlxprice(3)_{md,fpdt}$	1 when the same relative export price falls within (1.6 , 4]; 0 otherwise
$rlxprice(4)_{md,fpdt}$	1 when the same relative export price falls within (4 , ∞]; 0 otherwise
$rlxprice(0)_{m,fpdt}$	1 when the US$ price of firm f exporting product p to destination d at time t relative to the *mean* US$ price of the same product imported into the Philippines falls within the interval [0, 0.3]; 0 otherwise.$^{(i)(ii)}$
$rlxprice(1)_{m,fpdt}$	1 when the same relative export price falls within (0.3, 0.7]; 0 otherwise
$rlxprice(2)_{m,fpdt}$	1 when the same relative export price falls within (0.7 , 1]; 0 otherwise
$rlxprice(3)_{m,fpdt}$	1 when the same relative export price falls within (1 , 1.72]; 0 otherwise
$rlxprice(4)_{m,fpdt}$	1 when the same relative export price falls within (1.72 , ∞]; 0 otherwise
	Proxy for model variables
$lnrlpop_{d,t}$	log of Philippine population as a ratio of population of destination d, the latter being a proxy for m
$lnrlipc_{d,t}$	log of Philippine income per capita as a ratio of income per capita of destination d, the latter being a proxy for λ
$reer_{d,t+1}$	proxy for $E\tilde{e}$; the percentage change in the real bilateral exchange rate expressed as real pesos per unit of real destination currency from t to $t+1$
$iceberg_{f,p,d.t}$	proxy for $E\tilde{r}$; US$ unitary transport cost as a proportion of received US$ export price by firm f for product p to destination d
$tariff^*_{d,t}$	proxy for $E\tilde{\tau}^*$; Simple average of applied tariffs in destination d
$tariff_t$	proxy for $E\tilde{\tau}$; Simple average of applied tariffs in the Philippines
$unc(\tilde{e})_{d,t+1}$	proxy for exchange rate uncertainty σ_e^2; rolling coefficient of variation of the nominal pesos per unit of destination currency (rolling window of 5 years $t-3$ till $t+1$)
$unc(\tilde{r})_{f,p,d,t}$	proxy for transport cost uncertainty σ_r^2; The median percentage change in transport costs of all products that firms export in both periods $t-1$ and t to destination d
$unc(\tilde{\tau}^*)_{d,t}$	proxy for foreign trade policy uncertainty $\sigma_{\tau^*}^2$; index of rule of law coefficient (normalized) of destination relative to that of the Philippines
$unc(\tilde{\tau})_t$	proxy for Philippine trade policy uncertainty σ_τ^2; gap between bound tariff and applied tariff

Notes: (i) The imported mean price is calculated from the universe of import data. If there is no corresponding mean import price at time t then the average over all the time periods for that product category is used as a proxy for the imported mean at time t. As not all products are imported every year.; (ii)Most consignment goods have no direct corresponding import category in terms of product code. There are, however, 13 extra consignment products, consisting of clothing, footwear, gloves and mittens, brassieres, semi–conductors and watches, that could be added due to matching to corresponding products not made on consignment basis. For example Women's wear manufactured on consignment basis could be matched to clothing articles not manufactured on consignment basis. (Mostly PSCC categories 842 and 844) The simple average (median) of the import prices of these corresponding products were used as proxies for the consignment goods.

Table 4.3: Destination, firm and industry characteristics

Variable Name	Description
	Additional model variable
$R\&D_{i,t}$	proxy for a reduction in the marginal cost of quality development c; The percentage of firms within a 5-digit PSIC section that respond in the manufacturing survey that it invests in R&D. Therefore 1 indicates that all the firms with a 5-digit PSIC section that responded to the survey indicated that they invested in R&D.
	Destination variables
$Trans(0)_{md,fpdt}$	1 when the gross kilo transport cost of firm f exporting product p to destination d at time t relative to the median gross kilo transport cost of the same product exported by the Philippines falls within the interval [0, 0.70]; 0 otherwise.
$Trans(1)_{md,fpdt}$	1 when the same relative transport costs falls within (0.70, 1]; 0 otherwise
$Trans(2)_{md,fpdt}$	1 when the same relative transport costs falls within (1 , 1.61]; 0 otherwise
$Trans(3)_{md,fpdt}$	1 when the same relative transport costs falls within (1.61 , ∞]; 0 otherwise
$lnDist_d$	The natural logarithm of the great circle distance between the capital city of the Philippines and that of the respective destination. If the destination had no capital city then the largest city is taken.
	Firm characteristics
$Emp200_{ft}$	Dummy variable takes value 1 when a firm has 200 or more employees. Data is obtained from the PSA manufacturing survey and interpolated for missing observations. The certainty stratum of the national survey is also used. If a firm was not surveyed then that firm had at least fewer than 200 employees
$Experience(0)_{ft}$	Dummy variables takes the value 1 when the number of previous spells is 0; 0 otherwise.
$Experience(1)_{ft}$	Dummy variables takes the value 1 when the number of previous spells is 1; 0 otherwise.
$Experience(2)_{ft}$	Dummy variables takes the value 1 when the number of previous spells is 2 or more; 0 otherwise.
$FirstTimeProduct_{fpt}$	Dummy variable takes the value 1 when it is the first spell for the respective firm in which it exports the product; 0 otherwise.
$FirstTimeDestination_{fpdt}$	Dummy variable takes the value 1 when it is the first spell for the respective firm in which it exports to the respective destination; 0 otherwise.
	Industry characteristics
$lnNetworkeffect_{fpdt}$	The log of the number of Philippine exporters exporting a certain product (7-digit Pscc) to a destination.
$consign_{fpdt}$	Dummy variable takes the value 1 product if produced on consigment basis (e.g. in PSCC groups 93101 + 93102) ; 0 otherwise.

4.5 Empirical Evidence

4.5.1 Main Results

Table 4.4 reports the estimated coefficients for the logistic regression model for Philippine manufacturing firms' product–destination export survival. The effects of changes in relative prices, other variables linked to the theoretical model and an industry variable, *consign*, are tested on the likelihood of firm exit. Relative prices, as proxy of quality, are expressed relative to the mean in columns (1) and (2) and relative to the median in (3) and (4).

Table 4.4: Basic results

	(1)	(2)	(3)	(4)
	Relative price variables			
	Mean (m)		*Median (md)*	
$lnrlxprice_{fpdt}$	0.030***		0.021***	
$rlxprice(1)_{fpdt}$		−0.030*		−0.063***
$rlxprice(2)_{fpdt}$		−0.049***		−0.080***
$rlxprice(3)_{fpdt}$		−0.002		−0.023
$rlxprice(4)_{fpdt}$		0.115***		0.060***
	Model variables			
$lnrlpop_{dt}$	0.074***	0.074***	0.074***	0.074***
$lnrlipc_{dt}$	0.076***	0.076***	0.076***	0.076***
$reer_{d,t+1}$	−0.590***	−0.589***	−0.588***	−0.586***
$iceberg_{fpdt}$	0.430***	0.403***	0.406***	0.377***
$tariff^*_{dt} - tariff_t$	0.539***	0.552***	0.543***	0.545***
$unc(\tilde{e})_{d,t+1}$	0.357***	0.359***	0.359***	0.356***
$unc(\tilde{r})_{fpdt}$	0.053	0.053	0.053	0.053
$unc(\tilde{\tau}^*)_{dt}$	0.002	0.002	0.001	0.001
$consign_{fpdt}$	−0.081*	−0.071*	−0.102**	−0.102**
Constant	0.605***	0.584***	0.600***	0.633***
	Random Component			
$ln(\psi)$	−1.255***	−1.247***	−1.255***	−1.250***
ρ	0.080	0.080	0.080	0.080
Year dummies	*Yes*	*Yes*	*Yes*	*Yes*
Industry dummies	*Yes*	*Yes*	*Yes*	*Yes*
No. of Obs.	347,858	347,858	347,858	347,856
No. of Firms	5,391	5,391	5,391	5,391
AIC	408783.5	408675.1	408821.9	408732.3
Log likeli.	−204340.7	−204283.6	−204360.0	−204312.2

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: For the calculation of the shared frailty survival models the Stata program xtlogit is used. ρ represents the estimated residual intraclass correlation of the latent responses (or between–firm heterogeneity).

Results point to a positive link between firm exit and product quality changes when the latter is proxied by relative export prices expressed in logs, as shown in the first row of Table 4. However, the coefficients in the succeeding rows, when relative prices are divided into quintiles, suggest that this relationship may be non-linear. Aiming for a quality range far above the mean lowers the probability of survival, while firms positioned in the quality niche just below the average leads to a significant fall in hazard rates.

Virtually all coefficients of the model variables are conssitent with the theory and are significant at $p < 0.001$. Higher exit rates are positively linked to m, proxied by ratio of Philippine population relative to that of its export partners, *rlpop*, and to the relative income parameter, *rlinc*: expected profits diminish as the size and the average income of the export market fall, thus leading to higher hazard rates. A real depreciation of the Philippine Peso, (i.e. higher *reer*) has a postive effect on export survival. Higher transport costs, or *iceberg*, as well as higher destination-specific tariff rates, on the other hand, lead to shorter exporting spells. With respect to variables linked to expected uncertainty, exchange rate variation, $unc(\tilde{e})$, is observed to have a positive and highly significant relationship with hazard rates. Uncertainty due to transport cost changes, $unc(\tilde{r})$, likewise have a positive, but insignificant effect. The same is true for the effect of uncertainty related to the foreign policy regime, $unc(\tilde{\tau}^*)$. Exporting spells are also more durable when products are traded on a consignment basis.

Empirical results of Table 4.4 lead to further comments. Using likelihood ratio tests to discern between the four models in Table 4, it is clear that we can reject the null hypothesis that one of the equations is the true model. Equation (4) is nevertheless preferred because the median price is less subject to outliers and quintiles better specify the non-linear contribution of product quality. Therefore it will the base equation for the extensions of the next table.

In Table 4.5, we further control for other firm-, destination-, and industry-specific characteristics or attributes. The additional effect of *R&D* is reported in column (1), showing that efforts to innovate are rewarded by a higher likelihood of firm survival. The effects of transport costs variation and distance is seen in column (2). As can expected, the estimated coefficients of higher transport costs and greater distance, measured separately, are positive, thus adding to the probability of exit. However, the interaction terms produce the opposite effect. Having higher transport costs relative to the median firm exporting the same product, to the same destination increases the hazard rates, but higher transport costs due to longer distance travelled do not negatively impact on survival; in fact, it raises the duration of exports.

Column (3) controls for firm-specific variables. Firms with more than 200 workers have lower hazard rates, as well as firms with prior trade experience, namely those that have previously exited and re-entered. Exporting a product for the first time have lower survival rates. Interestingly, exporting to a new destination increases survival, which hints to lower sunk costs when one exports to a new market, compared to when a new product is introduced.

Column (4) adds the impact of network effects, that is, the effect of being active in an export market populated by other Philippine firms. The negative coefficient indicates the presence of such network effects in improving the export performance of firms. The relationship of exit and consignment exports is likewise included. Contrary to the results in Table 4.4, *consign* carries a positive coefficient, so that the probability of survival is lower for exports produced in consignment basis. Firms active in this category typically produce under the more favourable conditions provided in export processing zones, hence, one would instead expect a higher survival rate. However, results here show that comparing firms with the same size and experience, those that export goods in this category have higher exit rates. These firms usually have higher foreign ownership and integrated in global production networks, so results suggest that there is a higher rate of product-destination turnover for these type of firms compared to those manufacturing under more standard circumstances.

4.5.2 Robustness Checks

Alternative specifications for key variables did not change the results of Tables 4.4 and 4.5. For example, $unc(\tilde{r})_{fpdt}$ stays insignificant when it is proxied instead by the difference in transport costs between the 75th and 25th percentile. Likewise, $unc(\tilde{\tau}^*)_{dt}$ stays insignificant as well when measured

Table 4.5: Extensions

	(1)	(2)	(3)	(4)
Relative price variable				
$rlxprice(1)_{md,fpdt}$	-0.057^{***}	-0.046^{***}	-0.046^{***}	-0.044^{**}
$rlxprice(2)_{md,fpdt}$	-0.078^{***}	-0.060^{***}	-0.060^{***}	-0.059^{***}
$rlxprice(3)_{md,fpdt}$	-0.023	0.001	-0.006	0.002
$rlxprice(4)_{md,fpdt}$	0.060^{***}	0.091^{***}	0.079^{***}	0.084^{***}
Model variables				
$lnrlpop_{dt}$	0.070^{***}	0.070^{***}	0.092^{***}	0.043^{***}
$lnrlipc_{dt}$	0.072^{***}	0.067^{***}	0.086^{***}	0.013
$reer_{d,t+1}$	-0.617^{***}	-0.567^{***}	-0.569^{***}	-0.635^{***}
$iceberg_{fpdt}$	0.530^{***}	0.635^{***}	0.391^{***}	0.368^{***}
$tariff^*_{d,t} - tariff_t$	0.580^{***}	0.522^{***}	0.806^{***}	0.549^{***}
$unc(\tilde{e})_{d,t+1}$	0.404^{***}	0.324^{***}	0.461^{***}	0.243^{**}
$unc(\tilde{r})_{fpdt}$	$0.107*$	0.061	0.058	$0.069*$
$unc(\tilde{\tau}^*)_{dt}$	-0.019	-0.003	0.017	-0.001
$R\&D_{it}$	$-0.360***$			
Destination variables				
$Trans(1)_{md,fpdt}$		0.174		
$Trans(2)_{md,fpdt}$		1.290^{***}		
$Trans(3)_{md,fpdt}$		1.401^{***}		
$lnDist$		$0.104***$		
$Trans(1)_{md,fpdt} \times lnDist$		-0.043^{**}		
$Trans(2)_{md,fpdt} \times lnDist$		-0.169^{***}		
$Trans(3)_{md,fpdt} \times lnDist$		-0.183^{***}		
Firm variables				
$Emp200_{ft}$			-0.105^{***}	-0.112^{***}
$Experience(1)_{fpd}$			-0.550^{***}	-0.508^{***}
$Experience(2)_{fpd}$			-0.808^{***}	-0.736^{***}
$FirstTimeProduct_{fpd}$			0.308^{***}	0.309^{***}
$FirstTimeDestination_{fpd}$			-0.411^{***}	-0.407^{***}
Industry variables				
$consign_{fpdt}$	$-0.161***$	-0.129^{***}	0.081^{*}	0.355^{***}
$lnNetworkEffects_{pd}$				-0.185^{***}
Constant	0.588^{***}	-0.159	0.688^{***}	0.754^{***}
Random Component				
$ln(\psi)$	-1.516^{***}	-1.240^{***}	-1.049^{***}	-1.015^{***}
ρ	0.063	0.081	0.096	0.099
Year dummies	*Yes*	*Yes*	*Yes*	
Industry dummies	*Yes*	*Yes*	*Yes*	
No. of Obs.	$275,100$	$347,856$	$347,856$	$347,856$
No. of Firms	$2,644$	$5,391$	$5,391$	$5,391$
AIC	326023.9	408220.2	401783.7	399788.4
Log likeli.	-162957.0	-204049.1	-200832.9	-199834.2

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ *Notes*: For the calculation of the shared frailty survival models the Stata program xtlogit is used.

by the gap between foreign bound and applied tariff rates. Other selection problems have included different structures of fixed effect. Besides the usual industry and time fixed effects, firms heterogeneity is finally captured by random effects that turned out to be parsimonious in terms of parameter estimates and supported by a significant variance ψ at $p < 0.001$.

4.5.3 Measurement of Product Quality

In the Nash equilibrium with intra-product trade described in (9)-(15), absolute quality levels depend on marginal costs of quality development, parameters that are difficult to come by at the firm level. In contrast, Proposition 2 solves for relative qualities as a function of relative export prices, information that is readily available in our database. This section therefore quantifies the mapping between the distribution of relative prices and that of firms' product quality and derive Philippine firms' export quality. Given this, we are able to display firms' relative quality levels among regions and across time and, ultimately identify the domains of the distribution of relative product qualities that lead to firms' export survival.

The analysis considers product quality for any given product for which intra-product trade exits. We first identify the median foreign firm, namely the firm registered in any specific destination (e.g., the USA) that charges the median export price to the Philippines. We then search for all Philippine firms that participate in this intra-product trade with the specific destination. These situations account for 187,676 observations, or about 55 percent of our sample. Let us introduce the subscript md to denote this median exporter to the Philippines. It is useful to adapt (15) to the dimensions of our data by adding subscripts and converting prices in the same currency:

$$\frac{q_{l;fpdt}}{q_{h;md,fpdt}} = 2\Omega_{fpdt}\frac{p_{l;fpdt}}{p^*_{h;md,fpdt}E\tilde{e}_{md,t}} \tag{4.23}$$

where firms' relative export quality $(q_{l;fpdt}/q_{h;md,fpdt})$ is proportional to the firms' relative $f.o.b$ price in foreign currency units. For any product p, the firms' export price $(p_{l;fpdt}/E\tilde{e}_{dt}\ )$ is expressed relatively to the import price $p^*_{h;md,fpdt}$ charged by the median exporter. Hence, a single firm f may export multiple product qualities to multiple destinations. This is consistent with the concept of flexible production (Eaton and Schmitt, 1994), that is, once firms invest in the necessary technology and organize their facilities to develop and produce one basic product, they can produce various downgrades of this basic product at no cost. The coefficient of proportionality depends also on all dimensions of our database:

$$\Omega_{fpdt} = \left(\frac{m_{md,t}U_{fpdt} + \lambda_{md,t}}{m_{md,t} + \lambda_{md,t}U^*_{md,fpdt}}\right)\left(\frac{U^*_{md,fpdt}E\tilde{e}_{md,t}}{U_{fpdt}}\right) \tag{4.24}$$

If $E\tilde{e}_{md,t}$ is assumed to be the actual nominal exchange rate between the Philippines and median country (index, base year 2005=100), all parameters in (25) are identifiable. For example, the various characteristics of the Philippine export firm are known, those of the median exporter to the Philippines as well. The proportion can therefore be computed using the information contained in our database.[18]

Equation (24) points out that relative quality is equal to relative prices multiplied by $2\Omega_{fpdt}$. Important for our paper is whether or not relative prices have a similar ranking as relative quality. If

[18]Our concepts of quality are related to those of Feenstra and Romalis (2014). It is clear from (9) that log quality is a fraction of log f.o.b prices as in their equation (18). Analogously, to isolate quality we would have to estimate the coefficient of proportionality from demands for product varieties and cost functions for quality. However, by taking relative prices as in (24), matters simplify as (25) can be computed using data for key variables.

Ω_{fpdt} does not alter the ranking then relative prices are a unbiased proxy for relative quality.

For the sake of illustration let us focus on bilateral transactions. The first step in the computations is to identify products for which intra–product bilateral trade exists. The export prices are matched to the corresponding bilateral median import prices in a given year t. When observations for the later are missing, its value is then interpolated by the median real value of the pooled sample of all observations for that product. Table 4.6 shows summary statistics on the variation in Ω_{fpdt}. The total number of export observations per destination are given in column (1). As already indicated, the USA is by far the largest export partner of the Philippines.

The value of Ω_{fpdt} varies across firms and over time. The 25^{th}, 50^{th} and 75^{th} percentiles of Ω_{fpdt} are displayed in columns (4), (5) and (6); the mean and standard deviation in column (7) and (8). The USA, Japan and China is notably higher than for the other destinations because of outliers. It is important to note that Ω_{fpdt} mainly contains variables that vary solely over time, except for two–way transport costs that differ across firms, products and destinations.

Table 4.6: Summary statistics of Ω_{fpdt} across firms in a given destination

	# obs. (1)	Min (2)	Max (3)	25^{th} P. (4)	50^{st} P. (5)	75^{st} P. (6)	Mean (7)	SD (8)
China	10,230	0.916	44.0	1.055	1.085	1.160	1.176	0.804
Hong Kong	18,111	0.038	4.2	0.929	0.960	0.976	0.945	0.068
Japan	37,122	0.209	69.7	0.915	0.943	0.966	0.945	0.522
Singapore	14,534	0.092	5.5	0.930	0.962	0.974	0.944	0.077
South Korea	10,131	0.290	2.4	0.858	0.883	0.904	0.879	0.064
Taiwan	13,463	0.170	1.2	0.884	0.906	0.920	0.897	0.046
Thailand	9,357	0.124	3.3	0.873	0.892	0.916	0.898	0.066
USA	74,728	0.004	279.7	0.912	0.940	0.972	0.949	1.156

Table 4.7 reports the rank correlation between the distribution of relative prices and the distribution of product quality. Rank correlations are very high, indicating that the ranking of relative prices is very similar to the ranking of quality. Hence, relative prices are a good indicator of relative quality in a bilateral setting. Even though this experiment does not extend directly to the full sample, the strength of the results at the very least makes a convincing claim for the use of relative prices as a proxy for relative quality, thereby validating our approach.

Lastly, Figures 4.4a and 4.4b display the bilateral distributions of relative quality at the beginning and end of the sample for the Philippine exports to the USA and South Korea. In both panels the value zero is crucial as it denotes that the relative quality is equal, namely that the median import quality and that of export are equal bilaterally. Both figures show that the relative bilateral quality of Philippine exports has decreased over time as the distribution shifts to the left.[19]

4.5.4 Marginal Effects on Exit Probabilities

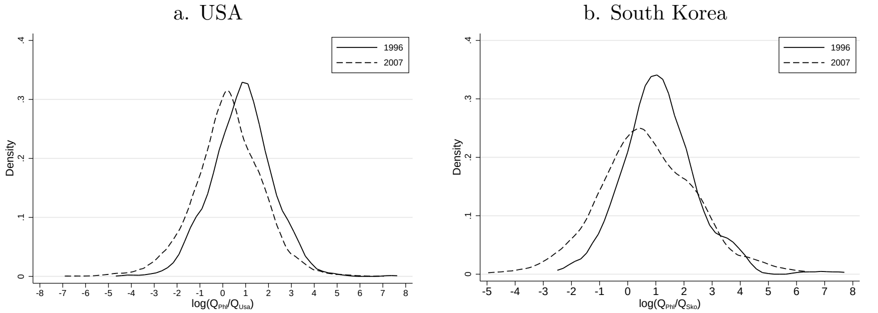
Marginal effects provide useful information regarding the relative response of the dependent variable to a change in a covariate. Table 8 quantifies these responses for two models in Tables 4 (columns 1 and 4) and two models in Table 5 (columns 1 and 4) that embed different specifications. All marginal effects are statistically significant at $p < 0.001$, except for the uncertainty in government policies that is never significant and that of transport cost whose p-values vary per specification.

[19]Similar conclusions can be reached for Thailand but other countries like China, Hong Kong, Taiwan, Thailand, Japan and Singapore show no change in the distribution of relative quality over time (see Appendix 4.D.1).

