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Essays on Firm Heterogeneity and Export: Productivity, Quality and Access to Finance

A dissertation submitted to the doctoral school of economics and management in partial fulfilment of the requirements for the Doctoral degree (Ph.D.) in Economics and Management

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Summary and Overview

The thesis investigates the relationship between firm heterogeneity and international trade from the perspective of a developing country. The standard heterogeneous firm trade models (Melitz, 2003; Bernard et. al, 2003) have largely focused on differences among firms in terms of an exogenously given productivity which would explain why only some firms self-select into international markets while the others serve the domestic market. Empirical evidences, especially from developing countries, note that firms' selection into export is also the result of conscious investment decisions by firms that aim to improve their productivity and product attributes with explicit purpose of becoming exporters (Lòpez, 2004). In order to further understand the selection mechanism of developing countries' firms into international markets, this thesis explores the roles of prices, quality and access to finance differences across firms as additional sources of heterogeneity, as well as their interaction.

The thesis is composed of three self-standing but related empirical papers that exploit a unique panel data set that come from the annual Ethiopian Large and Medium Scale Manufacturing Enterprise census, and one concluding chapter with policy implications. The census is run by the Central Statistical Agency of Ethiopia (CSA). Unusual in many firm-level surveys, this data set provides plant-product level information on quantity and value of production and sales in both the domestic and foreign markets. Among other information, the census also collects data on the obstacles that firms face in their activities including financial resources. The richness of the data set allows constructing plant-product-level price and quality index, and firm-level access to finance indicators.

The first chapter investigates the role of price heterogeneity and demand factors in examining the link between export and productivity. One of the well-known empirical regularities in the literature is that, on average, exporters are more "productive" than non-exporters (ISGEP, 2008; Wagner, 2012). Despite this consensus, what the referred productivity really captures remains blurred: since quantity information is rarely available in most data sets, the standard approach is to proxy quantity by firm-level revenues deflated by industry-level price indices. However, this approach ignores within-sector price heterogeneity and, as a result, it confounds physical efficiency (output per unit input) and demand components into the revenue-based productivity estimates (De Loecker, 2011). This bias would be further exacerbated when firms operate in different markets, and thus have

different pricing strategies. To the extent that the demand structure is different in domestic and foreign markets, it is reasonable to expect price differences between exporters and non-exporters, not to mention within-sector variations.

Using a rich panel data from Ethiopian manufacturing firms, the first chapter characterizes firms by three distinctive margins that are confounded in revenue productivity: physical productivity, output prices and demand shocks, and examines the relationship between these different sources of competencies of firms, and their separate role in shaping export participation. The main results show that exporters are more productive than non-exporters in both revenue and quantity based productivity measures. However, the productivity gap is larger in revenue productivity. Regarding the decision to export, revenue productivity and price significantly explain probability to export, but physical productivity hardly plays a role. Further evidence shows that price is increasing in revenue productivity and decreasing in physical productivity. On average, exporters charge higher prices than non-exporters. The overall results suggest that revenue productivity overstate the relationship between export and productivity because exporters have favourable demand condition that allows them to charge higher prices than non-exporters. This finding provides a new insight in understanding how export contributes to aggregate productivity growth. To the extent that exporters are more productive than non-exporters, the findings about prices are at odds with the standard firm heterogeneity model of Melitz (2003), where more productive firms have lower marginal costs and thus charge lower prices.

The second chapter addresses this puzzle, further investigating the determinants of firms' decision to export. To this end, I refer to the analytical framework that extends the standard firm heterogeneity model by introducing quality (e.g., Hallak and Sivadsan, 2013). Recent empirical findings also confirm that exported products feature higher prices than domestic products, and this price difference is ascribed to quality differences (for example see, Iacovone and Javorcik, 2012). Nevertheless, even if prices do correlate with quality, a major limitation of using prices as a proxy for quality lies in the inability to distinguish between quality and cost factors. To address this issue, I follow the recent empirical strategy proposed by Khandelwal (2010) to estimate quality, thus relaxing the assumption product quality is fully captured by its price.

The results show that high-price products are more likely to be exported. However, once price is adjusted for quality difference, products with higher quality-adjusted price are less likely to enter into foreign markets. Jointly these results suggest that the observed price-export relationship reflects quality differences. Furthermore, I find that quality is the most important factor in determining firm export decision; and the effect of firm efficiency on export mainly operates through the quality channel. Based on an analysis of the dynamics of quality and product entry, I find that high-quality products self-select into export. Specifically, the trajectories of exported products show that quality upgrading took place three years prior to export entry. In the run-up phases of export entry, firms also change the composition of their production in favor of future exported varieties.

The third chapter, is the result of a joint work with my supervisor Stefano Schiavo, and investigates the mechanisms through which access to bank credit affects firms export. In particular it examines the interplay between financial constraints and product quality in explaining firms' export behavior using information on a panel of Ethiopian manufacturing firms. Similar to many recent studies, the previous chapter suggests that quality matters a lot for export and, moreover, that firms need to make conscious investment decisions aimed at upgrading their product quality before entering foreign markets. The implication is that, in addition to its direct effect on firms' ability to pay upfront entry costs, access to finance may affect export decisions through its effect on investment. Since firms in developing countries have typically limited internal revenue and operate in underdeveloped financial markets, financial resources are especially important in shaping the decision to export.

The main results confirm the presence of substantial sunk costs associated with exporting. Despite this, bank finance does not appear to have a strong *direct* effect on export participation. On the other hand, both present and past product quality is robustly associated with export status, and quality upgrading requires substantial investment. Therefore, bank credit is relevant for export only insofar as it is channeled to the fixed investments required to enhance quality. An important implication of this chapter is that improving financial conditions and access to bank credit can help firms to move from low- to high-quality products, enhance their ability to access foreign markets and therefore improve the overall export performance of the economy.

The common message of all the three chapters is that the success of Ethiopian firms in international market is mainly driven by demand factors in which only firms that able to attract demand for their products succeed in foreign markets. However, despite the presumed relevance of firm productivity efficiency to drive export, there is no strong evidence that this apply for Ethiopian firms. Further analyses of the demand factors unveil the crucial role of product quality upgrading in determining firms' entry into export markets. These findings sheds some light on the sources of the productivity difference between exporters and non-exporters that have been found in the literature, including studies focusing on African firms (for example, Van Biesebroeck 2005, and Bigsten and Gebreeyesus 2009). Furthermore, it confirms the general importance of satisfying foreign market quality standards for firms in developing countries to succeed in international markets (Chen et.al., 2008). The evidence suggests that export promoting policies that exclusively focus on achieving quantitative targets, such as productivity, as a means to increase competitiveness in international markets should be revisited: especially for developing countries, a policy shift from quality to quantity is a right direction to go forward.

Chapter 1

Revisiting the Export-Productivity Link: Efficiency, Price and Demand Heterogeneity
Evidence from Ethiopian Manufacturing Firms

1.1. Introduction

One of the new frontiers of economics research is the analysis of trade from a microeconomic perspective by putting the focus on firms as a unit of analysis. Since the seminal paper by Bernard and Jensen (1995), a surge of interest in microeconometrics of international trade has yielded numerous studies on the link between trade activities and various aspects of firm characteristics, the main being productivity. Subsequent empirical studies for a large number of countries establish that exporters are more productive than non-exporters and explain this evidence as a self-selection into export and (or) learning effect from exporting. Similarly, many studies for African firms confirm the superior performance of exporters relative to non-exporters (for example, Bigsten et al. 1999, and Van Biesebroeck , 2005 for Sub-Saharan Africa; and Bigsten and Gebreeyesus, 2009 for Ethiopia). Along with these empirical studies, Melitz (2003) models decision to export considering productivity as a single source of firm heterogeneity. The model predicts that high marginal cost (less efficient firms) are less likely to enter into international markets as they cannot generate enough revenues to cover foreign market entry costs, suggesting only the most productive firms find it profitable to export while less productive firms serve the domestic markets.

Despite the large evidence on the relevance of productivity in determining firms export performance, many studies define productivity at a loose end. Since quantity information is rarely available in most data sets, early papers in this line of research proxy quantity by firm-level revenues deflated by industry-level price indices. However, given substantial within sector price variations, estimating productivity using deflated revenue confounds physical productivity and price differences. Recent studies emphasize that while the main interest of productivity analysis remains understanding what factors determine firm efficiency, the standard measures of productivity captures more than that. Since price may reflect firm-specific demand shocks or market power, high revenue-based productivity many not necessary reflect efficiency, it rather captures profitability (De Loecker and Goldberg, 2014).

Ignoring price difference has a particular implication in examining the relation between export and productivity. Since exporters sell in foreign markets that may have a different demand structure than the domestic market, comparing the exporters and non-exporters' productivity derived from revenue would be misleading. De Loecker and Warzynski (2012) find higher markups for exporters and suggest that the productivity difference between exporters and non-exporters is partly explained by this markup differences. In the same vein, De Loecker (2011) warns against inferring the productivity gains of trade based on revenue productivity: since revenue productivity contains price and demand components, the effect of trade can be generated through its effect on prices and demand, rather than on real efficiency.