Table 4.7: Rank correlations between the distribution of prices and the distribution of qualities

	Spearman's ρ	Kendall's τ
China	0.995	0.961
Hong Kong	0.998	0.980
Japan	0.998	0.976
Singapore	0.997	0.976
South Korea	0.999	0.980
Taiwan	0.999	0.983
Thailand	0.999	0.979
USA	0.998	0.970

Figure 4.4: Distribution of bilateral relative quality



Notes: The Kernel used for the figures is Epanechnikov.

A number of clarifications will enhance the interpretation of Table 4.8. It is clear that models of Tables 4 and 5 measure the probability that a firm with a number of characteristics selects to stop exporting to a destination. Specifically, using specification (21), the estimated conditional probability is equal to:

$$\hat{P}[y_{gt} = 1] = \frac{1}{1 + e^{-(\mathbf{D}_{gt}\hat{\alpha} + \mathbf{X}_{gt}\hat{\beta})}} \tag{4.25}$$

where $\hat{\alpha}$ and $\hat{\beta}$ are vectors of estimates and $g = (f, p, d)$ groups the subscripts of the model, except time. Given (25), if variable $x_{j,gt}$ is continuous, its marginal effect on this conditional probability is equal to:

$$\frac{\partial\, \hat{\mathrm{P}}(y_{gt} = 1)}{\partial x_{j,gt}} = \hat{\beta}_j \left\{ \frac{e^{-(\mathbf{D}_{gt}\hat{\alpha} + \mathbf{X}_{gt}\hat{\beta})}}{\left[1 + e^{-(\mathbf{D}_{gt}\hat{\alpha} + \mathbf{X}_{gt}\hat{\beta})}\right]^2} \right\} \tag{4.26}$$

where $\hat{\beta}_j$ is the estimated parameter obtained in Table 4 or 5. The term in brackets is a scale factor that arises from the non-linearity of the logistic function. Its derivative is not constant and therefore approximated at a specific initial point.[20] Consider a standard deviation (SD) increase in continuous variables. Exporting to destinations with fewer potential consumers (*lnrlpop*) or with lower per capita incomes (*lnrlipc*) increases the likelihood of exit by 3.1% and 1.5% respectively, stressing the importance of demand. An 5.6% drop in the likelihood of exit is associated with a *SD* increase in the

[20]In this regard, a number of assumptions are made: (*i*) continuous explanatory variables take their mean values; (*ii*) for binary variables, the mean is a weighted average, weights being the proportions of the sample associated to each category; (*iii*) random effects are assumed to take their mean values, namely zero. The computed value of the scale factor hovers roughly between 0.22 and 0.30.

Table 4.8: Marginal Effects

	(4.1)	(4.4)	(5.1)	(5.4)
	Relative price variable			
	Mean (m)		*Median (md)*	
$lnrlxprice_{fpdt}$	0.007^{***}			
$rlxprice(1)_{fpdt}$		-0.014^{***}	-0.013^{***}	-0.010^{***}
$rlxprice(2)_{fpdt}$		-0.019^{***}	-0.0187^{***}	-0.014^{***}
$rlxprice(3)_{fpdt}$		-0.005	-0.005	0.00
$rlxprice(4)_{fpdt}$		0.014^{***}	0.014^{***}	0.019^{***}
	Model variables			
$lnrlpop_{dt}$	0.017^{***}	0.017^{***}	0.016^{***}	0.009^{***}
$lnrlipc_{dt}$	0.018^{***}	0.017^{***}	0.017^{***}	0.003
$reer_{d,t+1}$	-0.135^{***}	-0.135^{***}	-0.146^{***}	-0.145^{***}
$iceberg_{fpdt}$	0.099^{***}	0.086^{***}	0.125^{***}	0.084^{***}
$tariff^{*}_{d,t} - tariff_{t}$	0.124^{***}	0.125^{***}	0.137^{***}	0.125^{***}
$unc(\tilde{e})_{d,t+1}$	0.082^{***}	0.082^{***}	0.096^{***}	0.055^{***}
$unc(\tilde{r})_{fpdt}$	0.012	0.012	0.025^{***}	0.016^{*}
$unc(\tilde{\tau}^{*})_{dt}$	0.00	0.00	-0.004	-0.000
$R\&D_{it}$			-0.085^{***}	
	Firm variables			
$Emp200_{ft}$				-0.0256^{***}
$Experience(1)_{fpd}$				-0.118^{***}
$Experience(2)_{fpd}$				-0.175^{***}
$FirstTimeProduct_{fpd}$				0.070^{***}
$FirstTimeDestination_{fpd}$				-0.092^{***}
	Industry variables			
$lnNetworkEffects_{pd}$				-0.042^{***}

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ *Notes*: The column number stand for the table and column number of the corresponding regression of the marginal effects. Therefore the notation (4.1) stands for the marginal effect for the regression in table 1 column 1. For the calculation of the marginal effects the Stata program margins is used. The marginal effects are average partial effects and it is assumed that the random effect are equal to zero for the calculation.

number of Philippine firms exporting to a destination ($lnNetworkEffects$) reducing the asymmetric information problem. A sector whose number of firms performing R&D increases by a SD has a lower exit probability of about 1.1%. Other variables have marginal effects on entry/exit of about 1%.

Marginal effects of binary variables are easier to derive from Table 8. If variable $x_{j,gt}$ is a binary variable, the following discrete change is computed:

$$marginal\ effect\ of\ x_{j,gt} = \hat{P}(y_{gt} = 1; x_{j,gt} = 1) - \hat{P}(y_{gt} = 1; x_{j,gt} = 0) \tag{4.27}$$

It is the discrete change in conditional probability $\hat{P}(y_{gt} = 1)$ as binary variable $x_{j,gt}$ changes from 0 to 1, holding all other variables equal to their means. For example, switching to a high quality product ($rlxprice(4)$) increases the probability of exit by 1.9%. A $FirstTimeProduct$ increases the exit probability by about 7%; $FirstTimeDestination$ decreases the exit probability by 9.2%.

4.6 Conclusion

The objective of this paper was to promote our understanding of firms' export dynamics in emerging economies where local firms face stiff foreign competition, both at home and abroad. Particularly, we have presented and tested a model of vertical product differentiation where firms in different countries produce quality–differentiated goods for their local markets and, eventually, for exports. We explore the role of product quality in affecting this export performance as well as governmental decisions related to multiple uncertainties faced by exporters like exchange rate, freight and trade policies. Some of the conditions we have assumed are related to the firms R&D productivity in attaining specific product quality levels, the relative size of potential demands, and taste differences linked to income gaps. We have shown that the export price of local firms relative to foreign competitors is proportional to relative product quality, the coefficient of proportionality being related to composite measures of uncertainties faced by traders.

Empirically, the observed exit rates of Philippine exporting firms are high in the first three years. It is therefore not surprising that the estimated hazard function reveals a short duration of export spells, the mean being 20 months. Also firms with the highest survival rate in foreign markets are found to select a product quality contained in the interval between the median and mean of the international distribution of product quality. In contrast, those choosing a quality located at both ends of this distribution have the least chance of survival. Another empirical finding is the decrease in the relative quality of their products over time in foreign markets like South Korea, Thailand and the USA.

Of course, an important issue is to establish the policy relevance of the above results. In that regard, our findings raise the following question: is the argument by which the typical Philippine "laissez–faire" mechanism gives enough incentives for firms to compete on world markets desirable? Answers to this question have been diverse, but generally there seems strong evidence against (Hausmann and Rodrik, 2003) Instead, the current policy is to design market protection schemes to induce product quality leadership via R&D productivity and knowledge accumulation. In doing so, governments have traditionally used "industrial" policy instruments like the protection of property and the quality of institutions together with promotion agencies of trade and investment as well as antidumping policy to support local firms.

Though we are enthusiastic about our framework several important features could be considered in future research. We have already discussed the contribution of firm heterogeneity in explaining trade. However, our dataset can be further exploited to explain the characteristics of first time exporters, both in terms of products and of destinations. Also, so far our empirical analysis has not explicitly isolated cases where local firms become quality leaders on international markets. Combining the time dimension of our data using relative export prices with data on policy measures and characteristics of vertically differentiated products may allow for an empirical testing of causes and timing of quality reversals.

4.A Proofs of Major Propositions

Risk-Dominant Nash Equilibrium

Given the information given in the main text, we can fold the game backwards and write down as in Table A.1 the normal-form game at the choice-of-quality and export stage. It is important to note that payoffs are expressed in local units. Therefore, variables are pre- multiplied by $E\tilde{e} = \bar{e}$ when necessary:

Table A.1: Quality Strategy Profiles

		Foreign Firm	
		q_h & X	q_l & X
Home Firm	q_l & X	$R_l - \frac{cq_l^2}{2}, \bar{e}R_h - \frac{\bar{e}c^*q_h^2}{2}$	$-\frac{cq_l^2}{2}, -\frac{\bar{e}c^*q_l^2}{2}$
Home Firm	q_h & X	$-\frac{cq_h^2}{2}, -\frac{\bar{e}c^*q_h^2}{2}$	$\bar{e}R_h - \frac{cq_h^2}{2}, R_l - \frac{\bar{e}c^*q_l^2}{2}$

Let $G_{11} = R_l + \frac{c}{2}(q_h^2 - q_l^2)$ be the gains the domestic firm obtains by predicting correctly that the foreign firm will select equilibrium 1, $\{q_l \ \& \ X, q_h \ \& \ X\}$. Likewise, $G_{12} = \bar{e}R_h - \frac{c}{2}(q_h^2 - q_l^2)$ denotes the gains the domestic firm derives by forecasting correctly that the foreign firm will select equilibrium 2, $\{q_h \ \& \ X, q_l \ \& \ X\}$. Similarly, for the foreign firm we have: $G_{21} = \bar{e}R_h - \frac{\bar{e}c^*}{2}(q_h^2 - q_l^2)$ and $G_{22} = R_l + \frac{ec^*}{2}(q_h^2 - q_l^2)$ It is said that equilibrium 1 risk-dominates equilibrium 2 when $G_{11}G_{21} > G_{12}G_{22}$. Substitution implies:

$(R_l + \frac{c}{2}(q_h^2 - q_l^2))(\bar{e}R_h - \frac{\bar{e}c^*}{2}(q_h^2 - q_l^2)) > (\bar{e}R_h - \frac{c}{2}(q_h^2 - q_l^2))(R_l + \frac{\bar{e}c^*}{2}(q_h^2 - q_l^2))$

Define $Z = \frac{c}{2}(q_h^2 - q_l^2) > 0$ and $\gamma = \bar{e}c^*/c \geq 0$. Then: $(R_l + Z)(\bar{e}R_h - \gamma Z) > (\bar{e}R_h - Z)(R_l + \gamma Z)$ and $(\bar{e}R_h + R_l)(1 - \gamma) > 0$ This inequality holds whenever $\gamma < 1$ or $c > c^*E\tilde{e}$.

Trade Equilibrium

The derivation of the market equilibrium starts by taking the expected value (3) and (4) and inserting constraints (7) and (8):

$$
\begin{aligned}
E\tilde{\pi} &= p_l(D_l + D_l^*) - \frac{c}{2}q_l^2 \\
E\tilde{\pi}^* &= p_h^*(D_h + D_h^*) - \frac{c^*}{2}q_h^2
\end{aligned}
\tag{A.1}
$$

Using the pair of demands in (1) and (2), taking expected values U,U^* and quality choices (q_l, q_h) as given, the problem of the domestic firm consists of finding p_l so as to maximize $E\tilde{\pi}$ in (A.1). On the other hand, the rival foreign firm chooses p_h to maximize its profits $E\tilde{\pi}^*$in (A.1). Solving the pair of reaction functions in prices, we obtain the subgame equilibrium prices of the two variants given in (9).

Consider now firms quality selection. In this second stage, firms take expected values U,U^* as given, anticipate the equilibrium prices of the continuation game obtained in (9), and choose their qualities to maximize reduced-form profits. Particularly, the domestic firm chooses q_l, and the foreign firm q_h to respectively maximize:

$$
\begin{aligned}
E\tilde{\pi} &= \frac{\lambda\bar{\theta}(m+1)^2}{(m+\lambda/U)} \frac{(q_h^2 q_l - q_l^2 q_h)}{(4q_h - q_l)^2} - \frac{c}{2} q_l^2 \\
E\tilde{\pi}^* &= \frac{4\lambda\bar{\theta}(m+1)^2}{(m/U^* + \lambda)} \frac{(q_h^3 - q_l q_h^2)}{(4q_h - q_l)^2} - \frac{c^*}{2} q_h^2
\end{aligned}
\tag{A.2}
$$

First order conditions from the maximization of reduced-form profits (A.2) lead to the reaction functions in qualities, $q_l(q_h)$ and $q_h(q_l)$. A subgame perfect equilibrium in qualities is obtained as the solution of these two curves, namely (13) and (14). The ratio of (13) and (14) gives the third degree polynomial from which we can solve for μ in (12). After substitution we can further characterize the market equilibrium by computing, for example, world demands for goods in (10) and (11) and country demands in (15) and (16).

Computation of Nash equilibria

Let X and NX denote an exporting and non-exporting strategy respectively. The game played by the two firms is summarized in Table A.2. In each cell, $R(R^*)$ is a shorthand notation for expressions representing the expected revenues for the home (foreign) firm under four strategies $(s^{11}, s^{12}, s^{21}, s^{22})$. Simple expressions in the table represent monopoly profits when one firm selects itself as a non-exporter. To shorten expressions, we do not write the corresponding fixed costs of quality because they are similar across strategies.

Table A.2: Quality Strategy Profiles

		Foreign Firm	
		q_h & X	q_l & X
Home Firm	q_l & X	$E\tilde{R}_l(s^{11}), E\tilde{R}_h^*(s^{11})$	$E\tilde{R}_l(s^{12}), E\tilde{R}_h^*(s^{12})$
	q_l & NX	$E\tilde{R}_l(s^{21}), E\tilde{R}_h^*(s^{21})$	$\frac{\bar{\theta}\lambda m q_l}{4}, \frac{\bar{\theta} q_h}{4}$

- s^{11}: under this strategy profile, the domestic firm continues to select the low-quality product and exports it to the foreign country; meanwhile the foreign firm chooses the high-quality product and exports it to the home country.
- s^{12}: under this strategy profile, the foreign firm selects the high-quality product but chooses to strategically exit the domestic market; meanwhile the home firm continues to choose the low quality and exports it to the foreign market. The home firm is a monopolist at home.
- s^{21}: under this strategy profile, the domestic firm continues to pick the low-quality product but chooses to strategically exit the foreign market; meanwhile the foreign firm continues to choose high quality and exports it to the foreign market. The foreign firm is a monopolist in its own market.
- s^{22}: under this strategy profile, both firms pick their own quality but choose to strategically exit the export market. By doing so, both become monopolists in their respective local markets.

From the trade equilibrium, it is straightforward to determine the corresponding expected revenues: $E\tilde{R}_l(s^{11}) = \left[\frac{\lambda\bar{\theta}(m+1)^2}{m+\lambda/U}\right] \frac{\mu(\mu-1)q_l}{(4\mu-1)^2}$ $E\tilde{R}_h^*(s^{11}) = \left[\frac{4\lambda\bar{\theta}(m+1)^2}{\lambda+m/U^*}\right] \frac{\mu(\mu-1)q_h}{(4\mu-1)^2}$ To obtain revenues under strategy s^{21} start by writing down profit functions:

$$E\tilde{\pi} = p_l D_l - \frac{c}{2} q_l^2$$
$$E\tilde{\pi}^* = U^* p_h D_h + p_h^* D_h^* - \frac{c^*}{2} q_h^2$$

or

$$E\tilde{\pi} = p_l m \left\{ \frac{p_h - p_l}{\lambda\bar{\theta}(q_h - q_l)} - \frac{p_l}{\lambda\bar{\theta} q_l} \right\} - \frac{c}{2} q_l^2$$
$$E\tilde{\pi}^* = U^* p_h m \left\{ 1 - \frac{p_h - p_l}{\lambda\bar{\theta}(q_h - q_l)} \right\} + p_h^* \left\{ 1 - \frac{p_h^*}{\bar{\theta} q_h} \right\} - \frac{c^*}{2} q_h^2$$

In this case, the strict imposition of anti-dumping constraints (7) and (8) is too restrictive because the foreign firm has a monopoly in the production of high quality in its own market. Instead we determine the parameter space such that these above two conditions are verified. Reproducing the steps of Proposition 2, we obtain the following key solutions for prices: $p_l = \frac{\lambda\bar{\theta} q_l(\mu-1)}{(4\mu-1)}; p_h = \frac{2\lambda\bar{\theta} q_h(\mu-1)}{(4\mu-1)}$ Given these, domestic and foreign demands are computed and revenues derived:

$$E\tilde{R}_l(s^{21}) = \frac{\lambda\bar{\theta} m q_l(\mu-1)\mu}{(4\mu-1)^2}$$
$$E\tilde{R}_h^*(s^{21}) = \frac{U^* 4m\lambda\bar{\theta} q_h \mu(\mu-1)}{(4\mu-1)^2} + \frac{\bar{\theta} q_h}{4}$$

Similarly for strategy s^{12}:

$$E\tilde{R}_l(s^{12}) = \frac{m\lambda\bar{\theta} q_l}{4} + \frac{U\bar{\theta} q_h(\mu-1)}{(4\mu-1)^2}$$
$$E\tilde{R}_h^*(s^{12}) = \frac{4\bar{\theta} q_l(\mu-1)\mu^2}{(4\mu-1)^2}$$

There are three Nash equilibria in the export-quality game of Table A.2, strategy s^{22} being dominated by the other strategies. To establish when s^{11} is a Nash equilibrium in Proposition 2, it is sufficient to compare $E\tilde{R}_l(s^{11}) > E\tilde{R}_l(s^{21})$ and $E\tilde{R}_h^*(s^{11}) > E\tilde{R}_h^*(s^{12})$. Particularly, $E\tilde{R}_l(s^{11}) > E\tilde{R}_l(s^{21})$if and only if the following condition is satisfied:

$$U > \lambda \frac{m}{(2m+1)} \tag{A.3}$$

Likewise $E\tilde{R}_h^*(s^{11}) > E\tilde{R}_h^*(s^{12})$ if and only if:

$$\frac{1}{U^*(m+2)} < \lambda \leq \frac{2U(\mu-1)}{(4\mu-1)} \tag{A.4}$$

This is a Nash equilibrium where all firms export while satisfying the anti-dumping constraint of the WTO.

Exit Conditions

To illustrate how exit conditions matter in the model, we focus on the other two strategies, namely $s^{21}$and s^{12}. Let us first consider strategy profile $s^{21} = \{q_l \;\&\; NX, q_h \;\&\; X\}$ as it is the one leading to home firms export exit and eventually re-entry. To establish when s^{21} is a Nash equilibrium, it is sufficient to compare $E\tilde{R}_h^*(s^{21})$ with $\bar{\theta} q_h/4$ and $E\tilde{R}_l(s^{21})$ with $E\tilde{R}_l(s^{11})$. Therefore $E\tilde{R}_l(s^{21}) > E\tilde{R}_l(s^{11})$ if and only if the following condition is satisfied:

$$U < \frac{(\lambda m)}{2m+1}$$

which is inequality (17) in the text. This condition is always satisfied for $U \to 0$. More generally, an equivalent expression can be derived:

$$m(2U - \lambda) + U < 0$$

and thus $U < \lambda/2$ is the necessary condition for (17) to be verified. Similarly, $E\tilde{R}_h^*(s^{21}) > \bar{\theta} q_h/4$ if and only if:

$$\frac{U^* 4m\lambda\bar{\theta}(\mu-1)\mu q_h}{(4\mu-1)^2} > 0$$

which is always satisfied as long as $U^* > 0$. In addition the anti-dumping constraint for the foreign firm must be imposed. Namely, $U^* p_h \geq p_h^*$ implies:

$$\frac{1}{\lambda}\frac{(4\mu-1)}{4(\mu-1)} \leq U^*$$

which is inequality (18). As both ratios on the LHS are larger than unity, U^* must be larger than 1 as well. Existence conditions for the other strategy are computed in a similar way. Strategy profile $s^{12} = \{q_l \ \& \ X, q_h \ \& \ NX\}$ is the one leading to foreign firms export exit and re-entry. To establish when s^{12} is a Nash equilibrium, it is sufficient to compare $E\tilde{R}_l(s^{12}) > \bar{\theta}\lambda m q_l/4$ and $E\tilde{R}_h^*(s^{12}) > E\tilde{R}_h^*(s^{11})$. Therefore $E\tilde{R}_l(s^{12}) > \bar{\theta}\lambda m q_l/4$ if and only if the following condition is satisfied:

$$\frac{U\bar{\theta}(\mu-1)q_h}{(4\mu-1)^2} > 0 \tag{A.5}$$

which requires $U > 0$. Likewise $E\tilde{R}_h^*(s^{12}) > E\tilde{R}_h^*(s^{11})$ if and only if:

$$\lambda \leq \frac{2U(\mu-1)}{(4\mu-1)} \tag{A.6}$$

Moreover the anti-dumping constraint is satisfied if and only if:

$$\lambda < \frac{1}{U^*(m+2)} \tag{A.7}$$

(A.7) determines the parameter space such that anti-dumping conditions are verified. Intuitively, though the home firm applies its monopoly price, it satisfies the WTO constraints only when the home country is relatively poor, namely for small values of λ.

4.B List of Destinations

The 181 destinations are: Afghanistan, Algeria, Angola, Antigua and Barbuda, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brunei, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Spain(including the destinations Canary Islands, Ceuta and Melilla) , Cape Verde, China, Christmas island, Colombia, Comoros, Congo, Democratic republic of Congo, Costa Rica, Ivory Coast, Croatia, Cuba, Cyprus, Czech republic, Denmark, Dominican republic, Ecuador, Ethiopia, Fiji, Finland, France (including the destinations Mayotte and Reunion), Gabon, Gambia, Georgia, Ghana, Greece, Grenada, Guadeloupe, Guatemala, Guinea, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan (including the destinations Okinawa and other Nansei islands), Jordan, Kazakhstan, Kenya, South Korea, Kuwait, Kyrgyzstan, Laos, Latvia, Leeward and Windward islands, Lesotho, Libya, Lithuania, Luxembourg, Macau, Macedonia, Madagascar, Malawi , Malaysia (including Sabah and Sarawak), Maldives, Mali, Malta, Martinique, Mauritania, Mexico, Monaco, Mongolia, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pacific trust territory, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Poland, Portugal (including the destinations Azores and Madeira), Qatar, Romania, Russia, Rwanda, Saudi Arabia, Senegal, Seychelles, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Sri Lanka, St. Lucia, St. Vincent and Grenadines, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, Taiwan, Tajikistan, Tanzania, Thailand, Tonga, Trinidad and Tobago, Tunisia, Turkey, Uganda, UK, Ukraine, USA (including the destinations Guam, Midway Islands, U.S minor outlying islands, Northern Mariana islands, Hawaii and Alaska), Uruguay, Vanuatu, Vietnam, Virgin Islands (British), Virgin Islands (U.S.), Yemen, Zambia and Zimbabwe.

4.C Variable definitions

Table 4.C.1: Data Sources and Methods

Variable Name	Description	Formula and notes	Sources
$rlpop_{d,t}$	Philippine (h) population as a ratio of population of destination d	$\frac{POP_{h,t}}{POP_{d,t}}$	World Bank WDI, WPT (World Penn Table) 7.1, Statistics Bureau of Japan, INSEE, EUROSTAT and U.S Census Bureau.
$rlipc_{d,t}$	Philippine income per capita as a ratio of income per capita of destination d	$\frac{GDPpc_{h,t}}{GDPpc_{d,t}}$	World Bank WDI, WPT 7.1
$reer_{d,t+1}$	The percentage change in the real bilateral exchange rate expressed as real pesos per unit of real destination currency from t to $t+1$.	$reer_{d,t+1} = \left(\frac{RX_{t+1}-RX_t}{RX_t}\right)$; $RX_t = \frac{\left(\frac{Xrate_{h,t}}{CPI_{h,t}}\right)}{\left(\frac{Xrate_{d,t}}{CPI_{d,t}}\right)}$	World Bank WDI, WPT 7.1
$iceberg_{f,p,d.t}$	US$ unitary transport cost as a proportion of received US$ export price by firm f for product p to destination d	$\left(\frac{Tk_{fpdt}}{Pk_{fpdt}+Tk_{fpdt}}\right)$ Tk_{fpdt} - Transport cost per kilo Pk_{fpdt} - f.o.b price per kilo	World Bank WDI, WPT 7.1
$tariff^*_{d,t}$	Simple average of applied tariffs in destination d		World Bank WDI
$unc(\tilde{e})_{d,t+1}$	Rolling coefficient of variation of the nominal pesos per unit of destination currency (rolling window of 5 years $t-3$ till $t+1$)	$unc(\tilde{e})_{d,t+1} = \frac{\sigma_{t+1}}{\mu_{t+1}}$ $\sigma_{t+1} = \frac{1}{4}\sum_{i=t-3}^{t+1}(y_i - \mu_{t+1})^2$ $\mu_{t+1} = \frac{1}{5}\sum_{i=t-3}^{t+1} y_i$	WPT 7.1
$unc(\tilde{r})_{f,p,d,t}$	The medium percentage change in transport costs of all products that are exported by firms in both periods $t-1$ and t to destination d.	$unc(\tilde{r})_{f,p,d,t} = Med(\Delta Tk_{11d,t}, \Delta Tk_{1pd,t}, \ldots$ $\ldots, \Delta Tk_{fpd,t})$ $\Delta Tk_{fpd,t} = \frac{Tk_{fpd,t}-Tk_{fpd,t-1}}{Tk_{fpd,t}}$	PSA Customs Data

Continued on next page

Table 4.C.1 continued

Variable Name	Description	Formula and notes	Sources
$Network-effects_{p,d,t}$	The log of the number of Philippine exporters exporting a certain product (7-digit Pscc) to a destination.	$Networkeffects_{p,d,t} = \#Ex_{p,d,t}$ $\#Ex_{p,d,t}$ - Number of exporters	PSA Customs Data
$unc(\tilde{\tau}^{*})_{d,t}$	Index of rule of law coefficient (normalized) of destination relative to that of the Philippines.	$unc(\tilde{\tau}^{*})_{d,t} = \frac{NRoL_{h,t}-NRoL_{d,t}}{NRoL_{h,t}}$ $NRoL_{d,t} = \frac{(RoL_{d,t}-min(RoL_t))}{(max(RoL_t)-min(RoL_t))}$	Worldwide Governance Indicators
$R\&D_{i,t}$	The percentage of firms within a 5-digit PSIC section that respond in the manufacturing survey that it invests in R&D. Therefore 1 indicates that all the firms with a 5-digit PSIC section (i) that responded to the survey indicated that they invested in R&D.	$R\&D_{i,t} = \frac{nrd_{it}}{N_{it}}$ nrd_{st}=Number of firms in i investing in R&D at time t N_{st}=Total number of firms in i at time t	PSA Survey data
$Dist_d$	The natural logarithm of the great circle distance between the capital city of the Philippines and that of the respective destination. If the destination had no capital city then the largest city is taken.	$ln(Dist_d)$	CEPII, Geodist database, variable: *distcap* Supplemented with own caluclations using http://www.movable-type.co.uk/ great circle distance latitude longitude scrips
$Emp200_{ft}$	Dummy variable takes value 1 when a firm has 200 or more employees. Data is obtained from the PSA manufacturing survey and interpolated for missing observations. The certainty stratum of the national survey is also used. If a firm was not surveyed then that firm had at least fewer than 200 employees		PSA Survey data

Continued on next page

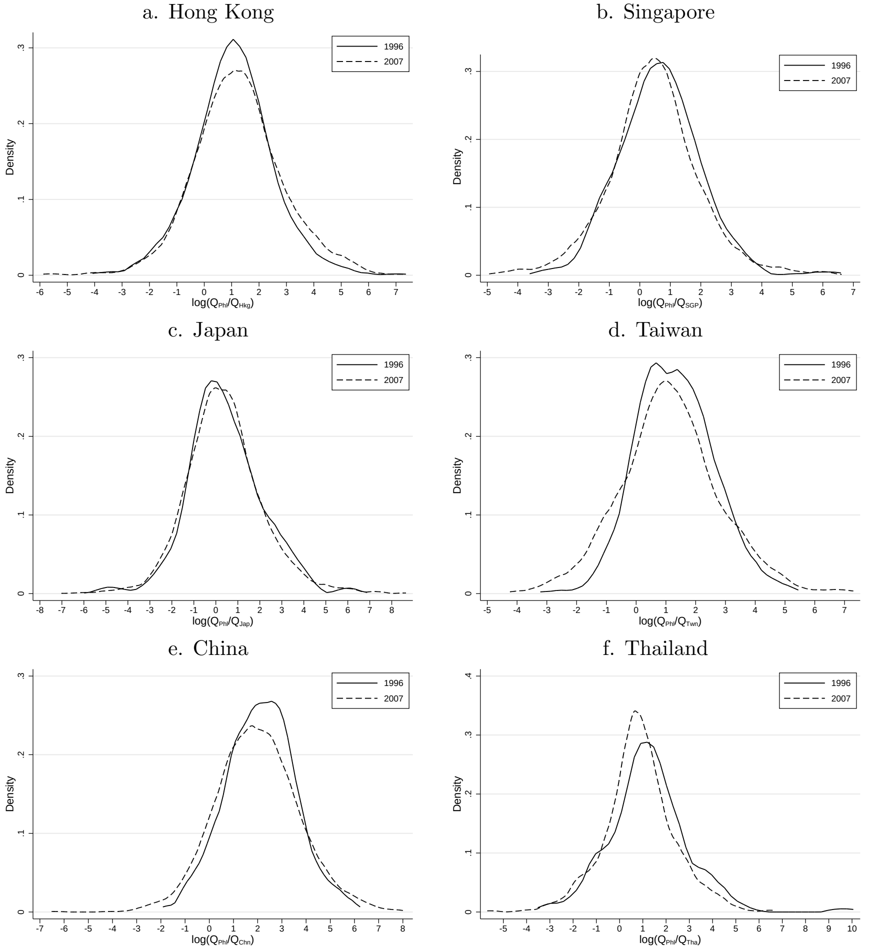
Table 4.C.1 continued

Variable Name	Description	Formula and notes	Sources
$rlxprice_{md,fpdt}$	US$ price of firm f exporting product p to destination d at time t relative to the *median* US$ price of the same product imported into the Philippines.$^{(i)(ii)}$	$ln\left(\frac{xprice_{fpdt}}{Med(mprice_{pt})}\right)$	PSA customs data
$rlxprice_{m,fpdt}$	US$ price of firm f exporting product p to destination d at time t relative to the *mean* US$ price of the same product imported into the Philippines.$^{(i)(ii)}$	$ln\left(\frac{xprice_{fpdt}}{Mean(mprice_{pt})}\right)$	PSA customs data
	Industry Dummies		
$Ind(1)$	Dummy variables takes the value 1 product is in PSCC section 0; 0 otherwise.		
$Ind(2)$	Dummy variables takes the value 1 product is in PSCC section 1; 0 otherwise.		
$Ind(3)$	Dummy variables takes the value 1 product is in PSCC section 2; 0 otherwise.		
$Ind(4)$	Dummy variables takes the value 1 product is in PSCC section 3; 0 otherwise.		
$Ind(5)$	Dummy variables takes the value 1 product is in PSCC section 4; 0 otherwise.		
$Ind(6)$	Dummy variables takes the value 1 product is in PSCC section 5; 0 otherwise.		
$Ind(7)$	Dummy variables takes the value 1 product is in PSCC section 68 + 667; 0 otherwise.		
$Ind(8)$	Dummy variables takes the value 1 product is in PSCC groups 971 ; 0 otherwise.		
$Ind(9)$	Dummy variables takes the value 1 product is in PSCC divisions 61 + 63 + 64 + 65 + 66; 0 otherwise.		
$Ind(10)$	Dummy variables takes the value 1 product is in PSCC divisions 67 + 69; 0 otherwise.		
$Ind(11)$	Dummy variables takes the value 1 product is in PSCC division 62; 0 otherwise.		
$Ind(12)$	Dummy variables takes the value 1 product is in PSCC groups 785 + 786 + 791 + 703 ; 0 otherwise.		
$Ind(13)$	Dummy variables takes the value 1 product is in PSCC groups 71 + 72 + 73 + 74 + 77-776 + 781 + 782 + 783 + 784 ; 0 otherwise.		
$Ind(14)$	Dummy variables takes the value 1 product is in PSCC groups 75 + 776 + 76 + 792 ; 0 otherwise.		
$Ind(15)$	Dummy variables takes the value 1 product is in PSCC groups 82 + 83 + 85 + 894; 0 otherwise.		
$Ind(16)$	Dummy variables takes the value 1 product is in PSCC groups 895 + 899 + 892 + 897 + 898 + 896; 0 otherwise.		
$Ind(17)$	Dummy variables takes the value 1 product is in PSCC groups 893 ; 0 otherwise.		
$Ind(18)$	Dummy variables takes the value 1 product is in PSCC groups 87 + 88 + 891 ; 0 otherwise.		
$Ind(19)$	Dummy variables takes the value 1 product is in PSCC groups 971 ; 0 otherwise.		
$consign_{fpdt}$	Dummy variables takes the value 1 product is in PSCC groups 93101 + 93102 ; 0 otherwise.		

Notes: (i) The imported median (mean) price is calculated from the universe of import data. If there is no corresponding median (mean) import price at time t then the median (mean) over all the time periods for that product category is used as a proxy for the imported median (mean) at time t. As not all products are imported every year.; (ii)Most consignment goods have no direct corresponding import category in terms of product code. There are, however, 13 extra consignment products, consisting of clothing, footwear, gloves and mittens, brassieres, semi–conductors and watches, that could be added due to matching to corresponding products not made on consignment basis. For example Women's wear manufactured on consignment basis could be matched to clothing articles not manufactured on consignment basis. (Mostly PSCC categories 842 and 844) The median (mean) of the import prices of these corresponding products were used as proxies for the consignment goods. (iii) The strategy for missing data for variables is replaced it by the most recent observation. If data is missing frequently the observation is dropped. (iv) The industry dummies are the interaction term between PSCC first digits (sections) and the Product class classification of the UNCTAD.

4.D Distribution of bilateral relative quality

Figure 4.D.1: Distribution of bilateral relative quality



Notes: All observations for which there is a match between the median import and export product are included in the sample. The imported median price is calculated from the universe of bilateral import data. If there is no corresponding real median import price at time t for product i then the median over all the time periods for that product is used as a proxy for the imported median at time t. As not all products are imported every year. The Kernel used for the figures is Epanechnikov.

Chapter 5

Change, Yes They Can!

5.1 Introduction

Hausmann et al. (2006) stress that what a country exports matters; when countries export the products that rich countries export then this will foster economic growth and development. This paper focuses on a fundamental issue that is presupposed in Hausmann et al. (2006) and that is whether or not firms change export products and even more important how they change export products over time?

In order to observe change an (initial) specific skill set has to be defined from which a firm can change. In this paper the skill set is revealed by the "Core competency" product of a firm. The term "Core competency" originates from the theoretical literature initially developed by Eckel and Neary (2010) in which it is assumed that each firm has a product which it can produce most efficiently, the "Core competency" product.[1] Therefore, in line with this theoretical literature, it is assumed that the core competency of a firm is revealed by the main export product, in terms of yearly export revenue.[2] A firm will, always, want to make the products that it can produce efficiently enough in order to sell without a loss and preferably with a profit. This is especially true when referring to products sold on the international market as competition is even fiercer. The main export product therefore embodies the "Core competency" of a manufacturing firm.[3] Focusing on the main export product is a relatively minor simplification as the main export product dominates the exports sales and should therefore embody the main skills of a manufacturing firm while avoiding issues with export products that are not produced by the firm (i.e Carry–along trade).

If the core competencies of firms are fixed over time then firms will keep exporting the same or related main products and this should lead to small changes. If on the other hand firms adjust their core competency over time than greater changes can be expected in main export products. Take, for example, an textile producing exporter that at first exports shirts for men as the main export product but over time switches to womens shirts. Even though there is a change in main export product the firm itself has, most likely, made very little adjustments over time in terms of core competency. However if this same firm has gone to exporting high end shoes then the firm has, most likely, made adjustments in core competency. Now if this same firm starts exporting simple electronic products

[1] A firm can produce other products however with declining efficiency.

[2] I refer to one- two-, four- and 7-digit PSCC (Philippine Standard Commodity Classification) categories as "sector", "division" "industries," and "products" . This classification corresponds until 5 digits to the SITC rev. 3 classification.

[3] The main export product switches are of course a simplification of the changes that occur within a firm. It could be the case that the firm has upgraded within the same product category. This type of change would not be captured in the switching analysis. However given the level of detail, 7-digit level categories, product changes will quickly be captured.

then clearly changes have been made in core competency.

The importance of export product switching was signified by Bernard et al. (2010). However the export product switching analyzed in Bernard et al. (2010) refers to the adding and dropping of products over time (i.e A change in the product mix). Timoshenko (2015) continues with this product mix analysis and finds, apart from similar results as Bernard et al. (2010), that changes in the product mix depend on exporter age. This gives a dynamic view of exporters where they add and drop products to their export mix over time. Cross section evidence that the ranking of products is almost unaltered over the destinations to which firms export seem to indicate a more static view where firms are centered around their main export product. (see Arkolakis and Muendler (2010) and Mayer et al. (2014)) The findings of Arkolakis and Muendler (2010) and Mayer et al. (2014) are in line with the core competence model that predicts that the closer the product is to the core competence product the more a firm will export of it as it can be produced more efficiently. On one side there is evidence that products are added and dropped and on the other side evidence that more important products are very stable and dominate the sells of a firm in a export market. These two empirical facts seem to contradict. However they could be corroborated under the idea that main products or products close to the core competency do not (frequently) change and that it are the less important products or products further away from the core competency that are more likely to be dropped and added over time. The data used in this paper finds similar empirical results as found in Mayer et al. (2014) and Timoshenko (2015). However this paper also finds that the main product also switches frequently.

In fact in 34.4% of the firm-year observations firm main product changes occur.[4] The highest digit change of the 7-digit PSCC classification can be used as a quick and dirty measure for the extent to which firms change in core competency after a main product switch. The higher the highest digit change, after a main product switch, the greater the difference between the two products.[5] It can be observed that most changes occur in the 1^{st} digit level which potentially indicates major changes in core competencies of firms.[6] What do these changes in main products reflect?

Do changes in main product reflect changes in core competencies due to, for example, innovation? This does not seem very likely as R&D in Middle–Income countries is often scarce. The World Bank development indicators show that for 2007 R&D expenditure is equal to 0.1% of the GDP for the Philippines; which even by Middle–Income country standards is low.[7] The model of Aghion and Howitt (1992) and Acemoglu et al. (2006) show that the relationship between competition and innovation depends on the distance of the product to the world technology frontier. Therefore it might not be optimal for firms in Middle–Income countries to innovate as many firms are not located on this frontier. The fact, however, that firms do change main product over time does indicate that adjustments are made. The question is what type of adjustments? This paper focuses on main product switching which is, as previously argued, a frequent phenomenon and therefore must have economic rational.

[4]82.9% of the main product changes happen within the same export spell of a firm. Where a spell is defined as the uninterrupted length of time that a firm exports.

[5]If the highest digit change is the 7^{th} digit then most likely little has changed while when the highest change is at the 1^{st} digit one might expect larger changes in core competencies for the firm.

[6]36.9% of the highest digit changes occur in the first digit of the PSCC product code. While only 8.2% of the highest digit changes occur in last digit on the product code.

[7]The average R&D expenditure as a percentage of GDP for Middle–Income countries in 2007 is 0.9%.

5.2 Literature Review

Bernard et al. (2010) signified the importance of product switching. However the product switching that has been analyzed refers to the adding and dropping of products to the total number of products exported; basically referring to a change in the product mix. This paper however defines product switching as a main product switch for the firm. A change indicating that, for some reason, the previously most important export product is not the most important export product any more. This seems a more appropriate definition of product switching as a firm adding one small insignificant product to the export list will be dubbed as a product switching firm in the previous literature while in this analysis the main export product of a firm has to change. The focus on the main product also avoids issues with Carry–Along Trade. Bernard et al. (2012) uncover this phenomena for Belgium manufacturing firms and find that more than $\frac{3}{4}$ of the exported products and more than $\frac{1}{4}$ of the export value are in products that are not produced by the firm. This Carry–Along trade could therefore, to a certain extent, explain the trend in adding and dropping of products of firms over time. However this Carry–Along trade would have a harder time explaining changes in the main product over time as manufacturing firms are more likely to be involved with the production of the main export product. The fact that the main export product dominates the export sales and that main product switching is quite frequent signifies the importance.

Timoshenko (2015) shows that both added and to–be–dropped products account for, on average, 29% of the export revenue for firms in Brazil. However this percentage differs by exporter age; for firms with two years of exporting added products account for 51% while firms with 5 years of experience derive 28% of their exports from added products. Timoshenko (2015) also shows that product mix changing is frequent as, on average, 72% of the firms change their product mix in a given year. Bernard et al. (2010) find that recently added and about–to–be dropped products each account for roughly $\frac{1}{6}$ of a producer's output, 54% of the manufacturing firms alter their mix every five year and 40% of the firms added products outside their existing set of four–digit SIC industries between census years. Especially the fact that relatively unrelated products account for a large part of the added products seems to hint on Carry–along trade driving, at least part of, the results.

The narrower the product classification the more frequent product switching will occur. This paper uses 7–digit PSCC classification changes while Bernard et al. (2010) analyze 5-digit SIC (Standard Industrial classifications) product mix changes per 5 years and Timoshenko (2015) analyze 6–digit HS (Harmonized tariff system) changes. Even though the product classification is broader (i.e less specific) for the other authors they nonetheless also point out that product switching is frequent, widespread and influential.

Bernard et al. (2010) stipulate three broad categories for possible alternate explanations for explaining the facts they uncover. The first category are explanations that focus on factors that are specific to products but common to all firms. (i.e relative demand) The second class of explanations focuses on factors that are specific to firms but uncommon to products. (i.e firm productivity) The third class focuses on firm–product attributes in influencing product switching. In the last class the model of Bernard et al. (2010) falls. The model Bernard et al. (2010) propose has both idiosyncratic shocks to firm productivity and firm–product demand that fosters both the selection of firms and that of products within firms.

The focus on the main product of this paper is related to the "Core competency" literature that is initially developed by Eckel and Neary (2010). The authors assume that each firm has a product that it can produce most efficiently also called the "Core competence". A firm can produce other products with declining efficiency. The inefficiency in the model translates into higher marginal labor requirements. In the framework of Eckel and Neary (2010) a firm produces less of each variety the further it is from its core competence. Which implies a direct link between quantity produced and the efficiency with which the firm can produce the product. Therefore the core competence product is by definition the product that the firm produces the most and generates the highest revenue. In this framework a firm will stop producing the less efficient varieties before it stops producing the core competence. Therefore main product switches will not frequently occur. Both Mayer et al. (2014) and Arkolakis and Muendler (2010) use the notion of "Core competency" which assumes that the firms' productivity declines in the rank of its products which is in line with their findings. Mayer et al. (2014) finds that variation in the toughness of competition causes firms to increase the relative share of better performing products as there is a downward shift in the distribution of markups. Using cross section data Mayer et al. (2014) find that ranking of products is almost unaltered over different destinations only the number of products exported changes. Implying that the firms' main product in terms of export revenue is also the main product in the destination to which a firm exports. Arkolakis and Muendler (2010) document that within firms and destination, exports are concentrated in a few top-selling products and that firms that export many products (wide–scope exporters) sell small amounts of their lowest–selling products.

"Core competency" literature predicts that firms will not quickly change main product as it is the product that the firm can produce most efficiently. If shocks happen other less efficiently produced products will be dropped before the main product is dropped from the existing export range. However the fact that the main export product does change over time seems at odds with the results of the "Core competency" literature and could imply the following: Firstly it could simply be due to the fact that the core competency changes over time. In the framework of Eckel et al. (2015) quality upgrading is deemed most likely to happen in the products that are closest the firms' core competency.[8] Therefore changes within the main product over time could be due to quality upgrading that takes place within a firm and is often centered around the core competence. However given the frequency of main product changes this is not likely to be the whole story. Secondly it might be the case that the firms' core competence are less fixed in one product. Instead the firm has a core competence that applies to a group of products leading to more frequent switches of main product without the firm changing its core competence. Then demand side shocks (e.g transient firm–destination–year preference shocks and firm–destination appeal) could lead to changes in the main product exported over time. Thirdly it could be the case that the "Core competence" is less well known to smaller/younger exporters and therefore main product switching is more frequent as self discovery takes place. While older/larger exporters are less likely to switch main product over time and when they change they change to products that are related to their previous main product. This is in line with Timoshenko (2015) who finds that the share of added and dropped products decreases with exporter age. Timoshenko (2015) underpins his findings with a demand learning model. This model implies that older exporting firms know better what the true appeal of their products are than younger exporting firms. This will imply that main product switching is more likely for younger exporters than older exporters. Also it should be expected that younger firms are more likely to make relatively unrelated changes than older firms in the quest of their core competence.

[8]Although a distinction is made between "cost—based" and "Quality—based" competence, the last being proxied by differentiated goods as classified by Rauch (1999), where "Quality—based" competence firms invest more in enhancing the quality of the core–products.

5.3 Data

In order to insure that the firms in the sample are involved in the production of the products that they export some corrections are necessary. Firstly the sample only consists of manufacturing firms.[9] Secondly the products that cannot be directly linked to a firms production and exports to unknown destinations are deleted.[10] Thirdly products that for a firm amount to a real value that is less than $1000 in a year are deleted from the sample; this in order to insure that products sporadically exported and very small firms are deleted from the sample. After the corrections the author is left with 6,074 exporters and 6,046 products which account, on average, for 70.2% of total yearly export revenue.[11]

The firms analyzed in this paper are firms of which the trader code has been matched to the Establishment Control Number (ECN) from the list of establishments. These firms have been traced to the manufacturing survey and can therefore, with a high degree of certainty, be dubbed manufacturing firm. Nonetheless a firm can change over time. Of the 2,999 main products produced by these firms 81.9% are products that are often classified as manufacturing products (i.e fall in sections 5–8 of SITC rev. 3 classification). Nonetheless this does imply that 18.1% of the main products are products which are usually not classified as manufacturing products. Firms that change to these "non-manufacturing" product categories are not dropped from the sample. The sample is constructed in such a manner that with a high degree of certainty all the firms in the sample are or were manufacturing firms. More importantly the unique trader codes and ECN ensures that the same firm is followed through time.