Using a rich panel data from Ethiopian manufacturing firms, this paper examines the role of price and demand differences across firms in shaping the relationship between export and productivity. Specifically, it characterizes firms by three distinctive margins that are confounded in revenue productivity: physical productivity (the quantity of output produced by a unit of input) as a shifter of production function; output prices as a movement along a demand curve; and demand shocks as a shifter of a demand curve. Thus, the empirical approach of the paper involves estimating these idiosyncratic factors, establishing their relationships, and examining their separate contributions in determining firm's decision to export.

Although earlier studies confound these factors in a single revenue productivity, these components capture different competency margins of a firm: while physical productivity indicates the idiosyncratic technology differences (Foster et al.2008), the demand components captures firms ability to sell their products at premium (Pozzi and Schivardi, 2012). This implies that revenue productivity could not be a good indicator of firm efficiency because an *inefficient* firm that be able to generate high enough demand for its products can have higher revenue than an *efficient* firm that fails to attract large demand for its products. Thus, the analysis based on revenue productivity could be misleading as it obscures the relative importance of demand and supply side factors.

The Ethiopian manufacturing survey provides information on quantity and values of production that allow to separately measure the various components of revenue productivity. This unique feature of the data is particularly relevant for the purpose of this paper. First, the availability of plant/product-level price or alternatively quantity allows estimating total factor productivity that is not contaminated with idiosyncratic demand effects. Second, the richness of the data allow to estimate plant-level demand shocks addressing the usual simultaneity bias in demand estimation by instrumenting output price with physical productivity as suggested by Foster et al., (2008). Since movements on the demand curve (due to price changes) are captured by physical productivity in the procedure of estimating demand, the estimated demand shocks reflect a shift in demand that is not related to productivity shocks. This in turn ensures an effective separation of technology and demand related components that constitute revenue productivity.

The results show that ignoring price heterogeneity leads to a significant difference in estimated productivity, causing revenue productivity to be larger than real physical productivity. Price is increasing in revenue productivity and demand shocks, and it is decreasing in physical productivity. Similarly, demand shock is positively correlated with revenue productivity and it is negatively associated with physical productivity. With regard to export-productivity link, on average, exporters are more productive than non-exporters in both revenue productivity and physical productivity measures. However, the productivity gap is larger in revenue productivity. Furthermore, exporters charge higher prices and have larger demand than non-exporters. All these pieces of findings suggest that revenue productivity that ignores price and demand factors overstate the productivity premium associated with exporting. In line with the existing literature, this paper finds that firms with higher revenue productivity are more likely to export. However, when revenue productivity is decomposed into various components, the results shows that price variations are the main factors that determine selection into export while physical productivity and demand shocks play no significant role. The main message of the paper is therefore, the association between export and revenue productivity is mainly driven by the fact that exporters charge higher prices and have positive demand than non-exporters, not necessarily by exporters superior efficiency.

In general, the findings of this paper deepen the understanding on the determinants of developing country firms' success in global markets by unlocking the black-box of export and productivity linkages, and shade light on the design of export promotion policies in developing countries. The evidence that firms ability to produce efficiently at low cost is not enough to succeed in international markets suggests that export promotion policies that exclusively focus on improving firms efficiency as a means to increase competitiveness need to be reconsidered.

The remainder of this chapter is structured as follows. Section 1.2 provides an overview of related literature that shapes the empirical framework of the chapter. Section 1.3 presents some backgrounds on the Ethiopian context. While section 1.4 describes the data, section 1.5 presents the main variables and estimation of demand and productivity. Section 1.6 presents the empirical analysis followed by section 1.7 providing further robustness checks. Section 1.8 concludes.

1.2. Related Literature

The analysis of the paper builds on three independent but a related strands of literature. First, the seminal Melitz (2003) model of international trade with heterogeneous firms emphasizes the superior productivity of exporters and the association of productivity with export decision where only more efficient firms self-select into export. In this model, preferences take the form of Constant Elasticity of Substitution (CES), and firms produce horizontally-differentiated varieties within an industry. In this setting, the presence of fixed exporting cost is the main reason behind the systematic relation between export and productivity: given substantial entry costs into foreign markets, only sufficiently high productive firms that can generate enough profit to cover the fixed costs of exporting self-select into foreign markets. In what follows, large empirical studies in many countries document average productivity difference between exporters and non-exporters, and the selection of more productive firms into export (see ISGEP, 2008 for a cross country comparison; Wagner, 2012 for a review; Bigsten and Gebreeyesus, 2009 for Ethiopia).

A handful of recent works in international trade have examined the implications of price and demand differences on link between trade and productivity. Smeets and Warzynski (2013) examine the relationship between export and productivity for Danish firms taking into account price heterogeneity. They find a larger export premium when taking into account price heterogeneity than the premium generated from revenue productivity. Moreover, the productivity effect on selection into export is stronger when they use firm-level deflator. In the same vein, De Locker (2011) shows that the effect of trade liberalization on productivity may simply arise because trade affects price and demand. Using Belgian textile producers' data the author finds that taking into account unobserved price heterogeneity substantially decreases the productivity gains associated with trade liberalization, and emphasize the need to reconsider the productivity gains in response to trade openings that have been established in previous studies.

Although CES assumption in Melitz (2003) model ensures constant producer markups over marginal costs, Melitz and Ottaviano (2008) introduce a linear demand that allows variations in mark-ups, and examine the relationships between markups and trade. In this model, exposure to trade may induce firms to lower prices through its effect on markups, and a firm can charge different markups in domestic and foreign markets. Specifically, more productive (lower cost) firms charge lower prices and set higher mark-ups that leads to higher profits. Furthermore, allowing price discriminations across markets, they show that in markets with severe competition firms charge lower prices and feature lower mark-ups. De Loecker and Warzynski (2012) investigate the relationship between export and mark-ups and its implication on the link between export and productivity. Using Slovenian manufacturing firms data, they find that exporters on average charge higher mark-ups than non-exporters and markups increase upon export entry. They further argue that this markup difference drives the gap between physical productivity and revenue productivity, and the well-documented superior productivity of exporters could at least reflect markup differences.

Second, this paper is related to a new wave of research that focuses on firm's price setting strategies in different markets. Based on the US import data Schott (2004) finds that unit values of the imported goods systematically correlated with the characteristics of the exporting country in which goods originating from developed countries have higher unit values. Similarly, based on within-exporters variations, Johnson (2012) documents that exporters selling in markets that are difficult to enter charge higher prices. Using detailed firm-level data Manova and Zhang (2012) find systematic variations in prices charged for the same product across destinations, where exporting to distant (high income) markets allow firms to charge higher prices. The same strand of trade literature introduces quality variations to explain price differences across firms and export markets. In this regard, with the recognition that lower-priced products are not necessarily better placed to compete in international markets Baldwin and Harrigan (2011) and Hallak and Sivadasan (2013) introduce quality as a source of heterogeneity in explaining firms selection into export. Gervais (forthcoming) separates revenue productivity into physical efficiency and product quality, and find that price is increasing in quality and decreasing in efficiency. Furthermore, selection into foreign markets is mainly driven by quality, but not by efficiency. These studies in general indicate differences in pricing behaviour between exporters and non-exporters, where exporters tend to produce higher quality products and thus charge higher prices than non-exporters.

Third, the paper also complements the strand of industrial organization literature that focuses on separating demand and supply factors as a determinant of firms profit margins and thus selection into markets. Most notably, Foster et al., (2008) introduce the importance of idiosyncratic technology and demand as a joint determinant of firm's selection and survival in a market. Considering firms that produce horizontally differentiated products, they show that plant-specific demand shocks unrelated to quality induces reduces demand elasticities and as a result firm that have favourable demand shocks increases their output prices. They argue that if prices reflect idiosyncratic demand shifts or market power differences, high revenue-productive firms may not be technologically efficient. Based on the US data Foster et al., (2008) find that when using revenue-based productivity, the contribution of new entering firms in the aggregate productivity of an industry is underestimated because entering firms charge lower prices than incumbents. Similarly, Siba and Soderbom (2010) investigate the relative importance of demand and productive efficiency for the performance of Ethiopian firms. They find that entrants have lower demand and output prices than incumbents, but no significance difference in physical productivity. Furthermore, demand differences are as important as productivity in determining Ethiopian firm's survival in the market.

The discussion above provides two key insights that discipline the empirical framework of this paper. First, similar to productivity, the demand side factors may influence selection into foreign markets. For instance, to the extent that export decision is determined by the capability to cover export entry costs, two firms that generate the same revenue either by generating more demand or producing at low cost can have the same export status. However, it is crucial to distinguish between demand and productivity factors as they capture different sources of firm competencies. While demand reflects firms' ability to sell their products at a premium, productivity indicates firm's ability to produce more output for a given input level. Thus, confounding these two different competencies of firms could be misleading. Second, given price differences between exporters and non-exporters that capture quality and mark-ups, relying on revenue to proxy physical output would overstate the relationship between export and productivity. Taking stock of these insights, the key working hypothesis of this paper is that the relationship between export and productivity will be mediated by price and demand differences between exporters and non-exporters. Specifically, given that revenue-productivity confounds price and physical productivity, and further price variations could reflect demand shocks, market power and/or quality, disentangling the demand components from the revenue productivity will decrease the marginal effects of productivity on firms export decision.