Another important aspect of the data is product classification consistency over time. This in order to insure that main product changes are observed instead of classification changes over time. The classification in the Philippines changes from a 7–digit to a 10–digit classification in 2006. This meant matching the PSCC 7-digit classification (harmonized to the SITC rev. 3 until 5 digits) to the PSCC 10-digit classification (Harmonized to the HS classification) which was used from 2006 onwards. The difficulty with correcting this change in classification is that in some cases a single 10-digit category matches with multiple 7-digit categories. Clearly indicating that the change in classification is not merely a switch to a more detailed classification. Actually the reverse is true in a few cases. The PSCC 7-digit classification was tailored to the Philippine economy while the 10-digit classification was set up in order to harmonize trade statistics between ASEAN (Association of Southeast Asian Nations) member countries. Whenever multiple 7–digit products match to a single 10–digit product the 7–digit product that a firm previously exported will be chosen, this to insure consistency over time. For example 10-digit product category A matches with 7-digit product categories B, C and D however firm 1 only produced product B the year before then B is assigned to all products from 2006 onwards that are classified A. The number of single PSCC 10-digit categories with multiple 7-digit categories is very limited however when they where encountered this strategy is applied in order to ensure within firm consistency.[12]

[9]Therefore name deletion and matching to manufacturing firm surveys is applied in order to insure that the respective sample consist of manufacturing firms. Firms that had in their names the following keywords, Moving, Shipping, Logistic, Trading, Trader, Export and Import, are deleted from the sample.

[10]Pscc product codes 93103 – 93109 , IIb and New are deleted.

[11]The manufacturing survey could only be obtained from 1996 onwards. This implies that the matching was done from 1996 onwards and that the export activity of firms that export between 1991–1995 however never export after 1996 do not appear in the sample. Therefore for the years before 1996 the exporters in the sample only accounts, on average, for 48.9% of total yearly export revenue. While in the years from 1996 onwards the firms account for 76.5% of yearly export revenue.

[12]There are 401 10-digit products which match in most cases to two (68.1%) up to a maximum of 35 7-digit product categories. Most of the products with this matching problem are also of less importance as the average importance ranking in terms of total revenue of these products is 3135. Indicating that this complication is mostly contained to relatively unimportant products for the Philippine economy. Also only 410 observations in the sample have this multiple

5.4 Same Results

5.4.1 Product Ranking over Destinations

The cross section evidence in Arkolakis and Muendler (2010) and Mayer et al. (2014) seems to point out that the core competency model is a good fit, as the ranking of products is almost unaltered over the destinations to which firms export. This finding is in line with the core competence model that predicts that the closer a product is to the core competence the more a firm will export of it as it can be produced more efficiently and therefore overcome more barriers. Mayer et al. (2014) construct a global ranking which ranks products in terms of total export revenue and then compares this ranking to the ranking of the products exported to a destination (the local ranking). The Spearman rank coefficient formula is used to calculate the rank correlation between the global ranking and the local ranking for firms. The Spearman rank coefficient will obtain its maximum value when the ranking of products is unaltered. Therefore if in a destination products with global ranking 1 and 8 are ranked 1 and 2 locally then the maximum value is obtained as the ranking is unaltered; this in the sense that the product ranked 1 globally is ranked higher locally than the product ranked 8 globally. Even though the method of Mayer et al. (2014) show that the ranking might be unaltered they do not correct for the fact that certain products sold frequently globally are not exported to the respective country locally. Therefore no correction is made for the fact that products 2 till 7 are not exported locally. This can be attributed to demand factors as certain countries might not demand all products exported by the respective firm. The method of Mayer et al. (2014) only takes the ranking of the exported products into consideration thereby avoiding factors related to local demand preferences. Similar results are obtained when using the method applied in Mayer et al. (2014) on the data in this paper. (see Table 5.1) The average firm Spearman Rank correlation between the global and local rankings in this paper of 0.897 is higher than the Spearman rank coefficient obtained in Mayer et al. (2014) of 0.676 and more comparable to the rank correlation of 0.837 obtained in Arkolakis and Muendler (2010).

Even though the Spearman rank coefficient cannot be calculated when only 1 product is exported to a destination Mayer et al. (2014) assume that the rank coefficient reaches it maximum value of 1 in that case. This assumption increases the value of the average Spearman rank correlation. Therefore dropping observations where a firm only exports 1 product to a destination leads to a lower average firm Spearman rank coefficient of 0.778. (See Tabel 5.2) Therefore similar results are obtained as Mayer et al. (2014) in the cross section data.[13]

Table 5.1: Spearman Correlation Between Global and Local Rankings

Firms exporting at least:	Number of products				
To number of countries	1	2	5	10	20
1	0.897	0.872	0.827	0.785	0.729
2	0.851	0.844	0.809	0.775	0.719
5	0.809	0.805	0.782	0.754	0.705
10	0.797	0.795	0.776	0.756	0.704
20	0.793	0.791	0.783	0.758	0.717

Notes: This table summarizes the average Spearman correlation between the Global and local ranking for firms in the year 2000.

matching difficulty.

[13]Although the author only shows the results for the year 2000 similar results are obtained when taking another year as bench mark.

Table 5.2: Spearman Correlation Between Global and Local Rankings (Excluding Destinations to which a Firm only Exports 1 Product)

Firms exporting at least:	Number of products				
To number of countries	1	2	5	10	20
1	0.778	0.778	0.728	0.680	0.624
2	0.725	0.724	0.700	0.666	0.610
5	0.656	0.656	0.639	0.625	0.582
10	0.640	0.639	0.618	0.612	0.569
20	0.641	0.641	0.631	0.610	0.570

Notes: This table summarizes the average Spearman correlation between Global and local ranking for firms when destinations to which only 1 product is exported are excluded in the year 2000.

5.4.2 Adding and Dropping

The definition of product switching used in previous papers (i.e the adding and dropping of products is defined as a change in the product mix for the rest of this paper with the exception of this section) will be retained and analyzed in this section. This to show how the results of product switching will relate to the product switching analysis performed by Timoshenko (2015) and Bernard et al. (2010). For firms that continue with exporting the next period the dropping and adding of products can be analyzed.[14] A product is added by a firm when it is not exported at time $t-1$ however it is exported at time t. A product is dropped when it is exported at time t however not exported at time $t+1$. Added (dropped) products account for 26.7% (25.9%) of total export revenue. There are however examples of firms that change there complete product mix when going from year t to $t+1$. This would automatically imply that a continuing exporter drops 100% of their revenue (products) in year t and adds 100% of their revenue (products) in year $t+1$. In 10% of the cases exporters do indeed change their complete product mix when going from one year to next. This is of course more frequently the case for small exporters than larger ones. In only 12.8% of the firm–year observations no products are added or dropped by surviving firms, so called inactive exporters. This implies that among continuing exporters 87.2% alter their product mix. This is notably higher than the 72% observed for Brazilian exporters in Timoshenko (2015). This difference is partly due to the fact that 7-digit switches are considered in this paper contrary to 6-digit switches (e.g Timoshenko (2015)).[15]

Table 5.3 and 5.4 shows that size has a negative effect on the percentage of revenue added by new products and the percentage of revenue dropped. Both size measured as total export revenue and the number of products exported has a significant negative effect. Export age is the uninterrupted number of years that a firm has been exporting in the sample.[16] In line with Timoshenko (2015) older exporters are less likely to alter their product mix over time. Older and larger firms are both less likely to add and drop products over time. (See Table 5.3 and 5.4) Therefore using the product mix definition will lead to similar results as Timoshenko (2015) found.

Therefore the data used in this paper finds cross section evidence that ranking is almost unaltered over destinations and evidence that product switching is frequent and dependent on exporter size and

[14] Analyzing adding at entry does not make much sense as all product exported that year are added product. The same logic holds for the dropping of product but then for exit

[15] Also sample differences play a role. In this paper firms that have been matched to the manufacturing firm survey are kept in the sample. The products that these firms export are not always products that are categorized as manufacturing products. (Generally speaking manufacturing goods are SITC rev. 3 5–8. Sometimes section 9 is included or division 68 is excluded.) However the exporter must export at least $1000 worth of the product (in real terms) in order for it to be included in the analysis. There are 6,046 products exported of which 4,833 are classified as manufacturing goods.(i.e Fall in SITC rev 3. section 5–8)

[16] Therefore in line with Timoshenko (2015) left censored exporters receive an exporter age of 1 in the first year of the sample. Deleting left censored observation leads to similar results.

Table 5.3: Percentage of Revenue Added by New Products

	(1)	(2)	(3)	(4)
$Log(Exports_{t-1})$	-0.067^{***}		-0.062^{***}	
$Log(Scope_{t-1})$		-0.112^{***}		-0.098^{***}
$ExportAge_{t-1}$			-0.007^{***}	-0.012^{***}
Constant	0.797^{***}	0.071	0.730^{***}	0.041
No. of Obs.	39103	39103	39103	39103
AIC	6502.9	11801.1	6027.4	10635.5
Log likeli.	-2836.4	-5485.6	-2597.7	-4901.7
R-squared	0.34	0.25	0.35	0.27
Year dummies	Yes	Yes	Yes	Yes
Division dummies	Yes	Yes	Yes	Yes
Destination dummies	Yes	Yes	Yes	Yes

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ *Notes: The division (2–digit) dummies are main product classification dummies in terms of revenue. Destination dummies are dummies for the destination that is the most important for the firm in terms of revenue. (i.e the main destination)*

Table 5.4: Percentage of Revenue Lost by to be Dropped Products

	(1)	(2)	(3)	(4)
$Log(Exports_{t-1})$	-0.048^{***}		-0.047^{***}	
$Log(Scope_{t-1})$		-0.048^{***}		-0.040^{***}
$ExportAge_{t-1}$			-0.003^{***}	-0.008^{***}
Constant	0.591^{***}	0.055	0.564^{***}	0.034
No. of Obs.	35668	35668	35668	35668
AIC	2167.9	6745.0	2086.6	6217.0
Log likeli.	-847.0	-3135.5	-805.3	-2870.5
R-squared	0.25	0.14	0.25	0.15
Year dummies	Yes	Yes	Yes	Yes
Division dummies	Yes	Yes	Yes	Yes
Destination dummies	Yes	Yes	Yes	Yes

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ *Notes: The division (2–digit) dummies are main product classification dummies in terms of revenue. Destination dummies are dummies for the destination that is the most important for the firm in terms of revenue. (i.e the main destination)*

age. The next section however adds a new dimension to the analysis as it shows that main product switching is also a frequent phenomena. Which given the cross section evidence would not be expected.

5.5 Empirical Evidence of Changing Main Product

Manufacturing firms are involved with the production of the products they export. Therefore the products they export are a reflection of the competencies of a firm. What these competencies are is left in the middle, however, they are assumed to be revealed by the main export product of the firm. Products that a firm exports are a strong reflection of the firm competencies even more so than domestically sold products. For the mean (median) firm the main export product accounts for 72.1% (75.9%) of a firms total export revenue within a year. Looking at Table 5.5 it can be seen that even for firms that export more than 51 products in a year the main product, on average, still accounts for 24.7% of total export revenue. Clearly demonstrating the importance of the main export product and thereby making a strong case for classifying a firm on the basis of the main product it exports as a revealed firm core competency.

Of the manufacturing firms that export 72.7% change main product over time. Keep in mind that some firms stop exporting after one year and can therefore never change main export product

Table 5.5: Top 5 products shares, by firm type, average 1991-2012

	Firm's products scope					
	1	2	3	4-10	11-50	51+
1	100.0	81.3	74.1	65.7	51.1	24.7
2		18.7	19.3	18.7	17.7	12.4
3			6.6	8.2	9.3	8.0
4				4.0	5.8	6.0
5				2.4	3.9	4.8

Notes: This table summarizes the number of products exported by a firm in a year and the importance of the top 5 products in terms of total yearly export revenue. The observation level is firm–year implying that firm that export more years appear more often in the table.

by definition. In fact of the firms that export for at least two years in the sample 86.9% change main product. Firms that export, on average, one product are, with 53.4% unchanging firms, the least likely to change. Table 5.6 indicates that the more products a firm exports the more likely it is that a firm changes main product category. The number of products exported is synonym for firm size in many cases. Larger firms generally have longer export spells and therefore have longer time periods in which they can change export product. This to a certain extent drives the results in Table 5.6.

Table 5.6: Number of Main Product Changes by Average Number of Products Exported Between 1991-2012

	Products Exported				
Changes	1	2	3	4-10	11+
0	53.4	18.5	18.6	15.8	9.7
1	18.0	21.6	15.0	13.5	10.0
2	12.8	14.8	13.0	13.6	9.1
3	6.3	15.0	9.6	11.8	12.0
4	5.2	8.7	9.9	10.4	10.4
5	2.1	5.8	7.9	8.8	9.7
6+	2.3	15.7	26.0	26.1	39.2

Notes: This table summarizes the number of main product changes per mean number of product exported. Main export product is defined as the 7–digit category of which the f.o.b value in a respective year is the greatest. Therefore a mean of 1 implies that the firm exported yearly on average 1 product. The mean values are rounded of to the nearest integer. A main export product change is defined a change in main export product between two consecutive export observations of the same firm. These two export observation do not have to take place in consecutive years.

Table 5.7 shows the export spell duration of a firm and the number of times the firm changes main product. Where a spell is the uninterrupted length of time that a respective firm f exports. As can be expected the longer the export spell lasts the more likely it is that the firm changes main product at least once. For firms that have export spells that last 10 or more years 34.9% change main product 6 or more times. But even firms that have export spells that last 2 years change main export product in 73.2% of the cases. Firms with short spells have a relatively high tendency to change main product given the time frame. Even though firms with longer time spells are more likely to change they are less likely to change the maximum amount of times, given the time frame, compared to firms with shorter time spells.

The export product changes are defined as changes in the 7-digit PSCC code. Around 37% of the product changes have highest 7-digit code changes that are in the 1^{st} digit, possibly indicating distinct product changes. (See Table 5.8) However, most 7-digit main product changes occur without the 1^{st} digit changing. (see Table 5.8 and 5.9) Main products located in the Food and live animals section (section 0) and Miscellaneous manufactured articles (section 8) are, when they switch, more likely to

Table 5.7: Number of Main Product Changes by Export Spell Duration

	Export Spell Duration						
	2	3	4	5	6	7-10	10+
0	26.8	19.9	21.0	14.6	17.0	15.5	17.3
1	73.2	26.4	19.0	17.5	14.5	14.9	10.3
2		53.7	28.0	16.4	13.5	13.0	11.7
3			32.0	23.7	19.0	12.6	9.8
4				27.8	19.3	11.8	8.4
5					16.7	14.3	7.7
6+						17.8	34.9

Notes: This table summarizes the number of main product changes per spell duration. A spell is the uninterrupted length of time (in years) that a respective exporter exports. Left censored spells are not deleted from the analysis and assumed to start in 1991. Main export product is defined as the 7 digit category of which the f.o.b value in a respective year is the greatest. A main export product change is defined a change in main export product between two consecutive export observations of the same firm. These two export observations do take place in consecutive years. Firms that only export for one year are excluded in this table as by definition they can never change main product category.

remain within the same 1-digit section than other products. Although main product switching occurs in each section it occurs most frequently, in decreasing order, in sections Machinery and transport equipment (section 7), Chemicals (section 5), Manufactured goods classified chiefly by material (section 6) and Miscellaneous manufactured articles. Interestingly enough firms in these sections have the tendency to change to each others sections. Animal and vegetable oils, fats and waxes (section 4), Mineral fuels, lubricants and related materials (section 3) and Beverages and tobacco (section 1) are small sections in terms of number of firms. Firms within these sections are also less likely to change main export product over time. Although firms that export on consignment basis have the lowest tendency to switch main product over time. This however is partly due to the product definitions for the consignment based products which is notably larger than that of other 7-digit classifications.[17]

Table 5.8: Highest Digit Change of Main Product Changes

digit	Percentage
1^{st}	36.9
2^{nd}	17.1
3^{rd}	13.5
4^{th}	13.6
5^{th}	7.8
6^{th}	2.9
7^{th}	8.2

The sections are very broad and do not give a clear indication of the type of product one is looking at. A classification of the UNCTAD of products by technological categories based on Lall (2000) is more insightful.[18] This classification gives a clearer overview of main export changes of firms. The frequency of changes is relatively similar for most product groups. Only firms that produce a primary product as main product are, notably, less likely to change main product over time. When firms

[17] The product definitions for consignment based goods are broader. For example there is one 9 section category for mens clothes manufactures from materials on consignment basis while when mens clothes are not made on consignment basis a distinction is made between the type of clothing and material from which it is made. Partly due to this phenomena firms that have their main product in a consignment based product change less frequently and why changes within its own category are the lowest of all sections.

[18] Consignment product groups are not classified by this classification. Therefore they are categorized by related product sections.

Table 5.9: Percentage of 7-Digit Changes Per 1-Digit Sector

Changed from	Changed to 0	1	2	3	4	5	6	7	8	9	$\frac{\#changes}{\#obs}$
0	**70.4**	1.4	3.8	0.1	1.8	6.0	4.4	5.0	6.5	0.5	**25.9**
1	15.6	**64.9**	1.3	0.0	0.6	1.3	3.2	8.4	4.5	0.0	**30.2**
2	6.5	0.1	**42.7**	0.3	0.4	4.9	22.1	8.7	12.4	1.7	**33.9**
3	2.6	0.0	7.7	**69.2**	0.0	5.1	0.0	15.4	0.0	0.0	**29.1**
4	15.2	0.0	2.3	0.0	**65.9**	9.8	3.8	0.8	2.3	0.0	**27.0**
5	5.7	0.2	2.2	0.2	0.7	**57.5**	8.1	10.7	13.6	1.3	**39.1**
6	2.1	0.3	4.5	0.0	0.1	3.2	**50.5**	14.9	22.2	2.2	**38.0**
7	1.8	0.4	1.5	0.1	0.1	3.6	12.5	**64.2**	12.0	3.8	**40.4**
8	1.0	0.1	1.1	0.0	0.0	2.6	11.1	6.2	**72.9**	4.9	**36.6**
9	0.5	0.2	1.1	0.0	0.3	2.7	7.2	14.8	33.5	**39.8**	**16.3**

Notes: This table summarizes the number of main product changes by the product section (1st digit of the Pscc classification). The **Changed from** category indicates the original section the firms product was classified in. **Changed to** is the new section in which the product is now classified after a change has taken place.

within this section change they often change to other primary products or resource based products. Firms that produce low, medium and high tech products are the most likely to change. Low tech products producing firms tend to change to other low technological products. While firms producing medium technological products tend to change to other medium and low tech product categories. A firm producing a high technological product will when it changes main export product change to a medium or high technological product in 79.3% of the cases. Displaying that most export switches happen to products that require relatively similar skills.[19]

Table 5.10: Percentage of Product Changes per Product Category

Changed from	Changed to: Primary Com.	Resource Based	Low Tech.	Med. Tech.	High Tech	$\frac{\#changes}{\#obs}$
Primary Com.	**49.2**	22.5	15.5	9.5	3.3	**26.1**
Resource Based	8.7	**57.2**	18.7	12.1	3.2	**32.4**
Low Tech.	1.7	6.5	**79.9**	9.0	3.0	**34.3**
Medium Tech.	2.3	7.7	19.9	**57.4**	12.7	**39.4**
High Tech.	2.1	5.0	13.7	31.0	**48.3**	**34.3**

Notes: This figure summarizes the number of main product changes by UNCTAD classification of products by technology categories (based on Lall (2000)). The **Changed from** category indicates the original section the firms product was classified in. **Changed to** is the new section in which the product is now classified after a change has taken place.

[19] One category that was added to the classification is consignment basis. This category comprises of products manufactured from materials on consignment basis. This implies that the inputs that a firm uses in its production are owned by a third party. The firm puts these inputs together and then exports the finished product. The product categories are matched to corresponding product categories that are classified by UNCTAD.

5.6 Method

5.6.1 From Tobit to Selection Models

In this paper the switching of main product and the type of switching is analyzed. The first part of the analysis, the switching of main product, is a binary analysis that can be analyzed by using a Probit or Logit regression. The second part of the analysis, the type of switch, is more complicated as it involves a truncated regression containing only the observations of firm main product changes. Both the first and the second part can be estimated with Tobit, Hurdle and Selection models. The dependent variable of the second part, similarity between main products, is observed only when a firm changes main product. Therefore the sample will be a mixture of observations with zero and positive values. The Tobit 1 model makes a strong assumption that the same probability mechanism generates both the zeros and the positive values. This assumption is not likely to hold as the variables that influence the decision to change main product might not be the same factors that influence the type of change made. Therefore this chapter uses a more flexible model such as the Hurdle model and the selection model which allow for different mechanism to generate the zero and positive values. The problem with Hurdle regressions is that they assume that the two parts, changing main product and similarity of product switched to, are independent. It is conceivable that, after controlling for regressors, that the firms that change are not randomly selected from the population. This will imply that the regression of the second part would suffer from selection bias. The selection model considers the possibility of selection bias by allowing for possible dependence between the two parts of the model. Given the implausibility that the same probability mechanism generates both the zeros and the positive values and the plausibility of sample selection the selection model will be used in the analysis.