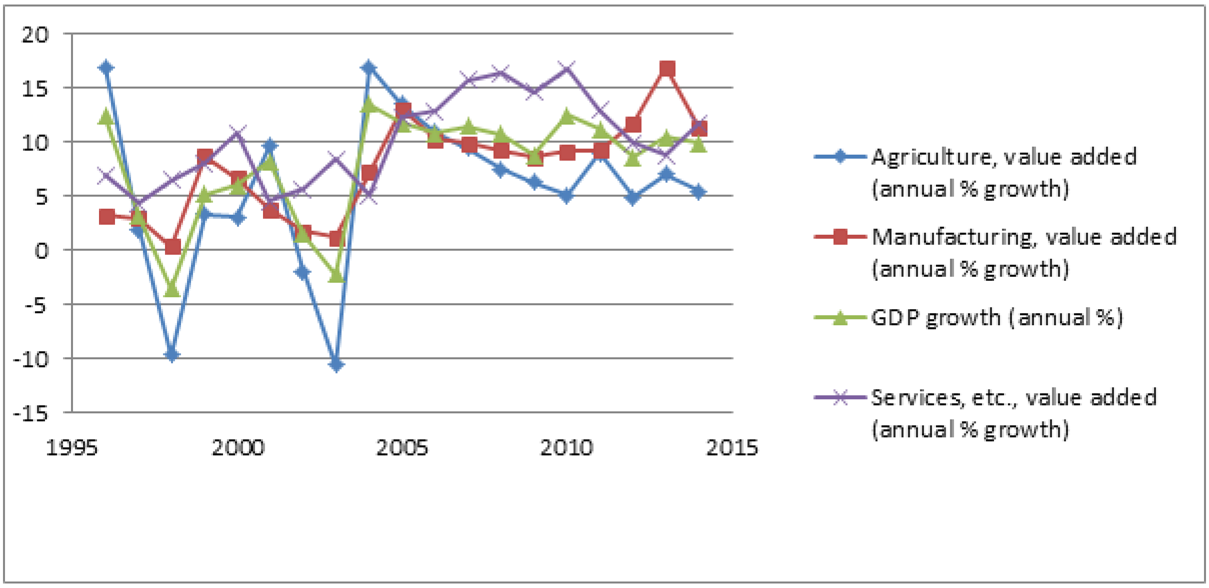
1.3. The Ethiopian Context

Before going into the main theme of the paper, this section introduces the context in which the analysis is carried out. This would facilitate the interpretation of some of the results through the thesis. Given that the main research of the thesis is on the export performance of Ethiopia, the topics covered in this introductory section mainly focus on the structure and performance of the country's export while briefly describing the overall structure of the country.

1.3.1 Economic Performance and Sectorial Composition

With a population of 97 million, Ethiopia stood as the second populous country in Sub-Saharan Africa as of 2014. The population grows at an average rate of 2.5%. About 85 % of the population lives in rural areas. The country's per capita income of USD 550 is substantially lower than the Sub-Saharan average of USD 1300 in 2012.

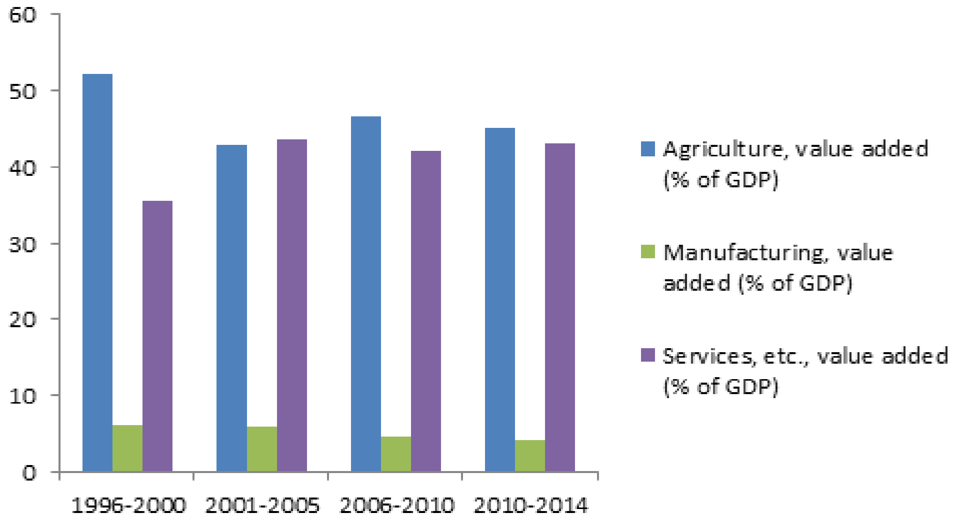
Figure 1.1. GDP, agriculture and manufacturing growth rates



Source: own computation from World Development Indicators

Between 1996 and 2014, the Ethiopian economy grew with a yearly average of 8 % starting from negative growth rates in late 1990s (Fig 1.1.). Between 2004 and 2014 country has sustained an average GDP growth rate of 10.9% supported by big national plans[1]. This encouraging growth was reflected in all sectors. In the same period, the service sector grew by 12.5 %, mainly driven by expansion of hotel and truism, financial intermediation, trade, and transport and communication[2]. The manufacturing and the agricultural sectors grew by an average of 10.6 % and 8.8%, respectively.

Figure 1.2. The GDP share of Agriculture, manufacturing and service sector



Source: Own computation based on World Development Indicator

Although its share has declined recently, agriculture continues to be the major contributor for the economy. Between 1996 and 2000, on average, the sector accounted for 52 % of the GDP value added (Fig 1.2.). Nevertheless, the structure of the economy has been slightly changed in recent periods. In particular, the service sector has been expanded, and its contribution to the GDP has become equivalent to the share the agricultural sector: in 2014, the service sector accounted for 42.2 % of the economy while the agriculture sector contributed about 42.3 %.. On the other hand, the share of the manufacturing sector remained low and furthermore declined from 6 % between 1996 and 2000 to 4 % of the GDP between 2010 and 2014. This indicates that despite the country has shown impressive growth, the manufacturing sector loses momentum.

As in many other low income economies, the informal sector in Ethiopia is significant. It is estimated at about 38.6 % of GDP compared with an average of 38.4% for SSA and 38% for all low

[1] During 2005/06-2009/10 the government of Ethiopia implemented the Plan for Accelerated and Sustained

[2] For example, in 2013/2014 hotel and tourism grew by 26.6 %; financial intermediation by 17.8 %;wholesale and retail trade by 14.9 % and transport and communication by 13.7 % .

income countries (IMF,2013)[3]. The Central Statistical Agency of Ethiopia conducted the first nationwide survey of urban informal sector in 2003. Accordingly, about 50.6 % of urban employed are in the informal sector. Looking at the sectoral distribution of the sector, 43 % of informal establishments are engaged in manufacturing while trade, hotels and restaurants together account for 58 % of the total informal businesses. Weak institutional frameworks and low regulatory quality of the country along with the high costs of registrations are the main reasons behind the expansion of informal sector in Ethiopia (IMF, 2013).

1.3.2. Export Performance

Given that the main theme of the paper understands the export performance of Ethiopian manufacturing sector, this section gives a background information about the overall export performance of the country by focusing on the structure, destination markets and costs of export.

1.3.2.1. Export structure

Table 1.1. Ethiopian export (% of merchandise exports)

	1999-2003	2004-2008	2009-2013	1999-2013
Agricultural raw materials	20.04	15.85	10.69	15.53
Food	67.38	73.62	73.64	72.44
Fuel	0.02	0.001	1.33	0.61
Manufactures	11.12	7.31	9.06	9.17
Ores and metals	1.43	1.26	0.75	1.15

Source : own computation from World Development Indicators

Despite the progressive economic liberalization and overall growth of the country in the past decade, the export structure did not show a significant change in the past decade, rather, the export of the country has become increasingly dependent on primary products. Food and agricultural raw materials took the largest share accounted for about 87 % of the merchandize export of the country between 1999 and 2013 (Table 1.1). In particular, food export remained on the top, and its share in the total export increased from 67.4 % between 1999 and 2003 to 73.6 % between 2009 and 2013. On the other hand, the manufacturing export remained low at an average of 9 % in the total merchandize export between 1999 and 2013. This share is even below the average in early 2000 (between 1999 and 2003) where the export share of the manufacturing was 11 %.

[3] https://www.imf.org/external/pubs/ft/scr/2013/cr13309.pdf

A more detailed examination of the export profile of the country indicates the dominance of primary products in the merchandize export, however there were gradual shift and diversification within primary products (Table 1.2). In 2000, coffee was the major export accounting for 45 % of the total merchandize export. In the same year, leather and leather products, chat, oilseeds, and gold, in their respective order, were the main exports following coffee. In total these commodities accounted for 49 % of the total exports. In 2013 the top five exports were coffee, oilseeds, gold, chat and pulses, with a total share of 75 % of the total merchandize export. The data have shown a steady fall in the export share coffee, and the emergence of non-traditional export items, particularly fresh flowers. Starting from lower base in 2005 (2.4 %), the share of flower export grew to 6.8 % in 2010. Its share, however, slightly declined to 6.4 % in 2013. The general picture of this analysis indicates a slow move towards high-value added primary products, such as cut flowers and pulses, from the historical export brand of Ethiopia-coffee.

Table 1.2 Share of export commodities (% of merchandize export)

	2000	2005	2010	2013
Coffee	45.0	38.3	32.4	23.0
Oil seeds	8.0	22.9	12.6	20.0
Leather & leather products	18.8	8.1	4.0	4.1
Chat	15.1	9.6	9.1	9.5
Gold	7.0	7.0	18.0	14.6
Pulses	2.2	4.0	5.3	8.0
Meat products	0.4	2.0	2.4	2.4
Live animals	0.0	3.0	5.7	6.0
Flowers	0.0	2.4	6.8	6.4
Fruit and vegetables	1.4	1.4	1.2	1.5
Sugar	2.0	0.0	0.0	0.0
Textile and textile products	0.0	1.2	2.4	3.5
Bee's wax	0.2	0.2	0.1	0.1

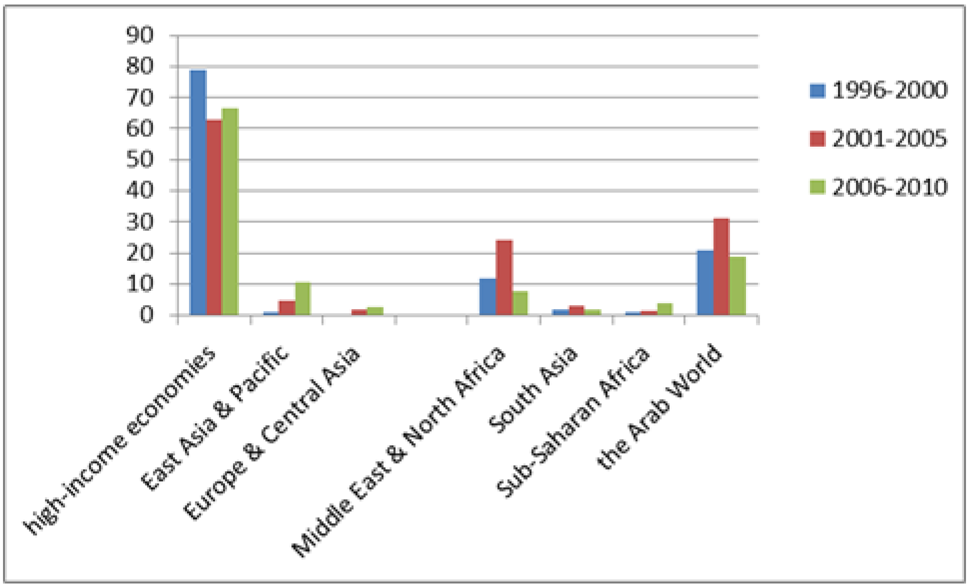
Source Ferede and Kebede (2015)

The export performance of the manufacturing sector is disappointing where only leather industry appeared to have a noticeable share in the total merchandize export. Yet, its share declined from 19 % in 2000 to 4 % in 2010 and 2013 (Table 1.2). On the other hand, the share of meat and textile products showed encouraging trend. Between 2005 and 2013 the export share of textile products increased from 1.2 % to 3.5 % . Similarly, the share of meat products increased from 2.0 % to 2.4 % in the same period. In general, the export performance of the country is heavily dependent on few agricultural products. The contribution of the manufacturing sector is not only small, but it is also concentrated in few sectors.

1.3.2.2 Export Markets

Figure 1.3 shows that the main export destinations of Ethiopia are high-income economies. Between 1996 and 2009, on average, 69 % of the total merchandize exports of the country went to high income countries. In the same period, the Arab world and Middle East and North Africa (developing only) bought 21% and 13 % of exports, respectively. On the other hand, exports to the sub-Saharan African economies were very low, it accounted only 2 % of the total merchandize export.

Figure 1.3. Export Destinations (% of merchandize export)



Source : own computation from World Development Indicators

1.3.2.2. Costs of Export

Entering into global markets for companies in Ethiopia seems to be more costly than for companies in any other developing country. Table 1.3 shows that, on average, exporting a container of merchandise from Ethiopia costs about USD 2181 compared with an average of USD 1953 in sub-Saharan Africa and USD 876 in East Asia and Pacific developing countries. These costs include fees associated with completing the procedures to export (costs for various documents, administrative fees for custom clearance and technical control, customs broker fees, terminal handling charges) and inland transport.

On average, an exporter required to process 8 documents in Ethiopia compared with an average of 7.75 in SSA and 5.79 documents in Latin American and Caribbean developing countries. Furthermore, completing an export business in Ethiopia takes longer than in any other parts of the world. While exporting requires 46 days in Ethiopia, it takes 34 days in sub-Saharan Africa and 19 days in Latin American developing countries. The longer period between the commencement of export and its completion implies a lag between production and the actual realization of revenue. Given the low development of the financial sector and limited access to finance in Ethiopia, this in turn may have a negative effect on the export performance of the country by creating shortage of working capital for companies that intend to export. In general, the presence of large costs of exporting and the requirement of longer periods to complete export transactions make exporting costly for firms in Ethiopia.

Table 1.3. Costs of export (2000-2014 average)

	Ethiopia	East Asia& Pacific (*developing only*)	Latin America & Caribbean (*developing only*)	Sub-Saharan Africa (*developing only*)
Costs to export (USD per container)	2181.8	876.2	1155.8	1953.45
# of documents to export	8	6.51	5.79	7.75
# days to export	45.9	23.72	18.69	33.8

Source: own compilation from the World Development Indicators

1.4. The Data: the manufacturing sector of Ethiopia

This section describes the performance of Ethiopian formal manufacturing sector focusing on output, employment, market churning, export and ownership. The data used for the analysis come from the annual Ethiopian Large and Medium Scale Manufacturing Enterprise Survey run by the Central Statistical Agency of Ethiopia (CSA). The manufacturing survey covers all major manufacturing sectors in all regions of the country based on 4-digits international standard industrial classification (ISIC)- Revision 3.1. The data covers periods from 1996 to 2010, at annual interval. The unit of observation in the sample is plant[4] and all plant with 10 or more employees that use power-driven machinery are covered in the survey. In the sample period there were 5458 firms in the data and the number of years over which any firm can be observed ranged from 1 to 15 years. The distribution of the time period of each firms indicate that 50 % of the firms were observed for 2 years or less, and 5 % of the firms were observed for 13 years. Furthermore, the largest fraction of firms that account for 19.85 % were observed only in the last period, 2010 and not before. On the other hand, only 2.88% of firms were observed in all the periods, indicating the unbalanced nature of the data.

All plants are uniquely identified, and information such as production quantity, production value, sales quantity and sales value (in both the domestic and foreign markets), value of fixed assets,

Table 1.4 Production, Employment and Churning of Ethiopian Manufacturing Firms (1996-2010)

		Employment and Production				Firm Entry and Exit			
		Employment		Production		Numbers		Rates	
Year	No. of Firms	Mean	Median	Total	Mean	New entry	Exits	Entry	Exits
1996	623	131.8	20	88.08	5.5	623	---	----	-----
1997	697	109.6	19	81.9	5.1	201	127	28.8	18.2
1998	725	114.4	20	84.3	5.3	183	155	25.2	21.3
1999	725	110.6	20	93.8	6.1	136	136	18.7	18.7
2000	739	108.5	21	94.0	6.0	168	154	22.7	20.8
2001	722	103.7	22	97.7	6.3	133	150	18.4	20.7
2002	883	94.4	20	84.9	5.1	289	128	32.7	14.4
2003	939	89.6	20	80.6	4.8	182	126	19.3	13.4
2004	997	89.4	23	89.1	6.1	194	136	19.4	13.6
2005	763	114.7	36	114.0	15.3	118	352	15.4	46.1
2006	1153	89.3	24	86.4	6.9	485	95	42.0	8.2
2007	1339	85.1	20	79.3	5.7	480	294	35.8	21.9
2008	1734	66.3	17	57.2	3.4	515	120	29.7	6.9
2009	1948	66.6	16	50.1	2.7	686	472	35.2	24.2
2010	1958	83.7	21	74.1	6.3	1065	---	-----	------
Average	1066	90.8	20	78.8	5.2			22.4	19.1

Note: Production is computed as sales deflated by GDP deflator obtained from the World Bank development indicators data base and converted to base year 1996. The entries for production are in '00000. Employment is the number of permanent employees.

[4] As most Ethiopian manufacturing firms have a single plant, the distinction between firm and establishment is somehow blurred. In the rest of the paper, when it does not generate confusion, I use the two terms interchangeably.

employment, intermediate inputs and investment are available. The data also contains source of financing for different kinds of firms fixed investments and working capital. Firms were also asked to list the major problems associated that hinders their activities. The unique feature of the dataset is its provision of detailed information on both the value and the quantity of sales at firm-product level: this allows us to build firm-product level price and quantity indexes. This data set has been used by earlier works (see, for example, Siba et.al, 2012; Bigsten, and Gebreeyesus, 2009).

1.4.1. Firm size, Entry and Exit

Table 1.4 presents the size (output and employment) and the churning of firms in the sample period. The number of firms covered in the census increased over time from 623 in 1996 to 1958 in 2010. On the other hand, the average number of permanent workers of the formal manufacturing decreases over time. One possible reason for this declining trend can be that small firms that marginally passed the employment threshold required included in the survey in recent years. In fact, the large gap between the median (90.8) and the mean (20) indicates a high skewness of the size distribution towards left reflecting the dominance of small firms in the manufacturing sector. The production pattern is similar to the employment pattern: a declining trend has been observed in the total production of the manufacture sector, especially in recent years.