Suppose a firm has a latent propensity to change main product, denoted by y_1^*, and a latent similarity between the previous main product and the product switched to, denoted y_2^*. The type of switch y_2^* is only observed if $y_1^* > 0$ and a main product switch takes place. Therefore the two–equation model comprises of a selection into changing main product (y_1), where

$$y_1 = \begin{cases} 1 & \text{if } y_1^* > 0 \\ 0 & \text{if } \ y_1^* \leq 0 \end{cases} \tag{5.1}$$

and the result outcome equation for the type of switch (y_2), where

$$y_2 = \begin{cases} y_2^* & \text{if } y_1^* > 0 \\ - & \text{if } \ y_1^* \leq 0 \end{cases} \tag{5.2}$$

Therefore y_2 is observed only when a main product change takes place (i.e $y_1^* > 0$) whereas y_2 does not take on any value when no switch takes place. Suppose the model is linear with additive errors:

$$\begin{aligned} y_1^* &= \mathbf{X_1'}\beta_\mathbf{1} + \epsilon_1 \\ y_2^* &= \mathbf{X_2'}\beta_\mathbf{2} + \epsilon_2 \end{aligned} \tag{5.3}$$

Where ϵ_1 and ϵ_2 are possibly correlated. The correlated errors are assumed to be jointly normally distributed and homoskedastic.

$$\begin{pmatrix} \epsilon_1 \\ \epsilon_2 \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \sigma_{12} \\ \sigma_{12} & \sigma_2 \end{pmatrix}\right] \tag{5.4}$$

The heckman two–step estination method can be used to estimate the selection. The first step is to estimate the first part of the model which can be estimated with a probit regression. Then the estimated bais correction term, the inverse Mills ratio (i.e λ) can be estimated with:

$$\lambda(\mathbf{X_1'}\beta_\mathbf{1}) = \phi(\mathbf{X_1'}\beta_\mathbf{1}/\sigma)/\Phi(\mathbf{X_1'}\beta_\mathbf{1}/\sigma) \tag{5.5}$$

The second step of the regression is to perform OLS (Ordinary Least Squares) with the estimated bias term as an additional variable.

$$E(y_2|\mathbf{X}, y_1^* > 0) = \mathbf{X_2'}\beta_\mathbf{2} + \sigma_{12}\lambda(\mathbf{X_1'}\beta_\mathbf{1}) \tag{5.6}$$

The two–step estimation relies on a univariate normality distribution and is relatively more robust than the maximum likelihood estimation. However the standard errors are larger due to the fact that the inverse Mills ratio can be collinear with the other regressors of the second part regression. When $\mathbf{X_1} = \mathbf{X_2}$ this is likely to be the case. Therefore, for a more robust identification, having an exclusion restriction may reduce the collinearity problem. An exclusion restriction is a variable that should have substantial impact on the probability of changing main product that does not directly effect the type of switch.

5.6.2 The Similarity Index

A similarity index is created for all main products that the Philippines export. For the product similarity a binary vector is used to represent patterns of co-exporting similarity. The binary vector for similarity is built up of different components. Firstly all the products that a firm exports within the same year are given the value 1 and all other products the value zero. Therefore the vector displays the products that a firm exports within the same calendar year. The vector only includes products that have been exported by at least one firm as main product in the sample. Therefore the similarity measure is a measure of similarity between main export products. When combining all these firm–year row vectors into a matrix the columns of this matrix are product vectors. These product vectors contain the information for which firm–year the respective product is exported. Take two products, i and j, that are represented by the binary product export vector. Let t denote the time in years and f the firm. Then for product vector i 1 indicates that a firm f exports product i in year t and 0 that it does not. Let then a denote the number of firm–years that both product i and j are exported, also called positive matches; b is the number of firm–years that export product i is exported but not product j, called j absence mismatches; c is the number of firm–years that export product j is exported but not product i, called i absence mismatches; d is the number of firm–years that neither product i nor product j is exported, also called negative matches.

The binary similarity measures use different ways to combine the values of a, b, c, and d to create a similarity measure. Applying an appropriate measure of similarity will lead to more accurate data analysis.[20] The clearest distinction between similarity measures is between measures that include negative matches and those that do not. Negative matches do not necessarily imply any similarity

[20]See for example Cha et al. (2010) for a more complete overview of binary similarity measures.

between the two products this because there is almost an infinite number of firms that produce neither products. (Sokal and Sneath (1963)) Considering the large number of negative matches in the data including negative matches quickly leads to a domination of negative matches in the calculation of a similarity index. Due to the fact that the information of negative matches is in most cases significantly less than that of positive matches this paper will reside to similarity measures that exclude negative matches.[21] More specifically this paper uses the Jaccard similarity measure. This measure is defined as follows:

$$S_{ij} = S_{ji} = \frac{a}{(a+b+c)} \tag{5.7}$$

The S_{ij} calculates the similarity between two distinct products i and j. S_{ij} ranges from 0 till 1. Where 1 indicates that in all firm–year observations when product i is exported product j is also exported but also implies that when product j is exported product i is also exported and 0 indicates that both are never exported together. The Jaccard index matrix is symmetric. (i.e $S_{ij} = S_{ji}$) The Jaccard value therefore automatically implies that for a firm producing product i it is just as easy to produce product j as it is for a firm producing product j to produce product i. This of course does not have to be the case. One direction might be notably simpler than the other. Therefore the Jaccard value signifies a relation between the two products without imposing a direction.[22] A high Jaccard value will therefore be obtained for products which are often co–exported. The fact that the products are related will be picked up by the Jaccard index. Lower values will indicate that co–exporting is not frequent and therefore the products are relatively hard to produce together and therefore not frequently exported together.[23]

In order to understand the Jaccard similarity index two extreme cases are discussed. Firstly, take the case that only one firm exports product A then the Jaccard index does not automatically equal 1 with product B that the respective firm also exports. This because the Jaccard value also depends on the number of firms that export the product B. The greater the number of firms exporting B the lower the Jaccard value between product A and B. Secondly, take a product that is exported by many firms that only export one product. A firm exporting only one product will add an observation that the export product is unrelated to all other products. Therefore products that are exported by many firms that only export one product will have low Jaccard values. Due to the binary specification observations of small firms will have the same weight as large firms. For the relative unimportance of small firms in terms of total revenue will not be corrected. However because the unit of observation is firm-year and considering the fact that larger firms often export for longer time periods their weight in the Jaccard index will be greater.

The similarity index measures product co-exporting similarity. Products that are frequently co-exported are deemed more similar to produce or export together than products that are not frequently exported together. There are multiple ways in which similarity can be captured. One could use the total value with which the two are exported together or some form of ranking, however in this paper a binary specification is preferred. This of course implies that each product a firm exports is equally

[21] Examples of these measures are Jaccard, Tanimoto, Dice and Sorenson, Ochiai I and Mountford.

[22] However in theory a one direction relation should have lower Jaccard values than a two direction relation. Especially when the one direction relation is between a product that is difficult to produce and a product that is simpler to produce. In most cases there will be more firms producing the simpler product but not being able to produce the more advanced product. It might be the case that the more advanced product producers also produce the simpler product however the other way round it is never the case. Due to the fact that there are more simple product producers the Jaccard value will get pulled towards zero even though there is a one directional relation.

[23] One way to correct for this is to give a higher weight to firms for which it is a main product and discriminate between S_{ij} and S_{ji} by imposing higher weights for firms that produce as main product i in S_{ij} and the reverse when calculating Sji. This would impose direction. However the weights should differ by number of firms exporting the respective product.

related to all other products it exports within the same year, thereby discarding information of relative (within firm) product importance. Of course the threshold of $1000 and the fact that only products that are exported by at least 1 firm as main product are included insure that relatively unimportant products are removed from the sample. The binary specification has as advantage that each firm-year is equally important. Therefore large firms will not dominate the results and emphasis is placed on the number of firm-years two products are exported together. The importance of the firm or the relative importance of the export product is not taken into account in this similarity index. The Jaccard index is in that sense more likely to pick up supply conditions, especially since the sample consists of manufacturing firms. However demand conditions could also drive the results of the Jaccard similarity index. Whether it be supply-side or demand-side factors which drive the results is not what is of most importance. The Jaccard index shows that for some reason two products are often exported together. Given the fact the sample consist of manufacturing firms it should be expected that if the two products are exported together frequently by different firms than there must be some production advantage. However as stated before this is not the only possible explanation. The fact that a (small) firm, which already export products A, has, with its limited resources, chosen to export product B from the 2999 other potential products reveals that product A and B are related. This revealed relatedness is what the similarity index captures.

One slight alternation of the Jaccard similarity index is to use firm-destination-year vectors. All the products that a firms exports within the same year to the same destination are given the value 1 and all other products the value zero. Therefore the vector displays the products that a firm exports within the same calendar year to a destination. Given that the ranking of products is hardly unaltered over destinations more important products will be exported more frequently together by a firm than less important products. By focusing on the products that a firm exports together to a certain destination more important products will receive higher weights and so will firms that export to more destinations (Which is often synonym for a larger exporter). Of course the drawback of the method is that if a firm produces products that it never exports to the same destination that they will never be linked. The advantage is that small insignificant products get lower weights while more important products for the firm will receive higher weights as they are exported more frequently to different destinations.

5.7 Empirics

5.7.1 Innovation

The UNCTAD classification of products by technological categories which is based on Lall (2000) can be used to calculate the average technological category to which the products that are co–exported belong to. The UNCTAD categories range from 1 (denoting Primary commodities) to 5 (denoting High–technology). The classification of a product co–exported (CL_j) is multiplied by the Jaccard value (S_{ij}) and divided by the summation of the Jaccard values ($\sum_{j=1;\ i\neq j}^{n} S_{ij}$) of product i. Therefore products that are more intensely related to product i will receive a higher weight in the calculation. When this is summed over all products co–exported (n) the weighted technological category of products that are co–exported with product i is calculated (TC_i).

$$TC_i = \sum_{j=1;\ i\neq j}^{n} \frac{S_{ij}}{\sum_{j=1;\ i\neq j}^{n} S_{ij}} * CL_j \tag{5.8}$$

Table 5.11 shows the values of TC_i by UNCTAD classification of product i. Firms that export primary commodities also, on average, export resource based products; while firms that export a high–technological product have a higher weighted mean and are therefore more likely to export other medium and high–technological products. Table 5.11 shows that as the product increases in technological category the products that are co–exported also often increase in terms of technological category. Therefore firms often co–export goods that require similar skills.

Table 5.11: Technological Classification of Products Co-Produced

	Median	mean	St.Dev	N
Primary Com.	2.01	2.02	0.72	277
Resource Based	2.34	2.42	0.67	590
Low–Tech	3.03	3.06	0.52	904
Medium–Tech.	3.65	3.44	0.88	881
High–Tech	4.21	4.00	0.89	305
Total	3.07	3.04	0.92	2957

Notes: Authors own calculations using UNCTAD classification of products based on Lall (2000) At least 1 firm in the Philippines has to export the respective product as main product in order to be included in this sample.

This result is due to the fact that each category has the tendency to be related to products in it own technological category. Table 5.12 shows that primary commodities are most related to other primary commodities (0.158) followed by resource based products (0.075). While these products are relatively unrelated to low, medium and high technology products. Resource based and low-technological products have the highest average maximum Jaccard value for their own classification and are therefore more intensely related to products within its own classification. High technological products, although being most related to other high technological products, are relatively unrelated to other product classifications. For example, the average maximum Jaccard value of all high–technological products to primary commodities is only 0.014. Indicating that these product categories are highly unrelated. As can be expected.

A revenue weighted technological category for the products that a firm exports (TC_{fy}) will represent the average technological content of the products exported. The values will range form 1 indicating that all the products exported by the firm are primary products till 5 indicating that all

Table 5.12: Average Maximum Jaccard Value by UNTAD Classification

	1	2	3	4	5
1	0.158	0.084	0.037	0.041	0.014
2	0.075	0.184	0.053	0.059	0.021
3	0.018	0.031	0.178	0.043	0.017
4	0.023	0.039	0.043	0.136	0.038
5	0.016	0.028	0.036	0.076	0.138
Total	0.043	0.068	0.084	0.077	0.036

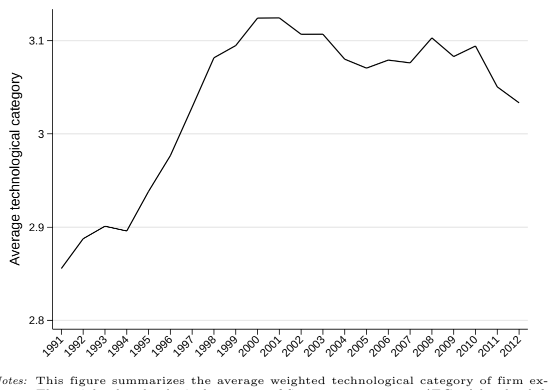
Notes: For this table the unweighted Jaccard value is used for the n=1 data set. The average is taken over the maximum Jaccard values of all the products belonging to a certain UNCTAD classification. Therefore each product gets a weight of one and these values are not observation weighted.

the products exported by the respective firm are high–Tech products. TC_{fy} is calculated with the following formula:

$$TC_{fy} = \sum_{i=1}^{n} \frac{rev_{fiy}}{\sum_{i=1}^{n} rev_{fiy}} * CL_i \tag{5.9}$$

Where rev_{fiy} is the export revenue generated by product i in year y for firm f and CL_i is the technological category classification of product i. The average weighted technological category for exports of firms in the Philippines is 3.06. Indicating that, on average, firms export low–tech products. In Figure 5.1 it can be seen that the average weighted technological category of firm exports in the Philippines has changed relatively little over time. It was increasing to a maximum just above 3.1 in 1999 and has shown a slight decreasing trend since then.

Figure 5.1: Average Weighted Technological Category of Firm Exports



Notes: This figure summarizes the average weighted technological category of firm exports. The weighted technological category of firm exports per year (TC_{fy}) has by definition one observation per year per firm. The average of TC_{fy} is taken over all firms in a respective year for this figure. Therefore the values in the figure represent the average TC_{fy} of firms in the Philippine economy in a certain year.

Taking the difference of TC_{fy} over time will indicate whether or not a firm has upgraded the technological content of its exported products. In 35.3% of the cases the technological category does not change and when adjustments over time are made they are often small.[24] The results in Table 5.13 indicate that firm size matters in terms of upgrading over time. Larger firms have the tendency to slightly upgrade over time. Therefore even though smaller firms are more likely to change main product they are less likely to upgrade over time. Indicating that the changes made by smaller firms

[24] The average change is -0.00427

are more indicative of survival or experimentation. Their product switching behavior is often not related to an upgrading of skills. Firm export age has a negative coefficient although the significance of this effect differs by the specification. Nonetheless this effect indicates that older firms are less likely to upgrade over time than younger firms.

Table 5.13: Upgrading

	(1)	(2)	(3)	(4)
$Log(Exports_{t-1})$	0.003***		0.004***	
$Log(Scope_{t-1})$		0.005**		0.006***
$ExportAge_{t-1}$			-0.001**	-0.001
Constant	0.094	0.128	0.084	0.127
No. of Obs.	38,173	38,173	38,173	38,173
AIC	33235.1	33242.5	33232.1	33242.0
Log likeli.	-16533.6	-16537.3	-16531.1	-16536.0
R-squared	0.053	0.053	0.053	0.053
Year dummies	Yes	Yes	Yes	Yes
Divisions dummies	Yes	Yes	Yes	Yes
Destination dummies	Yes	Yes	Yes	Yes

Notes: Difference in TC_{fy} over time is the dependent variable. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.7.2 Main product switching and co-production similarity

The mean Jaccard value of product i to all main products exported is used as an indicator of overall similarity for product i. Due to the large number of products that are unrelated this value is pulled towards zero. Therefore the mean Jaccard value is normalized between 0 and 1 in order to make the interpretation of the results easier. Table 5.14 shows that the similarity index has a positive significant effect on the probability that a firm changes main product category. This result remains even after controlling for other variables. Therefore firms that produce main products that are similar to other main products are more prone to switch main product than firms that produce products that are less similar to other main products. The other variables indicate that larger firms and firms that have been exporting for a longer time period are less prone to switch main product.

The mean Jaccard value

Table 5.14: Similarity Index

	(1)	(2)	(3)	(4)	(5)
$Similarity_{t-1}$	0.456***	0.457***	0.564***	0.466***	0.475***
$Log(Exports_{t-1})$		-0.402***		-0.392***	
$Log(Scope_{t-1})$			-0.077***		0.021
$ExportAge_{t-1}$				-0.016***	-0.075***
Constant	-2.425**	2.120**	-2.396**	1.979*	-2.551***
No. of Obs.	39,367	39,367	39,367	39,367	39,367
AIC	48407.4	43313.3	48372.5	43285.7	47633.6
Log likeli.	-24009.7	-21461.6	-23991.2	-21446.9	-23620.8
R-squared	0.062	0.162	0.063	0.162	0.077
Year dummies	Yes	Yes	Yes	Yes	Yes
Division dummies	Yes	Yes	Yes	Yes	Yes
Destination dummies	Yes	Yes	Yes	Yes	Yes

Notes: Normalized mean Jaccard values. The observations only included products that are exported by at least one firm as main export product. The destination and division dummies are main destination and main division dummies in terms of revenue. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.7.3 Deviations from the Jaccard similarity index

The similarity index is influenced by the number of products that product i is related to and the intensity with which it is related to other products. In order to distinguish between these two effects the index is split up. Firstly in order to analyze the intensity of similarity the highest and average of the two, five and ten highest values of the Jaccard similarity measure for product i with respect to the other products is taken. These values indicate how related product i is to products it is most frequently exported with. Products that are unrelated with all products will have low values and visa versa. The Top 5 Jaccard similarity values range from 0 till 0.61. The highest Top 5 Jaccard value is obtained for the product "Manioc (Cassava) fresh/dried in the form of pellets".[25] While the lowest Top 5 value is zero and it is obtained for 95 different products. These products are exported sporadically by the Philippines. In fact these 95 products get exported for 155 firm–year observations over the whole sample period. The two product that get exported the maximum firm–year observations of the this sample are "Staples in strips" and "Wind musical instruments".[26]

Secondly the number of products to which a product is related, basically the scope of similarity, will be analyzed. For the construction of the scope index Jaccard similarity values that are greater than or equal to 0.1 for product i are denoted by 1 and 0 otherwise. A minimum threshold of 0.1 is chosen in order to avoid that products that are only exported once together enter the scope index. The number of products with which product i is related is the scope index. Therefore if product i only has one product with which it has a Jaccard value greater than or equal to 0.1 then the scope index is equal to 1. The mean (median) value of the scope index is 5.8 (2). The mean value of 5.8 implies that product i has 5.8 other products with which it is exported together with a minimal intensity of at least 10% of the firm–year observations. The scope index ranges from 0 till 105. The scope index minimum value of 0 is obtained for 875 products. Indicating that around 29.2% of the main products are relatively unrelated to the other main export products of the Philippines. A majority of these unrelated products are located in sections 7 (259), 6 (211) and 8 (169).[27] These three sections also account for 70% of the main products exported. The maximum value of 105 is obtained for "Dried Herring". The reason for this is that dried herring are frequently exported together with other products, mostly by agri–processing firms. The mean (median) real value of dried herring for a firm–year observation is \$181,101 (\$25,748). In fact 82.9% of the products with which dried herring has a Jaccard value that is 0.1 or higher are located in Food and live animals section.

When adding the Top (intensity) indexes together with the scope index in the same regression the scope index is always significant unlike the Top index.(See Table 5.15) Indicating that it is the scope of similarity that drives the results instead of the intensity with which products are exported together. Firms with a main export product that is exported more frequently with other products (i.e has a greater scope) are more likely to change main export product. The Top indexes have a positive effect on the probability that the firm will switch main product however they only become significant after Top 5. Therefore there is also evidence that the firm that has a main product that is highly related to a few other products will also be more prone to switch main product over time. However the scope of similarity has an effect that is always significant and therefore drives the similarity index results more than the intensity. Also the more products that are added to the Top index the more this index will correspond to the scope index. This is why, when the Top index becomes significant, the effect of

[25] The PSCC code for this product is 0548100.
[26] The PSCC code for these products are 8951202 and 8982309. Both these products get exported for 6 firm–year observations.
[27] These unrelated products account respectively for 36.5%, 30.1% and 24.5% of the products in section 7, 6 and 8.

the Scope similarity index drops slightly.

The mean jaccard value will most likely attain high values for products that are relatively easy to produce or export. A product that is frequently exported with other porducts will, most likley, not be a product that requires high fixed cost (i.e high initial investments) to produce. This attribute of the mean jaccard value will be captured more quickly by the scope index than the intensity index. This is probably also the reason why products with a high mean similarity index value are more prone to switch main products over time.

Table 5.15: Scope of Similarity and Top Index

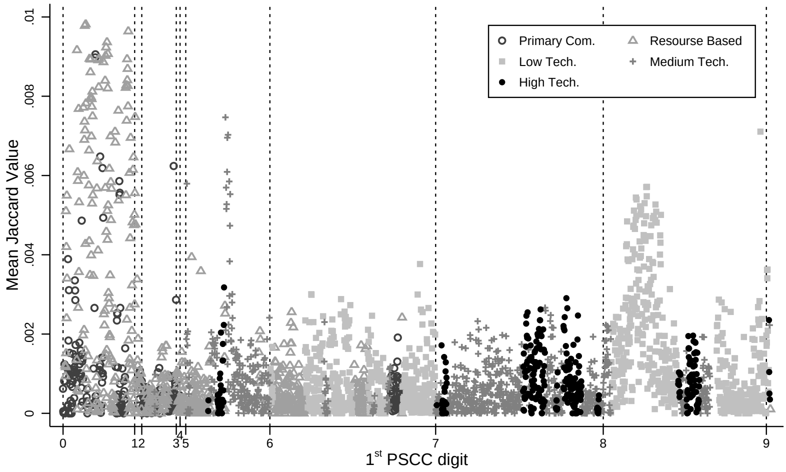
	(1)	(2)	(3)	(4)
$Top1_{t-1}$	0.146			
$Top2_{t-1}$		0.225		
$Top5_{t-1}$			0.608*	
$Top10_{t-1}$				0.809*
$Scope\ Similarity_{t-1}$	0.006***	0.006***	0.005***	0.004**
$Log(Exports_{t-1})$	−0.392***	−0.392***	−0.393***	−0.393***
$ExportAge_{t-1}$	−0.017***	−0.017***	−0.017***	−0.017***
Constant	1.960*	1.960*	1.963*	1.961*
No. of Obs.	39,367	39,367	39,367	39,367
AIC	43248.3	43247.6	43243.4	43243.9
Log likeli.	-21427.1	-21426.8	-21424.7	-21424.9
R-squared	0.163	0.163	0.163	0.163
Year dummies	Yes	Yes	Yes	Yes
Division dummies	Yes	Yes	Yes	Yes
Destination dummies	Yes	Yes	Yes	Yes

Notes: The observations only included products that are exported by at least one firm as main export product. The destination and division dummies are main destination and main division dummies in terms of revenue. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Medium–tech products belonging to PSCC section 5 (Chemicals and related products, n.e.s.), Low–tech. and Resource based products have the tendency to have higher mean Jaccard values (see figure 5.2). While many medium–tech. and high–tech. products, not belonging to section 5, have relatively low mean values. Indicating that these products are less related to other main products. However in Figure 5.3 it can be seen that even though many medium and high skilled products have low overall similarity they nonetheless are often related to at least one other product, as the Top 5 index indicates. But again resource based and low–tech products often have the highest values. Therefore part of the similarity result is driven by inherent characteristics of an industry or product section.[28] Nonetheless there is a lot of variation even within the broad product classifications.

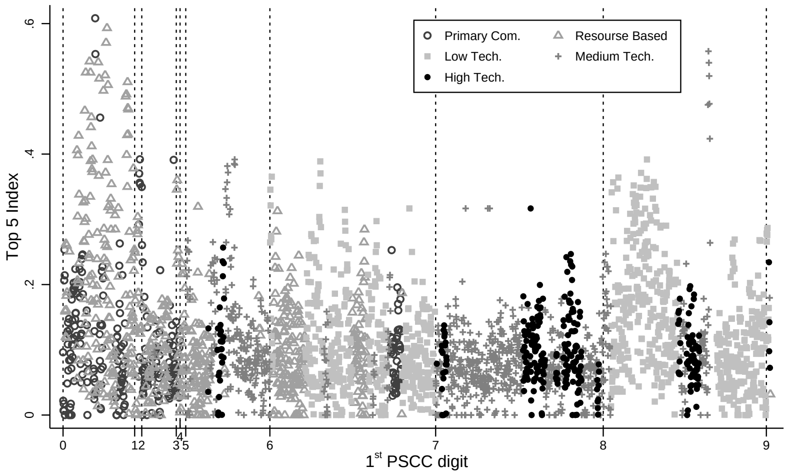
[28]For example product belonging to the divisions Clothing (division 84), travel goods & handbags (division 83) and furniture & parts (division 82).