The table also presents the entry and exit of firms in the formal manufacturing sector. A firm is considered as an entrant if it is observed in the data at time t but not at $t-1$. Similarly, Exciters are those firms that exist in $t-1$, but not at t. However, since the survey covers only firms with more than 10 employees, entry does not distinguish firms that passed the threshold from those that are new to the markets. Furthermore, entry also includes firms that exit at some point and reappear in the data. As well, exit does not distinguish firms that fall below the employment threshold from those that exit from the market. Entry rate is defined as the number of new firms per the total number of incumbents. Similarly, exit rate is defined as the number of exiters per the total number of incumbents. However, since the definition of entry and exit includes switchers, the churning rates might be overestimated and thus the interpretation needs caution. As can be observed, on average, the entry rate is higher than the exit rate, reflecting the increase in the number of firms in the sample over time. The time trend of the data also indicates there was a declining trend in the entry rate before 2000, while the exit rate was moderately constant. In the recent periods, on the other hand, the entry rate increased rapidly while the exit rate declined.

1.4.2. Manufacturing Export Performance

Table 1.5 presents the manufacturing size and export participation by industry defined by 2-digit ISIC classification. On average, food and beverages; textile; wearing apparels; and tanning and dressing of leather products accounted for 63 % of the total employment and 55 % of the total production of the manufacturing sector. More recently, both the employment and production shares of chemical and chemical products; rubber and plastic products; and non-metallic mineral products increased. The share of textile sector, on the other hand, decreases by more than 40 % from 1996 to 2010 in both employment and production. However, food and beverage has remained the leading sectors accounting for 32 % of total employment and 42 % of total production in 2010.

The Ethiopian manufacturing sector is characterized by very low export participation. On average, only 4.4 % of firms were exporting, and 5% of the total manufacturing products were exported in the sample period. Still, the export participation largely varies by industry where tanning and leather (25.6 %); textiles (22.4 %); and wearing apparel (14.0 %) are the top three sectors with higher export participation rates. The recent data indicates the emergence of new sectors in export markets. Specifically, chemical and chemical products; and the metal industry have emerged as a new exporting sectors. For instance, 5.4 % of firms in the chemical sector and 2.7 % of firms that produce basic metals participated in international markets in 2010 starting from no participation in 1996. In the same period, the participation of firms in metal products increased to from 2.5 % to 4.3 %.

Tanning and leather industry is not only the leading by export participation, but it is also the most export intensive sector by exporting 54 % of the total production of the sector. It is interesting to note the gap in export intensity between the leading and the second top sector: the textile industry follows far behind the leather industry by exporting only 9.5 % of its total output. Overall, the time trend of the data show an average decline in the export share of the manufacturing output (from 6.8 % in 1996 to 3.0 % in 2010). However, there are large variations across sectors, where some sectors showed progress while the others showed declining trends. Most notably, the export intensity of leather declined from 62 % in 1996 to 22 % in 2010. On the other hand, the wearing apparel and the textile export intensity, respectively, increased from 5 % to 30 %, and from 0.2 to 11 % in the same period.

Table 1.5: Employment, production and export by industry (1996-2010)

Industry (ISIC-2 Digit))	Employment and output shares of the industry (%)						Export shares from the industry firms and output (%)					
	Employment share of the industry from the total manufacturing employment			Output share of the industry from the total output of the manufacturing output			% of exporting firms from the total firms in the industry			% of exports from the total production of the industry		
	1996-2010 Average	1996	2010	1996-2010 Average	1996	2010	1996-2010 Average	1996	2010	1996-2010 Average	1996	2010
Food and beverages	28.22	25.11	31.96	39.33	39.59	42.22	4.36	3.12	4.61	4.14	0.05	1.72
Textiles	22.39	32.76	12.63	7.65	11.51	5.39	22.41	15.66	38.46	9.47	0.26	11.97
Wearing apparel	5.05	4.87	5.92	1.08	1.26	2.58	14.06	4.34	34.78	8.34	5.33	30.05
Tanning & dressing of leather	7.51	8.87	5.67	7.37	10.83	2.45	25.60	14.28	12.62	53.7	61.94	23.48
Wood & wood products	1.51	2.75	2.05	0.69	1.20	1.34	0.78	3.84	2.12	0.14	2.11	0.001
Chemicals & chemical products	5.13	3.12	6.01	6.78	5.49	9.58	1.85	0.00	5.74	0.46	0.00	0.09
Rubber & plastic products	6.10	2.31	7.97	6.40	3.16	9.21	0.68	0.00	0.76	0.05	0.00	0.01
non-metalic minerals	9.13	5.28	11.13	11.46	6.72	11.16	0.94	1.21	1.14	0.02	0.10	0.09
Basic metals	1.48	1.34	1.21	4.99	4.84	1.41	1.12	0.00	2.70	0.01	0.00	0.07
Metal products	3.78	2.26	6.49	3.79	1.83	8.78	1.25	2.56	4.34	0.02	0.00	0.13
Furniture	4.43	2.69	3.19	1.64	1.10	1.39	0.58	1.33	0.00	0.03	0.01	0.00
Others	8.87	8.60	5.71	11.13	12.40	4.42	0.88	0.00	1.42	0.01	0.00	0.02
Total		99.96	99.94		99.93	99.93	4.42	3.85	4.49	5.03	6.85	3.00

Source: Own computation based on CSA d

Table 1.6: Ethiopian firms relative export and import performance

	Ethiopia	Sub-Saharan Africa
% of firms exporting (at least 1% of sales)	6.5	12
% of firms exporting directly (at least 1% of sales)	4.1	7.5
% domestic sales	95.7	94.1
% total sales exported directly	2.4	3.1
% of total sales exported indirectly	1.9	2.8
% of firms using foreign origin material inputs	54.9	61.0
% of foreign origin inputs from total inputs	30.7	39.7

Source: The World Bank Enterprise Survey (2009-2015)

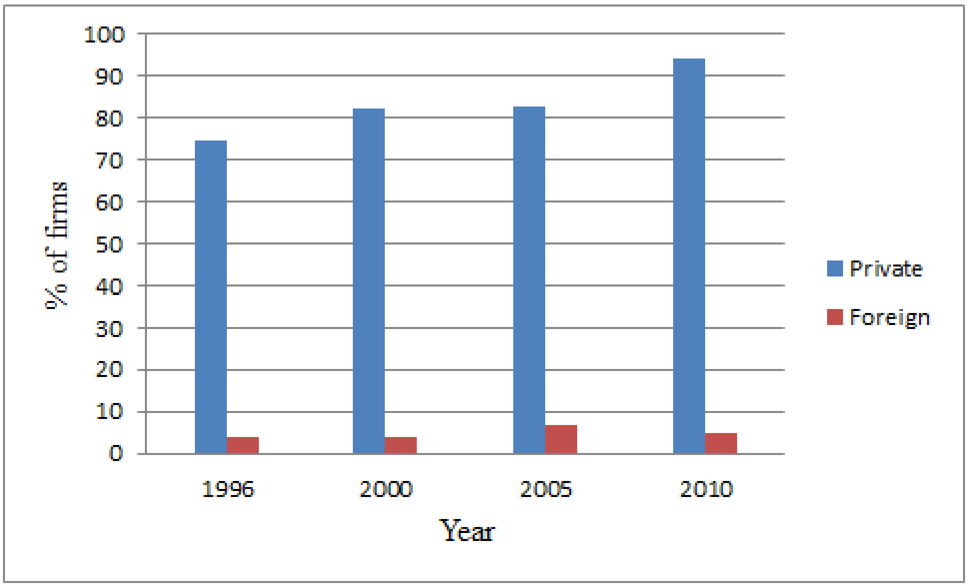
The export performance of Ethiopian manufacturing sector is below the average performance of firms in Sub-Saharan African countries (Table 1.6). Between 2009 and 2015, only 6.5 % of Ethiopian firms export at least 1 % of their total sales compared to the Sub-Saharan average of 12%. Furthermore, while firms in Sub-Saharan Africa, on average, export 6 % of their total sales, Ethiopian firms export only 4 % of their total sales. Looking at how firm trade, 4.1 % of Ethiopian firms export directly compared with the Sub-Saharan African average of 7.5 %. In other words, 2.4 % of Ethiopian exporting firms export indirectly while 4.5 % of Sub-Saharan exporters export indirectly. Similarly, 2.4 % of the total sales of Ethiopian firms' exported directly compared to the 3.1 % of Sub-Saharan African firms' average. The general picture of this analysis shows that although the export performance of Ethiopian firms is lower than the Sub-Saharan average, most of the exporting firms access foreign markets directly without middlemen.

Table 1.6 also shows that many firms in Ethiopia use domestic raw materials than firms in other Sub-Saharan African countries. Specifically, 55 % of Ethiopian firms source their 30 % of their inputs from foreign markets, whereas, on average, 61 % of Sub-Saharan African firms import 40 % of their inputs.