Figure 5.2: Mean Jaccard Value by Main Product



Notes: Authors own calculations using UNCTAD classification of products based on Lall (2000). At least one firm has to export the product as a main product.

Figure 5.3: Top 5 Index by Main Product



Notes: Authors own calculations using UNCTAD classification of products based on Lall (2000). At least one firm has to export the product as a main product.

5.7.4 Type of Switches

The mean, Top or scope similarity indexes say something about the general similarity of the product with respect to other main products. However the Jaccard value between two products reveals the actual similarity. Even though the similarity indexes have a significant effect on main product switching most changes are to relatively unrelated products. This in the sense that the two products have a low Jaccard value indicating that they are not frequently co–exported. (See Table 5.16) The positive results for the similarity index are driven by the resource based and low–tech products that are more frequently co–exported. The average Jaccard value of a change is 0.108 indicating that on average when a main product change takes place both products are co–exported in 10.8% of the observations when either product i or j is exported. However low–tech and resource based products have the highest Jaccard values indicating that the switches made for these product types are made to products that are more often co–produced. While medium and high technological products often make product changes to products that are less frequently co–exported and therefore seemingly unrelated product switches take place. These two product categories also have a high number of switches to products that are never co–exported. (respectively 22.2% and 15.0%) Therefore the similarity index is not a perfect indicator of possible switches especially for high and medium technological products.

Table 5.16: Similarity of Changes by Product Type

	All				Zeros	
	Median	Mean	SD	N	N	Percentage
Primary Com.	0.037	0.105	0.145	979	172	17.6%
Resource Based	0.059	0.115	0.137	2708	367	13.6%
Low–Tech	0.100	0.144	0.141	7460	603	8.1%
Medium–Tech	0.015	0.054	0.087	3804	846	22.2%
High–Tech	0.022	0.057	0.078	1552	233	15.0%
Total	0.051	0.108	0.131	16503	2221	13.5%

Notes: This table summarizes the Jaccard values for main product changes. Displaying the similarity between the previous product and the product changed to. For this table the unweighted Jaccard value is used for the n=1 data set. There are 410 main product changes that involve products that are not classified by the UNCTAD and are therefore missing in the table

Firm size is also related to the similarity of the switch. Smaller firms tend to make more unrelated switches and are more likely to switch main product. Therefore smaller exporters seem to search for products that they can export successfully. While larger firms are less likely to switch main product and when they switch they switch to products that are more related to their previous main product. Huge firms, for example, almost never make unrelated switches while tiny firms make unrelated switches in 24.9% of the cases.

Table 5.17: Similarity of Changes by Firm Size

	All				Zeros	
	Median	Mean	SD	N	N	Percentage
Tiny	0.012	0.056	0.091	4812	1200	24.9%
Small	0.033	0.088	0.118	4330	641	14.8%
Medium	0.070	0.124	0.138	3375	262	7.8%
Large	0.111	0.155	0.142	2566	97	3.8%
Huge	0.152	0.182	0.146	1812	55	3.0%
Total	0.050	0.106	0.130	16895	2255	13.3%

Notes: This table summarizes the Jaccard values for main product changes. Displaying the similarity between the previous product and the product changed to. For this table the unweighted Jaccard value is used for the n=1 data set. Each size variable represents $\frac{1}{5}$ of the yearly distribution of annual revenue. Where tiny represents the first quantile of yearly revenue distribution (containing the lowest yearly revenues) and small the second quantile of firm revenue distribution etc.

The selection model regressions in Table 5.18 show that even though larger and older firms are less prone to change main product that if they change main product they are more likely to change to products that are more similar to their previous main product. The results indicate that there is selection bias and therefore a selection model has to be used. In order to reduce the collinearity problem and for more robust identification an exclusion restriction is imposed. The exclusion restriction in column (1) is the variable *Ratio* which is the total export value of the second most important export product divided by the export value of the most important export product. Therefore *Ratio* can range from 1 where both products are equally important to 0 where there is no second product exported. The importance of the second product versus the most important product is expect to influence the tendency of a firm to change main product. However this ratio seems less likely to determine the type of switch that a firm makes. In the second regression a second exclusion restriction is added which is a similarity index however then constructed for firm–destination–year observations in order to reduce the correlation between the dependent variable in the second regression. The results remain unaltered and the similarity index still has a significant effect on the tendency to change main product. Although in the regressions of column (2) it would be harder to argue that the similarity index ($SimilarityDes_{t-1}$) is unrelated to the type of switch a firm makes.

Therefore a stylized fact that main export product switches are quite frequent if found. However the switching behavior depends on exporter age and size. The results seem to indicate that younger/smaller firms are less likely to know their core competence as they are more likely to switch and make relatively unrelated switches. Their switching behavior seems indicative of a survival or a experimentation or a search process. While larger/older firms are less likely to switch and when they switch they often switch to related products, which is more in line with the core competency literature.

Table 5.18: Selection Model

	(1)	(2)
Second Part: Type of Change		
$Log(Exports_{t-1})$	0.018^{***}	0.019^{***}
$ExportAge_{t-1}$	0.002^{***}	0.002^{***}
Constant	-0.071	-0.068
No. of Obs.	14,005	14,005
First Part: Change		
$Log(Exports_{t-1})$	-0.225^{***}	-0.225^{***}
$ExportAge_{t-1}$	-0.020^{***}	-0.020^{***}
Ratio	1.356^{***}	1.348^{***}
$SimilarityDes_{t-1}$		0.216^{**}
Constant	0.910^{*}	0.905^{*}
Mills λ	-0.051^{***}	-0.055^{***}
rho	-0.434	-0.469
No. of Obs.	39,460	39,459
Year dummies	Yes	Yes
Division dummies	Yes	Yes
Destination dummies	Yes	Yes

Notes: The observations only included products that are exported by at least one firm as main export product. The destination and division dummies are main destination and main division dummies in terms of revenue. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.8 Conclusion

The average technological content of Philippine exporting firms has hardly changed over time, remaining around the low–tech category. Nevertheless main export product switching for manufacturing firms is a frequent phenomena. Firms that export main products that are more related to other main products have a higher tendency to change main product over time. However many of the main product switches are relatively unrelated, in the sense that they are not frequently co–exported. Also a distinction should be made between the type of main product as main products located in the low–technology and resource based product are more likely to change to relatively similar products. The relatedness of switches also depend on the size of the exporter. Larger exporters are less likely to make unrelated switches, change main product and product mix over time. Older exporting firms are less likely to change main product, less likely to upgrade and less likely to change product mix over time. Smaller/ younger firms seem to experiment more with the products they export. They are therefore more likely to make unrelated switches and change their product mix however they are less likely to upgrade. Hinting on unrelated switches to products that require similar skills. Therefore the core competency of larger/older firms seems to be better defined in terms of a specific product. While smaller export firms seem to experiment more with their export products.

Chapter 6

Export Prices Across Firms and Destinations: Manova and Zhang Revisited

6.1 Introduction

This chapter looks at empirical regularities that have been uncovered for exporter prices, revisiting a number of robust facts about the substantial and systematic variation in export prices found in Manova and Zhang (2012). The paper by Manova and Zhang (2012) find six stylized facts about firm export prices using a cross section of Chinese trade. Using a new Philippine trade dataset this paper will analyze the following four of the six empirical stylized facts obtained in Manova and Zhang (2012):[1]

Fact 1 "*Across firms selling a given product, exporters that charge higher prices earn greater revenues in each destination, have bigger worldwide sales, and enter more markets. These patterns are more pronounced for products with greater scope for quality differentiation and for richer destinations.*"

Fact 2 "*Across countries within a firm–product, firms set higher prices in richer, bigger, more distant, and less remote markets. The effects of size, distance, and remoteness are concentrated in rich destinations and among firms that vary prices more across markets.*"

Fact 3 "*Across countries within a firm–product, firms earn more revenues in markets where they set higher prices. This pattern is more pronounced for products with greater scope for quality differentiation and for richer destinations.*"

Fact 4 "*Across firms within a product, firms with more destinations offer a wider range of export prices. This pattern is more pronounced for products with greater scope for quality differentiation.*"

[1]The two facts not analyzed in this paper are related to import prices. The author has the available data to analyze these empirical facts however it was chosen not to do so in order to limit the scope of this exploratory paper.

These facts raise the possibility that firms also vary product quality within and across markets. However Manova and Zhang (2012) only use a cross section to obtain their results. This chapter takes an extra step and tries to show how persistent price dispersion is over time. Do firms that charge high export prices for a product to a certain destination in a year also do so in the next or are the export prices more randomly set? It should be expected that if differences in export prices reflect quality that then these difference should be persistent over time. This analysis cannot be performed on all the products that the Philippines exports as certain condition have to hold in order to insure than statement about product price dispersion can be made. Therefore a selection of products is made on the basis of four conditions that the product have to meet in order to enhance within product price comparison. The products selected are relatively similar within its 7-digit product category, exported by many different firms, exported for a long time by the Philippines, and firms, on average, export this product over a relatively long period. This chapter takes 14 products that meet the 4 conditions and analyze price dispersion persistence using a similar approach as Lach (2002).

6.2 Data

Similar to Manova and Zhang (2012) this paper wants to make a distinction between manufacturing and intermediary firms. Therefore three main corrections are applied to the data before use. Firstly, firms that are not directly involved with the production of the product they export are dropped.[2] Secondly, firm–product–destination observations that in real terms have an export value worth less than $1000 are dropped from the sample. Lastly, product categories that cannot be linked directly to firms or domestic production are also deleted from the analysis.[3] After deletion 74.5% of the total 2004 sample remains, which according to Manova and Zhang (2012) are manufacturing firms. There are 7,733 manufacturing firms identified that export 3,259 products to 222 destinations. This is notably less than the 96,522 firms and 6,908 products of the sample of Chinese exporter in the sample of Manova and Zhang (2012).

The Philippine data has the possibility to exploit both unit values and gross kilo prices. Unit values are used in the paper of Manova and Zhang (2012). The possibility to exploit both measures of export prices will be used in this paper in order to compare the results when using the different measures. From 2001 onwards units are reported in which the quantity is measured. Before 2001 a quantity is reported however the units in which it is measured is not recorded. Therefore unit values can be calculated for 2004, however for the price dispersion analysis gross kilo prices can only be used.[4]

Based on the availability of data for destination indicators (i.e GDP, GDP per capita, and remoteness) destinations are included in the analysis. In order to avoid loosing destinations data from a range of sources is used when the data is missing from the World Bank which is the primary source of data for the export destinations.[5] For the remoteness dummy destinations located close to (or neighboring

[2]Similar to Manova and Zhang (2012) firms that had in their name the following words Export, Import, Trader, Trading, Logistic, Shipping and Moving are deleted from the sample.

[3]Therefore all observations that are linked to PSCC division 93 (with the notable exception of PSCC items 93101 till 93102 which contains products built on consignment basis).

[4]There are 15 different units. We have Bale, barrel (bbl), cubic decimeters, gross kilos, grams, liter, meter, net kilos, number, troy ounce, pack, pair, roll, sets and square meters. However Number (39.2%), Net Kilos (36.4%) and Gross Kilos (21.6%) in decreasing order are the main units and account for 97.3% of the observations. Also for all observations we have gross kilo accounts.

[5]U.S censuses, C.I.A world factbook, INSEE and IMF. (e.g data on Taiwan is not available in the World Bank development indicators) The data consist mostly of constant GDP with a PPP correction. However in a few cases the PPP correction was not available and then constant GDP is used.

countries) the respective destination are used as a proxy while for GDP and GDP per capita data from other sources are imputed. Although not perfect this is a better option than dropping destinations from the analysis for which the World Bank has no data. As doing so would lead to sample selection; as it are often poorer and smaller destinations for which data is missing.

Figure 6.1 shows that the most frequently occurring observations are firms that export to one destination and firms that export one product. The number of firms that export to a certain number of destinations decreases as the number of destinations exported to increases. The same trend can be seen for the number of products exported.

Figure 6.1: Firms, Markets and Products

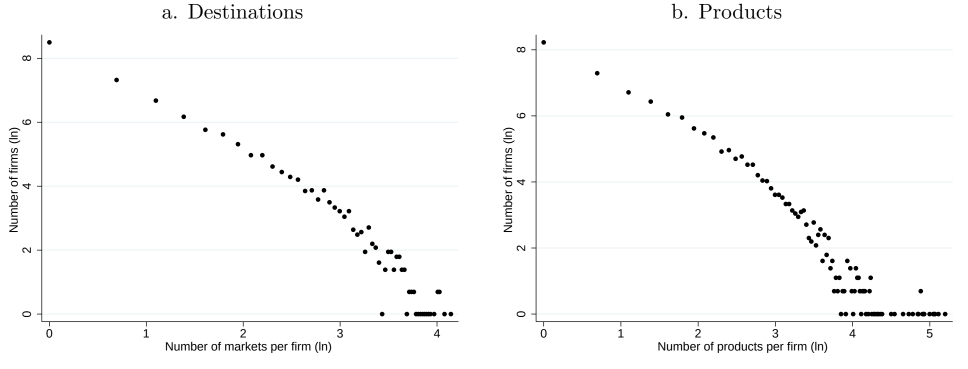
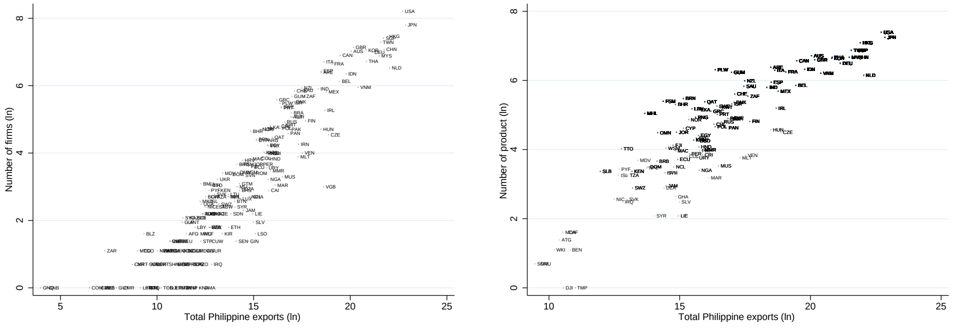


Figure 6.2 shows that when the total export value to a certain destination is larger it also increases in terms of number of firms that export to it and the number of distinct products exported to the destination. Therefore Japan and USA which are the most important export markets in terms of export value are also the destinations to which the greatest amount of firms export to and to which the greatest amount of distinct products are exported. However the relationship between the number of firms and total export value is more pronounced than that of number of products and total export value.

Figure 6.2: # Products and Firms versus total export value

a. # Firms b. # Products



The Philippines exports primarily to relatively rich destinations. Table 6.1 shows that 80.3% of the export value and 79.3% of the observations are to countries that the World Bank defines as high income countries. Therefore our analysis applies mostly to rich destinations. Making a real distinction between rich and poor destinations for this sample is difficult as the sample is dominated by relatively rich export destinations.

Table 6.1: Destination by World Bank Income Classification

Classification	# obs	Percentage	Total Revenue	Percentage
High	63,723	79.4%	30,140,410,931	80.5 %
Upper Middle	6,816	8.5 %	2,498,835,816	6.7 %
Lower Middel	7,423	9.3%	3,995,082,513	10.7 %
Low	2,384	2.9 %	810,976,923	2.2%

Table 6.2 illustrates the substantial variation present in prices across Philippine exporters, products and export destinations. After removing the product fixed effects the average log price has a standard deviation of 0.88 for gross kilo prices. Unit values, however, have more variation as is indicated by the higher standard deviation of 0.99. Prices vary across Philippine exporters selling a given product to a destination as the average standard deviation of firm prices in a destination–product market is 0.66 (0.73) for gross kilo prices (unit values). There is also variation in gross kilo price (unit values) across trade partners within a given exporter; As the average standard deviation of log prices across destinations within the firm–product pair is 0.46 (0.48). The magnitude of variation is similar to that found in Manova and Zhang (2012) and slightly larger for unit values than gross kilo prices.

Table 6.2: The Variation In Export Prices Across Frims, Products, and Destinations

	# Obs	Average	St. Dev.	Min	5th Percentile	95th Percentile	Max
Variation in (log) prices across firms and destination within PSCC 7-digit products							
1a. firm-product-destination gross kilo prices (product F.E)	80,267	0.00	0.88	-7.96	-1.43	1.42	9.88
1b. firm-product-destination unit values (product F.E)	80,267	0.00	0.99	-9.27	-1.62	1.57	9.81
2a. St. dev. of gross kilo prices across firms and destinations within products (product F.E)	2,339	0.86	0.58	0.00	0.14	1.91	6.86
2b. St. dev. of unit values across firms and destinations within products (product F.E)	2,339	0.96	0.70	0.00	0.12	2.29	7.44
Variation in (log) prices across destination within firm– PSCC 7-digit products pairs							
3a. St. dev. of prices across destinations and within firm-products pairs (firm-product pair F.E)	11,577	0.46	0.43	0.00	0.02	1.28	5.39
3b. St. dev. of unit values across destinations and within firm-products pairs (firm-product pair F.E)	11,577	0.48	0.46	0.00	0.02	1.35	5.65
Variation in (log) prices across firms within destination– PSCC 7-digit products pairs							
4a. St. dev. of prices across firms and within destination-products pairs (firm-product pair F.E)	10,850	0.66	0.56	0.00	0.04	1.73	6.32
4b. St. dev. of unit values across firms and within destination-products pairs (firm-product pair F.E)	10,850	0.73	0.64	0.00	0.04	1.90	8.59

6.3 Empirics

Manova and Zhang (2012) calculate conditional correlations. The correlations estimated are conditional because the regressions also account for fixed effects. Therefore given the fixed effect the correlation between the respective variables is the coefficient β. Manova and Zhang (2012) stress that their regression coefficients cannot be interpreted as a causal effect as the firms' unit values and sales are both effected by unobserved firm characteristics and are the joint outcome of firms' profit maximization. This paper reproduces a couple of the regressions performed in Manova and Zhang (2012) with a few slight deviations in order to corroborate the stylized facts they found but then for the Philippines.

6.3.1 Export Prices across Firms

The regressions and tables are similar to that of Manova and Zhang (2012) in order to enhance comparison between results. In the first regression the correlation between export prices and worldwide export revenues across firms selling a given PSCC 7–digit product is considered. To explore this variation the following equation is used:

$$logPrice_{fp} = \alpha + \beta \cdot logRevenue_{fp} + \delta_p + \varepsilon_{fp} \tag{6.1}$$

The variables of interest are aggregated at the the firm product level. The average export product price of firm f for product p across all destinations d it exports to is calculated as follows: $Price_{fp} = \frac{\sum_d revenue_{fpd}}{\sum_d quantity_{fpd}}$. Where $revenue_{fpd}$ is the f.o.b export value and $quantity_{fpd}$ is the amount exported, measured in gross kilos or in unit values, by firm f of product p to destination d. Product fixed effects δ_p are added to the regression to control for differences between products that effect all firms equally. The errors are clustered by firm.

The sign of β is the sign of the conditional correlation between export price and the revenues across firms within a product. In Table 6.3 it can be seen that, within a given product, firms that charge higher prices earn greater revenues. In columns (3) the interaction term between revenue and a dummy for differentiated products is added. This interaction terms shows that most of this effect is due to differentiated products which have a greater scope for quality upgrading than homogeneous products. The revenue coefficient which is still significant drops drastically in magnitude. Using unit values or gross kilo prices does not lead to very different results. Also in both cases exporting firms that charge lower prices export more in terms of quantity.

Table 6.3: Firms' Export Prices and Worldwide Export Revenues

	Variation across firms within products							
	Gross Kilo Prices				Unit Values			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
(log) Revenue	0.038***		0.011**	0.038***	0.042***		0.006	0.044***
(log) Gross Kilos		-0.114***						
(log) Quantity						-0.149***		
(log) Revenue x different. good			0.034***				0.044***	
(log) Revenue x Rich dest.				0.002				-0.001
Product FE	Y	Y	Y	Y	Y	Y		
R-squared	0.705	0.728	0.705	0.713	0.749	0.777	0.750	0.753
# observations	44,198	44,198	44,198	47,818	44,199	44,199	44,199	47,819
# firm clusters	7,733	7,733	7,733	7,733	7,733	7,733	7,733	7,733

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% level.

In columns (4) an interaction term is added to the regression in order to distinguish between rich and poor destinations. Therefore the average export prices and export revenue for a firm–product level is aggregated separately for rich and poor destinations.[6] Where rich destination are defined as destinations that are richer than the median GDP per capita for destinations.[7] When the interaction term between revenue and and rich destinations ((log) Revenue x Rich dest.) is included in the regression nothing changes as the interaction term is insignificant. Therefore the correlation between export prices and revenue is not different for richer or poorer markets. The destination that are poorer than the median GDP per capita only account for 13.1% of the observations. Richer destinations therefore account for the gross of the sample. The same is true for differentiated products that account for 80.9% of the observations. Therefore exports are is concentrated in richer destinations and manufacturing exports are concentrated in differentiated products. This concentration is also present in Manova and Zhang (2012) as in their sample rich destinations and differentiated products account for 84.2% and 91.3% of the observations.

The previous analysis variation across exporters in the destinations they sell to is not taken into account. Therefore potentially large differences across destination that influence both the participation and pricing decisions of firms are ignored. The following specification is at the firm–product–destination level takes this into account:

$$logPrice_{fpd} = \alpha + \beta \cdot logRevenue_{fpd} + \delta_{pd} + \varepsilon_{fpd} \tag{6.2}$$

The variables of interest are aggregated at the the firm–product–destination level. The export product price of firm f for product p to destinations d is calculated as follows: $Price_{fpd} = \frac{revenue_{fpd}}{quantity_{fpd}}$. Given the fact that the data is at the firm–product–level this the most disaggregate specification of export prices that can be obtained from the data. The fixed effects, δ_{pd}, are at the product–destination level. They, therefore, take into account the product–destination variation that is common to all firms exporting product p to destination d. (e.g Transport costs, bilateral tariffs and demand conditions) Table 6.4 presents evidence that firms that charge higher prices earn greater revenue. This relationship is again stronger for differentiated products. Also firms that charge lower prices sell larger quantities. The coefficient of (log) Revenue increases by a magnitude of around four when the interaction of revenues with importer's GDP per capita is added. This paper finds that firms that earn large revenues in poorer markets charge higher prices. As the GDP per capita increases the positive correlation between revenue and price becomes weaker, due to the negative interaction effect between GDP per capita and revenue. Therefore unlike Manova and Zhang (2012) this paper finds that prices of products are lower for markets where the GDP per capita is higher. The interaction between revenue and high income classification of the World Bank (High income) in columns (5) also shows that prices are lower for high income destinations.