1.4.3. Ownership

The other feature of Ethiopian manufacturing sector is very low foreign and public ownership (Fig 1.4). The percentage of publicly owned firms dropped from 25 % in 1996 to 5 % in 2010. This is partly the result of the progressive privatization measures that the government has undertaken since early 1990s following the shift from social-oriented centrally planned economy to market-oriented mixed economy approach as a part of structural adjustment programme. However, the participation of foreign investors in the manufacturing sector remained low and showed some fluctuations. In 1996, only 3.8 % of Ethiopian firms had capital contributions from foreign private investors. This figure increased to 6.7 % in 2005 and dropped to 5 % in 2010.

Figure 1.4: Ownership Structure



Source: Own computation from CSA data

1.4.4. Multi-product firms and their relative importance

Table 1.7 shows that, on average, about 36 % of Ethiopian manufacturers are multi-product firms while the remaining 64 % are single-product producers. Although there are some fluctuations across years, the fraction of multi-product firms in 2010 was 74 % suggesting a rapid increase in number of multi-product producers in recent years. Further disaggregation of the data shows that about 28 % of multi-product firms produce two products while 5 % of them produce three products and only a small fraction (less than 3 %) produce more than three products.

The largest number of products observed in the data is six products, but less than 0.2 % of firms reached this number (not reported in the table). The table also shows that, on average, 47 % of the total manufacturing sales is contributed by multi-product firms. The pattern also indicates an increase in the share of multi-product firms in recent years. For instance, about 35% of the total sales of the manufacturing in 2010 came from single product firms while nearly two-third of the total market share is accounted by multi-product firms.

Table 1.7 Multi-product firms and their relative importance

Year	% of firms producing			The share of multi-product firms in total sales (%)
	1 Product	2 products	3 products	
1996	67.9	24.9	4.9	43
2000	52.6	37.14	6.1	42
2005	60.9	29.6	7.1	37
2010	74.3	21.7	3.0	65
Average	63.9	28.3	5.2	46.7

Source: Own computation from CSA data

1.5. Variables, and Productivity and Demand estimation

The main interest of the study lies with separating the demand components from the revenue productivity, and analysing their separate role in shaping the export performance of firms. As such, it requires information on productivity and demand shocks that are not directly observed from the data. Thus, this section provides the description of the data required to estimate these variables followed by the estimation procedure. In what follow, the estimates of productivity and demand are presented.

1.5.1. Main Variables

Output and Productivity**:** in order to separate the price component from the "true" productivity, this paper relies on three alternative measures of total factor productivity (TFP) estimated using three output measures.

1. *Revenue*: firm-level sales deflated by industry average price index (firm revenue hereafter), where industry is defined as a group of firms that belong to the same 4-digit ISIC classifications. This is the standard approach that empirical studies use in the absence of firm-level data. The fact that, firms in the same industry are assumed to set the same price, the resulting productivity confounds within-industry price differences and physical productivity. Therefore, hereafter the resulting productivity is termed as revenue productivity (TFPR, hereafter), as in Foster et al, 2008).
2. *Quantity:* the data allow to estimate physical productivity I (TFPQ1, hereafter) using the reported physical output. In order to reduce measurement errors, the firm reported

quantities are standardized to the same unit of measurement in each sector. For instance, in beverage sector, all reported units of output are converted into litters.

3. *Deflated sales*: estimating physical productivity using quantity information may be prone to measurement errors and requires assumptions that within-industry firms produce homogeneous products. Furthermore, in the world of multi-product firms that may not produce homogeneous products this assumption will be very strong. Thus, in order to address this bias, the third version of TFP is estimated using firm-level sales deflated by firm-level price. The estimated productivity is then referred as physical productivity II (TFPQII, hereafter). However, because TFPQI and TFPQII are the same by construction reflecting output per input, when it does not create confusion, physical productivity (efficiency) will be used in forthcoming discussions of the paper referring to either TFPQI or TFPQII.

In the later stages, the robustness of the analysis carried out using TFP checked using three labour productivity measures (defined as output per labour) that corresponds to the three TFP measures: revenue labour productivity (LPR); physical labour productivity I (LPQI); and physical labour productivity II (LPQII).

***Capital stock*:** is computed using the perpetual inventory method from the stock value of tangible assets.

***Firm-level price*:** is computed as a weighted average of the unit values of all the products produced by the firm. Specifically ; $P_{it} = \sum_{h=1} W_{hit} P_{hit}$ where P_{it} is the average price of firm i at time t , W_{hit} is the shares in sales of product h of firm i at time t, and P_{hit} is the unit value of product h of firm i at time t.

***Intermediate inputs*:** are measured as the sum of the costs of raw materials, electricity and fuel. The real value of intermediate inputs is computed by deflating its components by their respective price indices obtained from CSA.

Table 1.8 provides the summary statistics of the main variables used in the analysis. The statistics are computed based on the sample sectors that will be for the analysis. Here, there is little variation in the mean output and inputs across sectors. However, as indicated by the standard deviations, there are reasonable variations in both inputs and output across firms within each sector. Comparing the averages of revenue and quantity based measures of output; the quantity based measure of output is less than the revenue based measures across all sectors. The standard deviations for the industry deflated output are lower than outputs deflated by firm-level prices and quantity output which indicates that applying common deflator reduces within-industry productivity heterogeneity.

Table 1.8 Summary statistics of output and inputs by sector, 2000-2009

	Food and Beverage		*Textile and Apparel*		*Leather and Tanning*	
variables	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Revenue	14.68	2.09	14.55	2.19	14.50	1.85
Deflated sales	16.66	2.74	15.76	2.93	16.23	2.37
Quantity	11.08	2.71	10.52	3.02	12.19	2.07
Labour	3.69	1.39	4.39	1.78	3.89	1.26
Capital	14.64	2.38	13.51	3.48	15.21	1.94
Material	12.27	2.11	11.66	1.12	12.26	12.27

1.5.2. Productivity and Demand Estimation

This section presents the estimation procedures used to estimate total factor productivity and demand shocks followed by descriptive statistics of the estimates.

1.5.2.1. Productivity and omitted price biases

This study mainly relies on total factor productivity (TFP) estimated from production function. However, I also employ labour productivity (LP) measured as output to labour ratio as a robustness checks. In order to calculate $TFP,$ I assume that that firms are producing according to the following Cobb-Douglas production function:

$$Y_{it} = A_{it}K_{it}^{\beta_k}L_{it}^{\beta_l}M_{it}^{\beta_m} \tag{1.1}$$

Where, i and t indicate firm and year, respectively. Y_{it} measures the quantity output put, K_{it} denotes capital , L_{it} denotes labour, and M_{it} denotes intermediate inputs. A_{it} measures firm level efficiency and once it is transformed into logarithmic form it is additively separable into two components:

$$lnA_{it} = \omega_{it} + \varepsilon_{it},$$

where ω_{it} captures the part of the productivity shocks that is known to firms, but not to econometricians and thus affects input decisions, ε_{it} captures random productivity shocks unobservable for both econometricians and firms and hence does not affect firm's input decisions. A logarithmic transformation of equation (1.1) yields a linear production function,

$$y_{it} = \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \omega_{it} + \varepsilon_{it} \qquad 1.2$$

where the lowercase letters indicates the natural logarithms, ω_{it} captures firm-specific productivity shocks and ε_{it} is the standard i.i.d. error term and captures any unforeseen shocks or measurement errors.

The typical empirical exercise in productivity analysis involves estimating the coefficients of inputs from equation (1.2) and deriving firm-level total factor productivity (TFP_{it}) as a residual from the production function estimates:

$$\widehat{\omega}_{it} = TFP_{it} = y_{it} - \widehat{\beta}_k k_{it} - \widehat{\beta}_l l_{it} - \widehat{\beta}_m m_{it} \qquad 1.3$$

The fundamental problem in estimating (1.2) using the standard methods, such as OLS, is that the choice of inputs is correlated with the unobserved productivity shock, results in the well-known simultaneity problem. A large class of methods have been proposed to address this issue (See Beveren, 2012 for a compressive review). However, the particular interest of this paper is related to the biases that may arise when one use deflated sales as a proxy for quantity.

In the absence of quantity information to estimate productivity, the standard practice is to substitute quantity with deflated sales, usually by using industry-level deflator. Specifically, quantity is substituted with deflated revenue ($\tilde{R}_{it} = {R_{it}}/{\overline{P}_{it}}$), where R_{it} is the revenue of firm i defined as the product of quantity sale (Y_{it}) and firm price (P_{it}) ;$R_{it} = Y_{it}\,P_{it}$; and $\overline{P}_{it}$ is industry-average price. [5]

Replacing the quantity output (Y_{it}) by deflated revenue ($\tilde{R}_{it}$) in equation (1.1); and transforming it into a log- linear form yields:

$$y_{it} = \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \omega_{it} + \eta_{it} \qquad (1.4)$$

where $\eta_{it} = (P_{it} - PI_t) + \varepsilon_{it}$.

[5] The objective of this discussion is to introduce the biases that mainly arises due to output bias. However, in the absence of firm-level price information for inputs, the bias become much more complicated (See Beveren, 2010 for an introductory discussion)

This simple algorithm shows that when we ignore within-industry price heterogeneity, the error term is not containing only a stochastic disturbance term (ε_i) , but also the deviation of firm-specific prices from the average-industry deflator. Indeed, Klette and Griliches (1996) noted that because the price of output affects the optimal choice of factors, the regressors in equation (1.3.4) are likely to be correlated with η_{it} and this results in a biased estimate of input coefficients. Recently, De Loecker (2011) shows that the omitted price might cause upward or downward bias depending on the correlation between firm's price and the choice of inputs level.

Under a perfect market condition, deflating firm-level sales by industry-average price yields firm-level quantity. However, when this perfect market assumption is not at work ($P_{it} \neq \overline{P}_{it}$) output price bias arises. For example, if $P_{it} > \overline{P}_{it}$, employing firm-level revenue deflated by average-industry price as a proxy for quantity output leads to under-deflation of the firm revenue. This in turn overstates the revenue-based productivity of the firm. For example, Foster et.al (2008) find that the revenue productivity underestimate the productivity of young entering firms because these firms on average charge lower prices than mature incumbent firms. In order to correct omitted price bias, for example, Ornaghi (2008) suggests replacing the unobserved prices by observed labour costs. More recently, De Loecker (2011) developed a framework that augment a demand structure in a production function in order to estimate input coefficients corrected for price and demand differences.

In order address the classical problem of simultaneity of the firm's input choice that arise in estimating TFP, this paper apply System-GMM estimator of Blundell and Bond (2000). Specifically, I use two period lagged inputs and output as instruments in the differenced equation and lagged first difference of the inputs in the level equation. This method is widely used in trade literature including earlier works on Ethiopian firm-level data (e.g. Bigsten and Gebreeyesus, 2009). In order to have a bench mark on the coefficients estimated using system-GMM, I also estimate the production function using pooled OLS and fixed-effect estimator To take into account the biases of estimated input coefficients due to heterogeneity of production technology across sectors, I estimate the production function at 2- ISIC digits level. In order to address the omitted price bias discussed above, I estimate three versions of productivity using revenue deflated by industry price, sales deflated by firm-level price and quantity as a dependent variable each in a separate regression. This approach has been applied by Foster et al., (2008). The estimated coefficients of inputs are reported in Appendix

1.A**.** This way, I generate three versions of productivity: TFPR- revenue productivity, and TFPQI and TFPQII (physical productivity I and Physical productivity II).

Table 1.9. Correlations between price and productivity

	TFPR	TFPQII	TFPQI	LPR	LPQII	LPQI
TFPR						
TFPQII	0.286					
TFPQI	0.460	0.467				
LPR	0.874	0.259	0.360			
LPQII	0.375	0.808	0.472	0.457		
LPQI	0.404	0.282	0.883	0.448	0.550	
Price	0.128	-0.739	-0.337	0.125	-0.781	-0.339
SD	1.238	2.430	2.033	1.291	2.319	2.053

Table 1.9 presents a simple correlation between the three productivity estimates and prices. I find that while revenue productivity positively correlates with price, physical productivity correlates with price negatively. This pattern is also consistent when we consider the correlations between labour productivity and prices. This result is in line with the findings of Foster, et al., (2008). The positive correlation between price and revenue productivity hints that firms that charge higher prices may feature high revenue-productivity. Furthermore, we can observe a positive and high (more than 80 percent) correlation between TFP and the corresponding labour productivity measures.

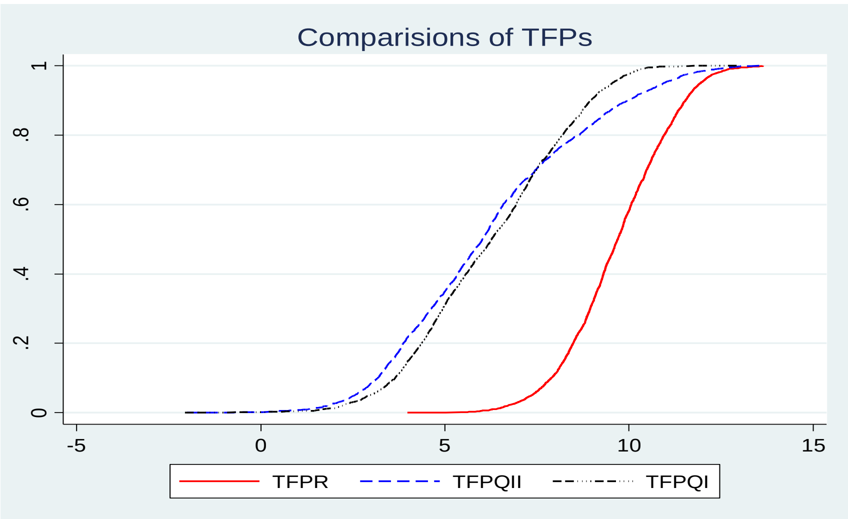


Fig 1.5 Cumulative Productivity distribution

Figure 1.5 compares the distribution of the three productivity measures. It is clear that revenue productivity lies to the right of the physical productivity, suggesting the stochastic dominance of the revenue productivity. However, it seems that there is no significant difference between TFPQI and TFPQII. By construction, revenue is the product of unit value and quantity and thus the latter result is expected.

1.5.2.2. Demand Estimation

The aim here is to estimate demand shock that will be used in separating the part of revenue-productivity attributed to shift in demand. Following Foster et al., (2008), demand shock is estimated as a residual from the following simple aggregate demand function that assumes common demand elasticity[6].

$$lnQ_{it} = \alpha - \xi lnP_{it} + \Upsilon lnM_{it} + \beta lnSize_{it} + \alpha lnAge_{it} + \lambda_t + \varepsilon_{it,} \qquad (1.5)$$

Where, i and t indices firm and year respectively; lnQ_{it} is the natural logarithm of physical output, lnP_{it} is price, lnM_{it} is per capita income, $lnSize_{it}$ is firm size and $lnAge_{it}$ is the age of the firm; $-\xi$ and Υ , respectively, capture price and income of elasticity of demand. The firm level price is defined as before $P_{it} = \sum_{h=1} W_{hit} P_{hit}$ where P_{it} is the average price of firm i at time t , W_{hit} is the shares in sales of product h of firm i at time t, and P_{hit} is the average price of product h of firm i at time t. Per capita income is defined as the weighted average income of the domestic economy and the top ten Ethiopia's export destinations[7]. Specifically, $M_{it} = DS_{it}(MD_t) + FS_{it}(MF_t)$, where DS_{it} is the share of output of firm i sold in domestic markets at time t, MD_t is the per capita income of Ethiopia at time t; FS_{it} is the export intensity of firm i at time ; MF_t is the average per capita income of the top ten export destinations of Ethiopia at time t.

[6] Here, I acknowledge that despite its simplicity, the demand system estimated in this section is crude in many ways. It assumes common demand elasticity for all firms and the presence of representative consumer which are strong assumptions and less realistic (see Nevo, 2000 for a review). In order to partly address these issues, some works specify separate demand for a set of closely related products (for example, Foster et.al, 2008; Eslava et.al, 2004) and estimate demand shock as a residual from the estimated function. However, the interest of these papers is to examine the role of demand differences for firm dynamics without much emphasis on the sources of variations in demand. Thus, in this paper I do not wish to emphasize what comprises the residual obtained from the estimated demand; rather the objective of this section is to separate the demand component from the revenue productivity. In the second chapter of the thesis, I estimate a nested logit demand system that explicitly reflects consumer heterogeneity and reflects both horizontal and vertical preferences of consumers to obtain product quality as in Khandelwal (2010).

[7] Despite some changes in their order over time, the main top Ethiopian export destinations in the sample period were Italy, Great Britain, Germany, the USA, Netherlands, China, Saudi Arabia, United Arab Emirates, Sudan and Somalia.

The log of firm-specific demand shock is then computed as a residual from demand equation and plus the contribution of income. The unobserved characteristics included in the error term can include the impact of unobservable firm activities (eg. promotion), unquantifiable factors such as quality, or systematic shocks to demand.

Since demand shock is likely correlated with firms' price setting behaviour, I use physical productivity to instrument price as in Foster et al (2008). Physical productivity can be a valid instrument because while efficiency is negatively correlated with prices (See Table 1.9), firms are less likely to change their efficiency responding to short term demand shocks. In order to allow some variability on the demand elasticities across sectors, the demand function is estimated at 2-digit sectors.

Table 1.10: Price and income elasticity estimates by sector

Sector	OLS		IV	
	Price	Income	Price	Income
Food and Beverage	-0.35**	0.68**	-3.10**	1.23**
	(0.030)	(0.077)	(0.195)	(0.218)
Textile and Apparel	-0.39**	0.72**	-6.12**	0.18
	(0.070)	(0.093)	(0.976)	(0.311)
Leather and Tanning	-0.30**	0.496**	-4.87**	1.13**
	(0.065)	(0.036)	(0.724)	(0.133)

Notes: estimators employed are OLS and 2sls- IV (instrumental variable). All models include year dummies, size, and age (coefficients not reported). Robust standard error in parentheses, **, * indicate statistical significance at 1% and 5% level respectively.

Table 1.10 presents the results of demand estimates. The first two columns show the OLS estimates. Price and income, respectively, have negative and positive statistically significant coefficients, as expected. The last two columns report the results of the IV regression. Both price and income have the expected signs. Price is statistically significant in all sectors. Income also has positive significant coefficient in two of the sectors, but not in textile and apparel. The IV estimates differ significantly from the OLS estimates, and relative to the IV, the OLS estimates are upward biased, as expected. For example, considering leather and tanning sector the coefficient of price has IV estimates of -4.87, greatly different from the OLS estimates of -0.30. This is a strong evidence that price is endogenous. However, one can see a loss of efficiency in using IV, as the standard error of price is higher in IV than OLS estimates. Despite the efficiency loss, I consider the IV results as preferred estimates for the subsequent analysis. The demand shock is thus computed as a residual from the IV regression plus the contribution of income.