Manova and Zhang (2012) point out that constructing unit prices as a ratio of export revenue to quantities does not restrict the sign of correlation between the two. However they also show that the only pattern which can be ruled out by construction is the combination of a positive correlation between price and quantity and a negative correlation between price and revenue. Therefore the positive correlation is informative and does not arise by construction.

[6] Therefore the number of observations increases slightly.
[7] The median GDP per capita in the sample is equal to \$8,976

Table 6.4: Firms' Export Prices and Worldwide Export Revenues

	Variation In Export Prices Across Firms In A Destination										
	Gross Kilo Prices					Unit Values					
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	
(log) Revenue	0.044***		0.028***	0.184***	0.060***	0.048***		0.027***	0.192***	0.067***	
(log) Gross Kilos		-0.122***									
(log) Quantity						-0.155***					
(log) Revenue x different. good			0.019**				0.024***				
(log) Revenue x (log) GDP per capita				-0.014***				-0.014***			
(log) Revenue x High Income					-0.019**					-0.023**	
Product–destination FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
R-squared	0.829	0.843	0.829	0.829	0.829	0.845	0.862	0.845	0.845	0.845	80243
# observations	80,267	80,267	80,267	80,191	80,243	80,267	80,267	80,267	80,191		

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% level.

6.3.2 Export Prices and Number of Destinations

This section the relationship between firms' export prices and number of export destinations in analyzed.

$$logPrice_{fp} = \alpha + \beta \cdot log\#Destination_{fp} + \delta_p + \varepsilon_{fp} \tag{6.3}$$

$$sd_{fp}(logPrice_{fpd}) = \alpha + \beta \cdot log\#Destination_{fp} + \delta_p + \varepsilon_{fp} \tag{6.4}$$

$Price_{fp}$ is the average export price of firm f for product p and $\#destination_{fpd}$ is the number of destinations that buy p from f. The measure of price dispersion ($sd_{fp}(logPrice_{fpd})$) is the standard deviation of the log export prices across destinations within each firm product pair. Product fixed effect are added to the regression to control for product–specific effects and the errors are clustered by firm. Table 6.5 shows that the number of destinations to which a firm exports a product is positively related to the export price. Adding the interaction term to the regression shows that this positive result is driven by differentiated products. In fact the coefficient of (log) # Destinations becomes negative indicating that for homogeneous products firms that export to more destinations charge lower export prices. As reported in Table 6.6, firms that export to more destinations also have greater variation of prices across destinations. This effect however is not stronger for differentiated products.

Table 6.5: Firms' Export Prices and Number of Export Destinations

	Gross Kilo Prices		Unit Values	
	(1)	(2)	(1)	(2)
(log) # Destinations	0.031***	-0.032*	0.036***	-0.044**
(log) # Dest x different. good		0.076***		0.098***
Product FE	Y	Y	Y	Y
No. of Obs.	44198	44198	44199	44199
Firm clusters	7,733	7,733	7,733	7,733
R-squared	0.702	0.702	0.747	0.747

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% level. Dependent variable is (log) average f.o.b export price, by firm and product.

Table 6.6: Firms' Variation in Export Prices and Number of Export Destinations

	Gross Kilo Prices		Unit Values	
	(1)	(2)	(1)	(2)
(log) # Destination	0.037***	0.035**	0.043***	0.044***
(log) # Dest. x different. good		0.002		-0.001
No. of Obs.	11577	11577	11577	11577
Firm clusters	3,383	3,383	3,383	3,383
R-squared	0.338	0.338	0.328	0.328

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% level. Dependent variable is standard deviation of (log) f.o.b export price, by firm and product.

6.3.3 Export Prices across Destinations within Firms

The focus has been on the variation in export prices within product categories or destination–product categories. The variation of export prices across destinations within a firm–product pairs is analyzed in this subsection. The difference with the previous regressions is that firm–product fixed effects (δ_{fp}) are added to the regression. This implies that product characteristics common to all firms and firm attributes are controlled for. This also implies that the effect of firms that only exports one product to a single destination is captured by the respective fixed effect. Therefore the coefficients of interest β are identified from the variation in prices across destinations within a given firm and product.

$$logPrice_{fpd} = \alpha + \beta \cdot logRevenue_{fpd} + \delta_{fp} + \varepsilon_{fpd} \tag{6.5}$$

Table 6.7 shows that firms that earn larger revenues from a given product in a destination in which it sets a higher price. In interaction term between revenue and differentiated products and revenue and GDP per capita are both insignificant. Therefore adding firm–product effects causes these interaction to become insignificant. The variable $Marketshare$ controls for the share of each firms' exports of a product to a destination and is added to control for local market power. The magnitude of the effect of revenue nor the significance changes when this variable is added to the regression. Indicating that the relation between higher prices and larger revenue cannot be solely attributed to market power. However it is of course not the market power of the Philippine firm with respect to other Philippine firms that matters per se, but the market power of the Philippine firm in respect to all exporters to that destination (i.e global market power). Therefore this variable is limited in explanatory power as it only reveals the concentration of the firm with respect to other Philippine exporters when these firms might not be the true competition, as possibly other exporters located outside the Philippines are. Although more local market power is related to higher prices, as can be seen with the significant effect for $Marketshare$.

The same regression is taken as before however destination specific variables are added as co-variates. This to see how market features affect Philippine firms. The market feature are income ($GDPpc_d$), Size (GDP_d), distance to the Philippines ($distance_d$), average transport cost per kilo ($Trans_d$), and overall economic remoteness ($remote_d$). The variables for distance and average gross kilo transport costs cannot be added at the same time in the regression as they both are proxies for transport costs. In this regression firm–product fixed effects are added. Therefore the identification of the coefficients of the market features is purely from the variation in prices across destinations for a given firm and product. Table 6.8 shows that firms charge higher prices in destinations that are richer, less remote and have higher transport costs. However when most variables are added at the same time in a regression (see column (7)) only GDP per capita remains significant. The results for GDP per capita remain significant even after correcting for the market share of the firm (Column (8))

$$\begin{aligned} logPrice_{fpd} = \alpha + \beta \cdot logGDPpc_d + \gamma \cdot logGDP_d + \\ \lambda \cdot logdistance_d + \mu \cdot logremote_d + \delta_{fp} + \varepsilon_{fpd} \end{aligned} \tag{6.6}$$

Table 6.7: Firms' Export Prices and Worldwide Export Revenues

	Variation In Export Prices Across Firms In A Destination									
	Gross Kilo Prices					Unit Values				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
(log) Revenue	0.044***		0.044***	0.048***	0.049***	0.041***		0.041***	0.050***	0.047***
(log) Gross Kilos		-0.058***								
(log) Quantity							-0.072***			
Market share			0.043***					0.055***		
(log) Revenue x different. good				-0.005					-0.011	
(log) Revenue x (log) GDP per capita					-0.000					-0.000
No. of Obs.	80,267	80,267	80,267	80,267	80,191	80,267	80,267	80,267	80,267	80,191
Dest–product clusters	25706	25706	25706	25706	25651	25706	25706	25706	25706	25651
R-squared	0.942	0.943	0.942	0.942	0.942	0.953	0.954	0.953	0.953	0.953

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% level.

Table 6.8: Firms' Export Prices and Worldwide Export Revenues

	Variation In Export Prices Across Firms In A Destination							
	Gross Kilo Prices						Unit Values	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(log) GDP per capita	0.021***						0.018***	0.023***
(log) GDP		0.004					0.001	0.005*
(log) Distance			0.003					
(log) remoteness				-0.052**			-0.024	-0.017
(log) Transport costs					0.012**		0.006	0.005
Market share						0.052***		0.075***
No. of Obs.	80,191	80,191	80,256	80,028	80,267	80,267	79,967	79,967
Firm-product clusters	25,651	25,651	25,695	25,521	25,706	25,706	25,481	25,481
R-squared	0.941	0.941	0.941	0.941	0.941	0.941	0.941	0.941

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% level.

Therefore this paper confirms the following facts:

Fact 1 Across firms selling a given product, exporting firms that charge higher prices earn greater revenues in each destination, enter more markets and have greater total sales. These patterns are also more pronounced for differentiated products however not for richer destinations. For firms that enter more markets this paper finds that for homogeneous products the price is lower while for differentiated products the price is higher.

Fact 2 Across countries within a firm–product, firms set higher prices in richer, more remote and with higher average gross kilo transport costs. Size and distance are not significant. When all variables are added in the same regression only GDP per capita remains significant. This paper does not find that the effect of size, distance and remoteness are concentrated in rich destinations.

Fact 3 Across countries within a firm–product, firms earn more revenues in markets where they set higher prices. However this paper does not find that these patterns are more pronounced for differentiated products and richer destinations.

Fact 4 Across firms within a product, firms with more destinations offer a wider range of prices. This patterns is not more pronounced for differentiated products.

Therefore the relation between prices and revenues is confirmed in this analysis. However the destination specific effect results are less pronounced than in the paper of Manova and Zhang (2012). There seems to be evidence that prices are higher in richer countries however there is also evidence that the prices are higher in poorer destinations. (See Table 6.4) The results on the other destination indicators are mostly insignificant. Even though destination factors seem to have no, smaller effects or possibly a non linear effect on the prices set by firms these same factors have strong significant correlations with the transport costs of firms. This is, however, out of the scope of the paper but in appendix some results of transport costs with destination factors are shown. (See Table 6.A.1)

6.4 Existence and Persistence of price dispersion

This part of the paper addresses the matter of persistence of export price dispersion overtime. Do exporters that charge a high price for their product to a certain destination do so consistently? Or are the prices set by exporters more random leading to changes in the export prices set by firms from year to year. The importance of this question relates to the estimation of quality over time for which export prices are often used. If prices are not consistently set then the perceived quality of these exporters will also be random; this in the sense that the prices will indicate different levels of quality when going from one year to the next.[8]

Not all products in the sample can be analyzed in terms of price dispersion over time. A selection of products is made on the basis of a number of indicators in order to insure that reliable statements about the existence and persistence of a price distribution can be made. Firstly the products should have a relatively large amount of firms exporting the product from year to year. Secondly variation in the firms that export the respective product over time should be limited. If the sample of firms

[8]The persistence of price dispersion can also be analyzed with a firm exporting the same products to different destinations. Do products exported to the same destination have prices dispersions that are consistent over time?

changes every year then the persistence of the price dispersion will be hard to analyze; as a firm can go from a high to low price exporter due to a change in the sample of exporting firms without the firm ever changing its price. A changing sample does not have to be problematic as it is also a reflection of the firms price position versus its current local competitors. However the change in sample over time should preferably be limited. Statements about the persistence of the dispersion for firm–product–destination observations that last 1 year cannot be made. Therefore spells that only last 1 year are excluded from the analysis. Thirdly the products within a product category analyzed need to be relatively similar. Otherwise price dispersions could occur due to the fact that different products are compared. The lower the level of analysis the more likely it is that similar products are compared. Given the fact that the analysis is at the 7–digit level products within a category are by definition relatively similar. However product categories that are relatively broad even at the 7–digit level need to be excluded as a potential candidate from this analysis, as a certain degree of homogeneity needs to be insured. Fourthly the products need to be exported for a relatively long, uninterrupted time period in the sample, the longer the better.

The analysis is at the firm–product–destination level. This due to the fact that a firm can differentiate the price of the product across destinations and has the added benefit that the product can be corrected for market specific effects. A firm that exports his products to different markets can set different prices at different markets. This also implies that the more products a firm exports the more influential its observations will be. If the firm–product level would be taken then the prices would be aggregated. This would be problematic as price changes of a firm can then be due tp changes in the composition of the destinations it exports to. A firm–product–destination level analysis is therefore more comprehensive. Table 6.9 shows the list of products selected and some summary statistics.[9] The selected products consist out of the following four categories: Furniture, Clothing, Simple manufacturing products and Electronics. All products are exported over the entire sample (22 years) with the exception of Electrical wiring harness for motor vehicles which is only exported from 1995 onwards.

Before excluding 1 year observations the products are exported every year by at least 12 different firms (Electronic Micro–assemblies) and firms, on average, export a product to a destination 2–3 years before stopping. (See Appendix 6.B.1)[10] When observations that only last 1 year are deleted from the sample then the summary statistics change. The average number of exporting firms per year drops while the number of destinations exported to increases. (See Table 6.9 and Appendix 6.B.1)) Indicating that the firms in the sample are probably larger. The minimum number of firms which export in a respective year is equal to 7 and is obtained for Electronic Micro assemblies in 1991. These 7 firms account for 29 observations and in 1992 the number of firms increases to 14 and the number of observation to 44 thereby insuring comparability. More importantly, however, the average number of years a firm–product–destination observation is in the sample increases from 3.1 to 5.6 years. Therefore the persistence of price dispersions becomes more comparable as observations remain longer in the sample and therefore the sample changes less overtime. One year observations have a higher tendency to have notably high or low gross kilo prices as the CV drops when 1 year

[9] The selected products have the following name and PSCC 7-digit category: Furniture of Rattan (8217903), Seats of Rattan/Cane (8211302), Seats, n.e.s, of Wood (8211802), Oth. Metal Furniture, n.e.s (8213909), Oth. Wooden Furniture, n.e.s (8215909), Trousers, breeches, etc, women's/girls', of cotton, not knitted/crocheted (8426002), Jerseys, pullovers, cardigans, waistcoats and similar articles , synthetic fibers , knitted/crocheted (8453003), Oth. Articles for Christmas festivities excluding lighting fittings and bulbs (8944500), Imitation Jewelery, of other non-precious materials, n.e.s (8972909), Oth. Basketwork from plaiting material goods (8997119), coconut (copra) oil, crude (4223100), Electrical Wiring Harness for motor vehicles (7731301), (other) Electronic (integrated circuits and) Micro–assemblies (7764900), Semi–Conductor Devices, manufactured from material on consignment basis (9310221)

[10] Firm–product-destination observations that only last one year make up at least 16.5% of the sample (Semi–Conductor Devices) to a maximum of 39.0% of the sample (Seats, n.e.s, of Wood).

observations are discarded. (See Table 6.10 and Appendix 6.C.1)

Table 6.9: List of Products Excluding Observations Lasting Only One Period

Product	No. of Firms Mean (Min, Max)	No. of Destinations Mean (Min, Max)	Years in sample Mean (Std)	No. of observations
Furniture of Rattan	232.1 (84, 326)	2.9 (1, 33)	6.2 (5.0)	14,919
Seats of Rattan	116.2 (53, 156)	2.9 (1, 30)	6.0 (5.0)	7,342
Seats n.e.s of Wood	117.8 (44, 180)	2.0 (1, 57)	5.4 (4.3)	5,082
Oth Metal Furniture	139.2 (30, 227)	2.1 (1, 33)	5.4 (4.0)	6,448
Oth Wooden Furniture	274.9 (72, 406)	2.3 (1, 36)	5.5 (4.6)	14,005
Trousers for Women of Cotton	112.9 (48, 220)	1.6 (1, 11)	5.0 (3.6)	4,026
Jerseys of synthetic fibers	99.1 (43, 137)	2.2 (1, 30)	5.5 (4.5)	4,701
Oth Articles for Christmas	291.6 (134, 460	2.8 (1, 29)	5.7 (4.5)	17,699
Imititation Jewelery	180.7 (96, 260)	3.3 (1, 33)	5.5 (4.5)	12,997
Oth Basket work from plaiting	264.0 (75, 382)	2.3 (1, 32)	5.6 (4.4)	13,433
Crude Coconut Oil	25.9 (13, 53)	2.7 (1, 14)	5.7 (5.0)	1,529
Electrical Wiring Harness	34.6 (20, 47)	2.5 (1, 15)	5.2 (4.5)	1,586
Electronic Micro assemblies	48.1 (7, 85)	4.9 (1.0, 43.0)	5.7 (4.4)	5,144
Semi Conductor Devices	45.4 (27, 80)	9.1 (1.0, 52.0)	6.6 (5.7)	9,089

The variation within product categories is considerable. (See Table 6.10) For semi–conductor devices 50% (90%) of the export prices in the middle of the distribution are 330% (3,810%) of each other. For trousers the variation within the product group is considerably less. But even for trousers 50% (90%) of export prices in the middle of the distribution are 80% (530%) from each other. It are, however, mainly simple manufacturing products (e.g Imitation Jewelery and Other articles for Christmas festivities) and electronic products that have a lot of variation within the product group. Indicating large differences in gross kilo export prices. The variation in prices are, of course, not solely a reflection of real price differences. In fact, destination and time specific effects such as tariffs, market conditions, distance, the business cycle, and transport costs are still present within these observations.

Table 6.10: Sample Statistics when One Year Durations are Excluded

	$Mean$ (StD)	CV	$\frac{75\%\ quantile}{25\%\ quantile}$	$\frac{95\%\ quantile}{5\%\ quantile}$	$\frac{99\%\ quantile}{1\%\ quantile}$
Furniture of Rattan	6.4(5.0)	0.8	2.4	8.8	22.6
Seats of Rattan/Cane	6.5(5.0)	0.8	2.4	9.0	20.2
Seats n.e.s of Wood	6.0(6.6)	1.1	2.7	9.8	25.4
Oth Metal Furniture	5.6(4.9)	0.9	2.5	8.0	19.4
Oth Wooden Furniture	6.0(8.8)	1.5	2.6	10.1	28.6
Trousers for Women of Cotton	19.0(11.2)	0.6	1.8	6.3	17.6
Jerseys of synthetic fibers	19.9(12.3)	0.6	2.1	7.0	17.6
Oth Articles for Christmas	19.3(26.5)	1.4	3.5	21.9	79.0
Imititation Jewellery	55.8(92.8)	1.7	3.3	23.6	113.5
Oth Basketwork from plaiting	6.9(6.1)	0.9	2.9	12.6	34.4
Crude Coconut Oil	1.5(1.5)	1.1	2.2	11.9	27.1
Electrical Wiring Harness	37.6(133.7)	3.6	2.9	18.9	101.4
Electronic Microassemblies	599.0(1038.1)	1.7	3.9	32.6	178.6
Semi–Conductor Devices	701.7(1621.7)	2.3	4.3	39.3	161.5

Notes: Prices not in log and differences to 2005 (CPI). Estimates are on the pooled data, that is, over years and firm–product–destination observations.

6.4.1 Heterogeneity–Controlled Estimates

Even though similar products are being sold by the respective firms, as the products fall within the same 7–digit product category, they nonetheless differ in terms of, for example, quality and export destination. The variation in measurable and immeasurable product characteristics across and within firms can render the same product as a differentiated product. Characteristics unrelated to real price differences should be isolated and removed from the price in order to capture the real differences in prices of the exported goods. Therefore price differences due to quality differences are allowed, however price difference due to tariffs or other destination differences need to be excluded. Unfortunately isolating factors that are unrelated to real prices is difficult. As products exported to richer destination might be of higher quality and therefore have higher prices. Then controlling for destination by adding destination fixed effects will cause the variation to be destination specific. Therefore the position of the firms versus other exporters to, for example, the USA will be picked up. However the fact that relatively high prices are charged for products exported to the USA versus other destinations will be partly, if not completely, missed. Adding a time trend also seems harmless however if prices increase over time then this will also be missed when a time trend is added. Therefore which factors to include to control for characteristics unrelated to real price changes is a choice. Arguments to include or exclude time and destination fixed effects or other possible effects can be found. However time and destination fixed effects seem the most prominent two factors to control for. Therefore the prices are only controlled for these two fixed effects only. The fact that variation decreases greatly can be seen as sign that prices are more comparable than without excluding these effects. (See Table 6.11) No claim is made that these are the only variables that should be controlled for. However the two factors controlled for seem the most obvious and refrain from adding more variables.

Before comparison of price differences are made variation over time and destinations is isolated and removed from the price variable. Therefore destination (time) effects that are common for all firms exporting product p to (at) destination (time) d (t) are controlled for by included destination fixed (time) effects. The following empirical model is estimated:

$$logPrice_{fpdt} = \alpha + \delta_{pd} + \delta_{pt} + \varepsilon_{fpdt} \tag{6.7}$$

For each product destination fixed effects (δ_{pd}) and time–varying fixed effects (δ_{pt}) are estimated. The residual variation is the variable of interest as the residual price $\hat{\varepsilon}_{fpdt}$ can be interpreted as the price of product p after controlling for destination and time fixed effects. These residual prices are more comparable. Table 6.11 shows that the variation in prices drops drastically when time and destination fixed effects are controlled for. For example the interquartile range for trousers is 50.2% and for Semi–conductor devices 138%. The lower variation within product can be interpreted as evidence that prices are more comparable after removing the fixed effects.

Table 6.11: Price Dispersion Measures Excluding Observations Lasting Only One Year

	Yearly Averages					
		Quartiles		Differences in Quartiles		
Product	Std	25%	75%	75%-25%	95%-5%	99%-1%
Furniture of Rattan	0.592	-0.397	0.381	0.778	1.890	2.743
Seats of Rattan/Cane	0.550	-0.386	0.356	0.742	1.776	2.610
Seats n.e.s of Wood	0.604	-0.415	0.390	0.805	1.906	2.828
Oth. Metal Furniture	0.560	-0.389	0.369	0.758	1.794	2.523
Oth. Wooden Furniture	0.644	-0.452	0.428	0.881	2.047	2.976
Trousers for Women of Cotton	0.469	-0.236	0.277	0.512	1.527	2.452
Jerseys of synthetic fibers	0.492	-0.309	0.327	0.636	1.582	2.410
Oth. Articles for Christmas	0.824	-0.509	0.518	1.027	2.725	3.963
Imititation Jewellery	0.890	-0.528	0.520	1.047	2.946	4.472
Oth. Basketwork from plaiting	0.716	-0.478	0.468	0.946	2.357	3.387
Crude Coconut Oil	0.343	-0.234	0.228	0.461	1.055	1.604
Electrical Wiring Harness	0.845	-0.482	0.430	0.912	2.833	4.225
Electronic Microassemblies	1.076	-0.670	0.723	1.393	3.453	5.323
Semi–Conductor Devices	1.015	-0.684	0.705	1.389	3.291	4.547

Notes: (i) Price dispersion based on $\hat{\varepsilon}_{fpdt}$ (ii) The values are averages over number of the years the product is in the sample; which in most cases is 22 years.

In order to analyze the evolution of prices over time the distribution of residual prices F_t at year t is cut up into 4 categories. A price classification which contains of four categories, consist of three thresholds. ($\mathbf{T_1}$, $\mathbf{T_2}$ and $\mathbf{T_3}$). The values of the thresholds are $\mathbf{T_1} = F_t(q_{t1}) = 0.25$, $\mathbf{T_2} = F_t(q_{t1}) = 0.50$ and $\mathbf{T_3} = F_t(q_{t3}) = 0.75$. Therefore prices that are lower or equal to the 25^{th} quantile in year t belong to the lowest price category; prices that are higher the 25^{th} quantile and lower the 50^{th} quantile in year t belong to the lower-middle price category; prices that are higher the 50^{th} quantile and lower the 75^{th} quantile in year t belong to the upper-middle price category; prices that are higher than the 75^{th} quantile in year t belong to the highest price category. Table 6.12 shows the one–step transition matrix for price categories over time. It can be seen that the lowest and highest prices have the lowest transition rates. The one–step transition rates for the lowest (highest) price category range from 0.48 (0.53)–0.67 (0.62). However this still implies that from year to year prices change form category quite frequently. Although the most changes happen to the categories that are closest. For example for the product jerseys prices classified in the lowest (highest) category remain in the lowest or lower middle price category the next year in 82% (81%) of the cases. Implying some consistency in terms of pricing at least for the two highest categories. While prices that are in the two middle categories have a greater tendency to shift over time. In fact in the majority of cases observations priced in one of these two categories have a greater chance of moving up or down a category than remaining withing the same category. It might be the case that observations charging prices in the middle categories might the most to gain with dropping and increasing their prices. However observations within these categories have two boundaries making it more like for

Table 6.12: One –Step Transition Matrix (One–year Horizon) Excluding Observations Lasting Only One Period

Crude Coconut Oil						Seats of Rattan					
#		q_{25}	q_{50}	q_{75}	∞	#		q_{25}	q_{50}	q_{75}	∞
193	q_{25}	0.68	0.19	0.10	0.03	1026	q_{25}	0.56	0.26	0.10	0.08
233	q_{50}	0.26	0.48	0.19	0.07	1119	q_{50}	0.22	0.42	0.25	0.10
244	q_{75}	0.08	0.26	0.41	0.25	1130	q_{75}	0.10	0.23	0.45	0.23
223	∞	0.03	0.10	0.30	0.57	1023	∞	0.08	0.12	0.25	0.55
Furniture of Rattan						Seats, n.e.s, of wood					
#		q_{25}	q_{50}	q_{75}	∞	#		q_{25}	q_{50}	q_{75}	∞
2146	q_{25}	0.56	0.27	0.11	0.06	727	q_{25}	0.65	0.22	0.09	0.04
2289	q_{50}	0.23	0.42	0.22	0.13	707	q_{50}	0.22	0.45	0.22	0.11
2339	q_{75}	0.11	0.22	0.44	0.23	676	q_{75}	0.08	0.25	0.44	0.23
2187	∞	0.07	0.12	0.24	0.57	615	∞	0.04	0.09	0.27	0.60
Oth. Metal Furniture						Oth. Wooden Furniture					
#		q_{25}	q_{50}	q_{75}	∞	#		q_{25}	q_{50}	q_{75}	∞
905	q_{25}	0.49	0.28	0.15	0.08	1959	q_{25}	0.58	0.25	0.11	0.07
946	q_{50}	0.26	0.38	0.23	0.13	1948	q_{50}	0.23	0.41	0.24	0.12
956	q_{75}	0.12	0.25	0.38	0.24	2080	q_{75}	0.12	0.21	0.41	0.26
862	∞	0.07	0.12	0.27	0.54	1954	∞	0.06	0.13	0.27	0.54
Jerseys						Oth. articles for Christmas festivities					
#		q_{25}	q_{50}	q_{75}	∞	#		q_{25}	q_{50}	q_{75}	∞
629	q_{25}	0.57	0.25	0.11	0.06	2524	q_{25}	0.54	0.25	0.13	0.08
689	q_{50}	0.25	0.37	0.27	0.11	2755	q_{50}	0.24	0.41	0.25	0.11
735	q_{75}	0.10	0.25	0.39	0.26	2629	q_{75}	0.12	0.25	0.41	0.22
682	∞	0.06	0.13	0.26	0.55	2462	∞	0.07	0.12	0.23	0.58
Basketwork						Electronic Mirco–assemblies					
#		q_{25}	q_{50}	q_{75}	∞	#		q_{25}	q_{50}	q_{75}	∞
2010	q_{25}	0.63	0.24	0.09	0.04	766	q_{25}	0.55	0.25	0.11	0.08
2079	q_{50}	0.24	0.44	0.23	0.09	813	q_{50}	0.23	0.41	0.25	0.11
1949	q_{75}	0.10	0.26	0.41	0.23	797	q_{75}	0.10	0.25	0.41	0.24
1755	∞	0.06	0.11	0.29	0.55	750	∞	0.08	0.12	0.26	0.54
Trousers						Imitation Jewellery					
#		q_{25}	q_{50}	q_{75}	∞	#		q_{25}	q_{50}	q_{75}	∞
490	q_{25}	0.48	0.27	0.14	0.11	1940	q_{25}	0.55	0.25	0.13	0.07
584	q_{50}	0.24	0.39	0.26	0.11	2102	q_{50}	0.25	0.38	0.26	0.11
645	q_{75}	0.10	0.25	0.42	0.23	2084	q_{75}	0.12	0.27	0.40	0.21
609	∞	0.08	0.14	0.25	0.53	1936	∞	0.06	0.13	0.22	0.59
Electrical Wiring Harness						Semi–Conductor Devices					
#		q_{25}	q_{50}	q_{75}	∞	#		q_{25}	q_{50}	q_{75}	∞
252	q_{25}	0.61	0.19	0.10	0.10	1606	q_{25}	0.67	0.22	0.07	0.03
268	q_{50}	0.17	0.54	0.24	0.05	1703	q_{50}	0.22	0.46	0.24	0.08
274	q_{75}	0.11	0.23	0.43	0.23	1702	q_{75}	0.08	0.23	0.45	0.25
227	∞	0.09	0.12	0.23	0.56	1610	∞	0.04	0.08	0.26	0.62

Notes: Based on the residual prices $\hat{\epsilon}$. Column # gives the number of price quotations in the initial quartile when firms–product–destination observations that only exists only 1 period are dropped. Therefore only firms–product–destination observations enter when it has data on two consecutive periods. The averages are total averages over all years.

price within the category to switch. However the transition rates do give preliminary evidence that price of observations are likely to change category over time. The estimated transition probabilities are based on a couple of strong assumptions (i.e the order of the Markov process and the chosen cutoff points and time horizon) Therefore these results should be interpreted with caution.

6.5 Conclusion

This paper confirms most of the stylized facts found in Manova and Zhang (2012) for the Philippines. Finding that prices and revenues are correlated, however the effects of income and to the lesser extent differentiated products on this correlation are less pronounced. The majority of the evidence point in the direction that this correlation is more pronounced for differentiated products. The results are mixed when income is interacted with revenue as some regressions indicate that firms set higher prices in destinations that are poorer and in other specifications the effect of the income interaction term is insignificant. This can possibly be attributed to sample differences as Philippine exports are concentrated around relatively rich destinations. However the fact that these sample differences are also present in the Chinese trade data makes this less likely. The most robust finding for the correlation of destination factors and export price is found for GDP per capita (income). The evidence shows that higher prices are set in destinations with higher income. Remoteness has the expected negative sign however is not always significant. The effect of distance is always insignificant while average transport costs are significant and are positively related to price.[11] The results also show that firms that export to more destinations set higher prices and also have greater variation in prices of products over destinations. The first effect, however, is only present in differentiated products. This paper also finds that using unit values or gross kilo prices does not lead to large differences in results.

Price dispersion within 7–digit product categories is large. This price dispersion is persistent, however, there is a lot of mobility of prices set by firms to a destination within a product category. This in the sense that products with a relatively high export price might have a relatively low export price the next year and visa versa. Indicating export price mobility over time. The highest and lowest prices have the lowest mobility while the prices in the two middle categorizes have the highest mobility over time. This might be due to the choice of product as the focus has been on products that are exported by many firms every year. Taking products that are smaller in terms of firms and more specific in definition might alter the results. The results are therefore preliminary and further, more thorough, research is needed before conclusions can be drawn on within price mobility. The tentative results, however, do point to a lot of price mobility within products over time.

[11] Transport cost however are influenced by destination specific effects being, for example, higher for destinations that are further away.

6.A Transport Cost preliminary regressions

$$logTrans_{fpd} = \alpha + \beta \cdot logRevenue_{fpd} + \delta_{fp} + \varepsilon_{fpd} \tag{6.8}$$

Table 6.A.1: Firms' Transport costs

	Variation In Transport costs Across Firms In A Destination				
	(1)	(2)	(3)	(4)	(5)
(log) Revenue	-0.076***				
(log) Gross Kilos		-0.098***			
(log) GDP per capita			0.053***		
(log) GDP				0.044***	
(log) Distance					0.363***
Firm–Product FE	Y	Y	Y	Y	Y
No. of Obs.	79,967	79,967	79,891	79,891	79,956
Firm clusters	7715.000	7715.000	7715.000	7715.000	7715.000
R–squared	0.859	0.862	0.856	0.857	0.867

***Notes*:** *, ** and *** indicate significance at the 10%, 5% and 1% level.

6.B List of Products Without Excluding One Year Observations

Table 6.B.1: List of Products

Product	No. of Firms Mean (Min, Max)	No. of Destinations Mean (Min, Max)	Years in sample Mean (Std)	No. of observations
Furniture of Rattan	304.2 (108, 435)	2.9 (1, 35)	3.4 (4.2)	19,110
Seats of Rattan/Cane	159.3 (66, 221)	2.7 (1, 39)	3.3 (4.1)	9,586
Seats, n.e.s, of Wood	174.9 (66, 279)	1.9 (1, 61)	2.9 (3.5)	7,485
Oth. Metal Furniture	194.0 (49, 316)	2.1 (1, 37)	3.0 (3.5)	8,958
Oth. Wooden Furniture	392.2 (123, 612)	2.2 (1, 37)	2.9 (3.6)	19,393
Trousers for Women/Girls of Cotton	139.7 (69, 269)	1.7 (1, 15)	3.4 (3.4)	5,327
Jerseys of synthetic fibers	130.2 (62, 201)	2.2 (1, 33)	3.3 (3.8)	6,265
Oth. Articles for Christmas	397.8 (183, 673)	2.6 (1, 32)	3.2 (3.8)	22,950
Imitation Jewelery	253.1 (140, 422)	3.0 (1, 37)	2.9 (3.6)	16,509
Oth. Basketwork from plaiting	354.4 (98, 536)	2.3 (1, 32)	3.3 (3.8)	17,707
Crude Coconut Oil	32.6 (16, 66)	2.7 (1, 14)	3.4 (4.2)	1,905
Electrical Wiring Harness	60.5 (33, 81)	2.1 (1, 16)	2.2 (2.9)	2,274
Electronic Micro–assemblies	67.4 (12, 123)	4.3 (1, 46)	3.0 (3.6)	6,362
Semi–Conductor Devices	64.4 (35, 115)	7.3 (1, 57)	3.1 (4.2)	10,395

Notes:

6.C Sample Statistics Without Excluding One Year Observations

Table 6.C.1: Sample Statistics

	Mean (*StD*)	*CV*	$\frac{75\%\ quantile}{25\%\ quantile}$	$\frac{95\%\ quantile}{5\%\ quantile}$	$\frac{99\%\ quantile}{1\%\ quantile}$
Furniture of Rattan	6.5(8.3)	1.3	2.4	9.5	26.0
Seats of Rattan	6.6(5.5)	0.8	2.4	9.7	24.2
Seats of Wood	6.2(6.6)	1.1	2.6	10.3	28.1
Oth Metal Furniture	5.8(6.9)	1.2	2.5	8.8	23.3
Oth Wooden Furniture	6.1(8.5)	1.4	2.7	10.9	33.1
Trousers for Women of Cotton	19.0(12.2)	0.6	1.9	6.4	18.6
Jerseys of synthetic fibers	20.2(12.9)	0.6	2.1	7.3	20.0
Oth Articles for Christmas	20.1(34.0)	1.7	3.6	23.8	91.2
Imititation Jewellery	60.3(259.2)	4.3	3.5	27.0	136.2
Oth Basketwork from plaiting	7.2(6.8)	0.9	2.9	13.5	37.9
Virgin Coconut Oil	1.6(1.8)	1.1	2.4	12.9	30.0
Electrical Wiring Harness	42.2(138.9)	3.3	3.1	24.1	166.9
Electronic Microassemblies	594.8(1004.9)	1.7	4.0	35.8	202.1
Semi–Conductor Devices	729.3(1600.1)	2.2	4.5	41.3	184.3

Notes: Prices not in log and differences to 2005 (CPI). Eatimates are on the pooled data, that is, over years and firm–product–destination observations.

6.D Price Dispersion Measures Without Excluding One Year Observations

Table 6.D.1: Price Dispersion Measures

	Yearly Averages					
		Quartiles		Differences in Quartiles		
Product	Std	25%	75%	75%-25%	95%-5%	99%-1%
Furniture of Rattan	0.615	-0.413	0.393	0.807	1.960	2.900
Seats of Rattan	0.576	-0.399	0.372	0.772	1.853	2.721
Seats of Wood	0.628	-0.436	0.402	0.837	1.996	2.996
Oth Metal Furniture	0.609	-0.412	0.376	0.789	1.953	2.860
Oth Wooden Furniture	0.677	-0.463	0.434	0.897	2.128	3.225
Trousers for Women of Cotton	0.494	-0.243	0.298	0.541	1.598	2.592
Jerseys of synthetic fibers	0.518	-0.317	0.332	0.649	1.681	2.563
Oth Articles for Christmas	0.860	-0.527	0.537	1.064	2.855	4.216
Imititation Jewellery	0.933	-0.555	0.543	1.098	3.091	4.683
Oth Basketwork from plaiting	0.740	-0.490	0.486	0.976	2.432	3.484
Virgin Coconut Oil	0.371	-0.253	0.256	0.509	1.142	1.688
Electrical Wiring Harness	0.922	-0.515	0.468	0.983	3.048	4.675
Electronic Microassemblies	1.094	-0.674	0.734	1.408	3.500	5.323
Semi–Conductor Devices	1.038	-0.707	0.718	1.425	3.355	4.685

Notes:

Nederlandse Samenvatting (Summary in Dutch)

"De toets van vooruitgang is niet het vermeerderen van het bezit van hen die al veel hebben, maar het voorzien van hen die te weinig hebben. (Franklin D. Roosevelt)

In de wereld waarin wij leven, zijn er landen met een hoog Bruto Nationaal Inkomen (BNI), volgens de Wereld Bank (WB) classificatie boven de $\$12,275$, en arme landen met een BPI van $995 in 2010. Hier tussenin zitten de landen die we de midden inkomen landen noemen. Deze landen hebben het moeilijk wanneer ze willen door groeien naar de hoogste inkomen groep. Ze komen vast te zitten. De Middle Income Trap (MIT) is een begrip dat voor dit fenomeen wordt gebruikt. De Filipijnen is een land dat vaak wordt gezien als een midden inkomen land dat al decennia lang vast zit. Dit proefschrift is een onderdeel van een project dat de MIT analyseert en de nadruk legt op de Filipijnen.

De bijdrage van dit proefschrift is tweezijdig. Ten eerste wordt getracht in beeld te brengen wat het tijdsspan is van een land om van een midden inkomen land door te groeien naar een hoog inkomen land. Daaropvolgend wordt beschreven wanneer we spreken van een land dat vast zit in de MIT. Het begrip MIT wordt hiermee vanuit een historische context gedefinieerd. Ten tweede wordt de Filipijnse economie geanalyseerd, waarbij een compleet nieuw dataset wordt gebruikt, welke is samengesteld door de auteur van dit proefschrift. Vier van de vijf hoofdstukken richten zich op dit tweede aspect. Het onderzoek naar de Filipijnse economie richt zich voornamelijk op export prijzen en dynamiek in de handel.

Het dataset dat in dit proefschrift wordt gebruikt laat onder anderen zien wat voor producten bedrijven produceren en naar welke bestemmingen deze producten worden geëxporteerd. Hiermee kunnen nieuwe dimensies van handel worden onderzocht. Zo laten Manova en Zhang (2012) zien dat bedrijven variëren in export prijzen naar bestemmingen, ook binnen bepaalde product categorieën. Ze laten ook een correlatie zien tussen de hoeveelheid producten dat geëxporteerd wordt naar een bestemming en de export prijzen van het betreffende bedrijf. Zinspelend op het feit dat kwaliteit niet alleen een verschil aanduidt tussen bedrijven, maar ook van belang is binnen een bedrijf, aangezien een bedrijf op meerdere niveaus kwaliteit kan produceren. Het belang van verschuivingen binnen een bedrijf wordt genoemd in Bernard et al. (2006). Zij beschrijven dat het toevoegen en afstoten van producten tussen 1972 en 1997 door bedrijven die blijven exporteren voor een derde deel bijdroeg aan de industriële groei van de Verenigde Staten. De nadruk is daarom komen te liggen op de veranderingen die plaatsvinden binnen (exporterende) bedrijven. Ook in dit proefschrift wordt de nadruk gelegd op wat er plaatsvindt binnen bedrijven. Dit proefschrift legt, bijvoorbeeld in het derde hoofdstuk, de nadruk op de tijdsduur van bedrijf-product- bestemming export relaties. De veranderingen over tijd van export producten binnen een bedrijf, wordt in het vierde hoofdstuk besproken. Door de Filipijnse handel te analyseren probeert dit proefschrift te verklaren wat een exporterend bedrijf beweegt in het maken van keuzes.

Zoals het citaat aan de start van de introductie zegt, moet onze vooruitgang gemeten worden door het feit of we voldoende voorzien aan hen die te weinig hebben. Het bijdragen aan onderzoek waar de Filipijnse economie mogelijk profijt van heeft en hen op weg kan helpen om een hogere inkomen land te worden is wat onderzoek meer dan de moeite waard maakt.

Dit proefschrift bestaat uit vijf op zichzelf staande hoofdstukken die verschillende onderwerpen gerelateerd aan export prijzen, handels dynamiek en economische ontwikkeling belichten. Het proefschrift is als volgt opgebouwd:

Hoofdstuk 2 is gekoppeld aan het dataset dat door de auteur is verzameld, samengesteld en opgeschoond in de Filipijnen met behulp van de Filipijnse Statistische Autoriteiten en is gebaseerd op van Heuvelen (2016b). In dit hoofdstuk wordt de samenstelling van de data beschreven, waarna een overzicht van de Filipijnse economie wordt weergeven met behulp van het dataset. De nadruk ligt met name op de dynamiek in concentratie, prijs en de samenstelling van de handel in de Filipijnen in termen van export, al wordt de import ook beschreven. Dit hoofdstuk eindigt met een focus op de top honderd producten die de Filipijnen exporteert. Deze top honderd producten geven, op een begrijpelijke manier, een samenvatting van de Filipijnse economie.

Hoofdstuk 3 zoekt naar manieren om de MIT te definiëren en is gebaseerd op van Heuvelen (2016d). De term MIT wordt gebruikt voor landen die uit de midden inkomen groep groeien, maar niet in de hoge inkomen groep komen. Één van de tekortkomingen van deze term ligt in het feit dat er een gebrek aan maatstaf is wanneer een land tot de MIT behoort en wanneer niet. Dit hoofdstuk gebruikt Maddison's Bruto Nationaal Product om een inkomens classificatie te maken waardoor de ontwikkeling van midden inkomen landen over een periode van 60 jaar in beeld kan worden gebracht. Een tijd definitie wordt gebruikt om onderscheid te kunnen maken tussen landen die vast zitten en landen waarvoor dit niet het het geval. Dit onderzoek laat zien dat landen gemiddeld 43-44 jaar nodig hebben om van midden inkomen status door te groeien naar een hoge inkomen status. Daarom worden landen die langer in de overgangsperiode zitten geclassificeerd als vastzittende landen.

Hoofdstuk 4 is gebaseerd op Pelkmans-Balaoing, van Heuvelen en Viaene (2016). Dit hoofdstuk onderzoekt de export dynamiek van bedrijven in opkomende economieën, waar lokale bedrijven te maken hebben met sterke buitenlandse concurrentie, zowel binnen de Filipijnen als daar buiten. Dit hoofdstuk laat zien dat de tijdsduur van exporteren opvallend kort is, gemiddeld genomen 20 maanden. 72,2% van de export relaties in het eerste jaar overleven het niet tot het tweede jaar. Onzekerheden binnen de markt, voornamelijk gerelateerd aan de wisselkoers en transport kosten, vergroten de kans dat een bedrijf, zoals verwacht, stopt met exporteren. Overlevingskansen van export relaties zijn het hoogst voor bedrijven die een export prijs selecteren die tussen de interval van de mediaan en het gemiddelde ligt van de internationale verdeling van product prijzen. Bedrijven die een prijs selecteren die aan de uiteinden van deze verdeling ligt, hebben de minste kans om te overleven.

Hoofdstuk 5 onderzoekt, over een periode van 22 jaar, veranderingen van export producten binnen Filipijnse bedrijven en producten die tegelijkertijd worden geëxporteerd, gebaseerd op van Heuvelen (2016a). Dit hoofdstuk analyseert hoe exporterende bedrijven hun specifieke vaardigheden aanpassen en veranderen over tijd. Het belangrijkste export product, ook wel kern kwaliteit (core competency) genoemd, laat zien wat de specifieke vaardigheden van een bedrijf zijn. Het belangrijkste export product van Filipijnse bedrijven wijzigt regelmatig, dit suggereert dat bedrijven hun specifieke vaardigheden veranderen over tijd. Door te kijken welke producten tegelijkertijd binnen een jaar door een bedrijf worden geëxporteerd, worden overeenkomsten tussen de producten onderzocht. Dit hoofdstuk beschrijft dat het veranderen van specifieke vaardigheden binnen een bedrijf, onder anderen, afhankelijk is van grootte, hoeveel jaar een bedrijf exporteert en de overeenkomsten tussen de gexporteerde producten. Dit hoofdstuk beschrijft ook dat het aannemelijk is dat jongere/kleinere bedrijven eerder veranderen van vaardigheden en wanneer ze veranderen, dit niet product gerelateerde veranderingen zijn. Het tegenovergestelde is waar voor oudere/grotere bedrijven.

Hoofdstuk 6 is gebaseerd op van Heuvelen (2016c). Dit hoofdstuk reproduceert gedeelten van de analyses van Manova en Zhang (2012) maar dan voor de Filipijnse economie. Uit dit onderzoek blijkt dat het empirische feit dat bedrijven hun prijzen over bestemmingen varireën en dat hogere prijzen positief gecorreleerd zijn met hoge opbrengsten ook voor de Filipijnse economie van toepassing is. Het empirische feit dat de correlatie tussen prijzen en opbrengsten sterker is in rijkere bestemmingen wordt niet gevonden voor de gebruikte data. De analyse is uitgebreid met een gedeelte over de spreiding van prijzen over tijd binnen veertien producten, waar bij gebruik wordt gemaakt van het raamwerk dat in Lach (2002) wordt toegepast. In deze uitbreiding wordt voorwaardelijk bewijs gevonden in het voordeel van willekeurig prijzen versus consistent prijzen. Exporterende bedrijven zetten hun export prijzen niet consistent laag of hoog ten opzichte van lokale concurrenten. Hoewel prijzen die binnen de hoogste en laagste categorie vallen over het algemeen minder mobiliteit laten zien.

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