1.6. Empirical Analysis

The econometric exercises of the paper so far are mainly to obtain the necessary variables needed for the next analysis. The main focus of this paper is to examine the extent to which price and demand differences across firms shape the productivity-exporting relationships. To achieve this broader objective, the empirical investigation is organized as follows. First, taking into account price heterogeneity, the average productivity difference between exporters and non-exporters is established. Second, the separate role of demand and supply factors in firms' probability to export is examined. Then, the relationship between the demand and supply components of revenue productivity is established. This would facilitate the interpretations of the results observed on export-productivity links.

1.6.1. Export Premium: revenue productivity and efficiency

To examine whether exporters are different from non-exporters in terms of productivity, I estimate the following specification

$$lnTFP_{it} = \alpha + \beta_1 EX_{it} + \beta_2 \mathrm{lnEmpt_{it}} + \beta_3 lnAge_{it} + \lambda_t + \theta_k + \mu_i + \varepsilon_{it} \quad (1.6)$$

where i and t indices firm and year, respectively; $lnTFP_{it}$ is total factor productivity capturing revenue productivity (TFR_{it}) or physical productivity ($TFPQI_{it}\ or TFPQII_{it}$); EX_{it} is dummy for current export status and equals to one if the firm exports, zero otherwise; $\mathrm{lnEmpt_{it}}$ is the natural logarithm of firm level employment included to capture firm size; $lnAge_{it}$ is the natural logarithm of the age of the firm included to capture market experience; λ_t and θ_k are full set of dummies for time and industry (4-digit ISIC), respectively; μ_i captures firm fixed-effects; ε_{it} is a stochastic error term.

The model is estimated using pooled-OLS and fixed effects estimates. The main interest of this analysis is the estimated coefficient of the export status that measures the average productivity differences between exporters and non-exporters. If exporters are more productive than non-exporters, the coefficient of the export status will be positive and significant. However, it is important to note that the results do not imply causal relations.

Table 1.11 presents the results. Odd (even) column numbers present the pooled OLS (FE) results. For ease interpretation, the estimated coefficients of export dummy transformed into percentage differences. In the pooled OLS estimates, there are significant differences between exporters and non-exporters independent of the productivity measures: on average, exporters are more productive than non-exporters. However, the gap is larger in revenue productivity. For example, the firm-level price deflated based productivity premium of exporters is 41% less than the premium from the revenue based productivity (Compare column 1 and 3). Using the same data set, but different samples, Bigsten and Gebreeyesus (2009) find revenue productivity premium that ranges from 28 to 16 % depending on the specification under consideration.

Table 1.11: Export premium

	TFPR		TFPQII		TFPQI	
	(1) OLS	(2) FE	(3) OLS	(4) FE	(5) OLS	(6) FE
Exp_{it}	0.950***	0.286***	0.612**	0.196	0.777***	0.084
	(0.128)	(0.072)	(0.208)	(0.150)	(0.182)	(0.130)
$lnEmp_{it}$	0.339***	0.104***	0.155**	0.571***	0.398***	-0.052
	(0.035)	(0.032)	(0.066)	(0.068)	(0.054)	(0.058)
$lnAge_{it}$	-0.013	0.069**	-0.147**	0.062	0.048	0.126**
	(0.036)	(0.032)	(0.065)	(0.065)	(0.059)	(0.057)
$Industry\ FE$	Yes	Yes	Yes	Yes	Yes	Yes
$Year\ FE$	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	2832	2832	2832	2832	2832	2832
No Firms	731	731	731	731	731	731

Note: the dependent variables are the three productivity measures as indicated on the top of the table. The reported values are export premium computed as $e^{(coefficientsof\ export)-1}$. Robust standard errors in parentheses. For the OLS estimates, the standard errors are clustered by firm. * p<0.10, ** p<0.05, *** p<0.01

The observed large difference between exporters and non-exporters in the OLS estimates of this paper may be explained by unobserved firm characteristics that are not controlled in the estimation. Once the time-invariant firm characteristics are controlled for using fixed effects estimate, some interesting results emerge. First, the difference between exporters and non-exporters remain significant only in the revenue productivity (column 2), but the physical productivity gap between exporters and non-exporters disappears. Intuitively this result suggests that within-firm exporting is only associated with the change in revenue but not efficiency. Although the results of this paper do not establish causations, the findings share the discussion of De Loecker and Goldberg (2014). They argue that, trade increases within-firm revenue productivity through its effect on the reallocation of resources from less profitable to more profitable products. However, the efficiency gain due to trade is minimal. Furthermore, the revenue the magnitude of the premium in the fixed effect is significantly lower than the premium from the OLS estimates. This indicates the importance of unobservable firm heterogeneity to explain the productivity gap between exporters and non-exporters.

The finding of the present paper that ignoring price heterogeneity leads to overstate the productivity gains associated with trade appears to be in sharp contrast with the results of results of Smeets and Warzynski (2013) for Danish firms. They find that export premium for Danish firms is larger when they control for price heterogeneity across firms. The authors explain their finding with the notion of productivity sorting models, in which exporters are efficient and thus charge lower prices than non-exporters. However, a number of recent studies reveal that exporters on average charge higher prices than non-exporters (Baldwin and Harrigan, 2011, Kugler and Verhoogen, 2012). Although, both explanations have theoretical backups and are undoubtedly important, I contend that a closer investigation of the pricing behaviour of exporters and non-exporters is essential to fully understand the role of price heterogeneity in explaining the productivity differences between exporters and non-exporters. Section 1.6.3 investigates this issue in details.

1.6.2. Decision to export: Price, demand shocks and Productivity

The above section shows substantial difference in the export premium derived from revenue- and quantity productivity estimates. The main interest of this section is to examine whether and to what extend physical productivity and revenue productivity together with price and demand shocks affects probability to export. I follow the standard procedure in the literature (e.g, Wagner, 2007) and estimate the following equation :

$$\Pr(EX_{it} = 1) = \alpha + \beta_1 Z_{it} + \beta_2 \mathrm{lnEmpt_{it}} + \beta_3 lnAge_{it} + \lambda_t + \theta_k + \mu_i + \varepsilon_{it} \quad (1.7)$$

where i and t indice firm and year, respectively; EX_{it} is a dummy indicator for export and takes 1 if the firm reports positive export and 0 otherwise, Z_{it} captures the three productivity indicators ($TFPR_{it}$, $TFPQI_{it}$, $TFPQII_{it}$), price (P_{it}); or demand shock (DSh_{it}) in alternative; $\mathrm{lnEmpt_{it}}$ is the natural logarithm of firm level employment included

Table:1.12 Probability to export

	Dependent variable: $\Pr(EX_{it}=1)$									
	TFPR		TFPQII		TFPQI					
	Pooled Probit (1)	FELPM (2)	Pooled Probit (3)	FELPM (4)	Pooled Probit (5)	FELPM (6)	Pooled Probit (7)	FELPM (8)	Pooled Probit (9)	FELPM (10)
TFP_{it}	0.084***	0.017**	0.008	0.005	0.016**	0.000				
	(0.012)	(0.008)	(0.007)	(0.004)	(0.007)	(0.004)				
$lnPrice_{it}$							0.012***	0.010**		
							(0.004)	(0.005)		
$lnDShock_{it}$									0.001	-0.002
									(0.001)	(0.001)
$lnempt_{it}$	0.065***	0.029**	0.092***	0.033***	0.085***	0.033***	0.073***	0.031**	0.073***	0.034***
	(0.010)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.009)	(0.012)	(0.010)	(0.012)
$lnAge_{it}$	-0.020	-0.007	-0.018	-0.007	-0.020	-0.005	0.013	-0.004	0.011	-0.006
	(0.022)	(0.023)	(0.025)	(0.023)	(0.024)	(0.023)	(0.018)	(0.023)	(0.018)	(0.023)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	2074	2074	2063	2063	2062	2062	2074	2074	2062	2062
Plants	496	496	494	494	494	494	496	496	494	494

Note: the dependent variable is dummy for export .Robust standard errors in parentheses. For the pooled probit estimates, the standard errors are clustered by firm. * p<0.10, ** p<0.05, *** p<0.00. The reported values are the marginal effects computed at the mean of the variables.

to capture firm size; $lnAge_{it}$ is the natural logarithm of the age of the firm since it established and included to capture market experience; λ_t,θ_k and μ_i are time, industry, and firm fixed-effects, respectively; ε_{it} captures a stochastic error. The coefficient of interest is β_1 that captures the relationships between probability to export and productivity, price or demand shocks.

This specification is estimated in two stages to control for various sources of bias. First, I estimate the export decision equation using pooled OLS. Then to control for unobserved firm heterogeneity, I run linear probability fixed-effects estimation (FELMP) as it is customary in this literature (For example, Bernard and Jensen,2004). Table 1.12 presents the results. The odd (even) column numbers report pooled probit (FELPM) estimates. The reported values are marginal values computed at the mean of the main variables of interest. I find that revenue productivity and prices are positively correlated with probability to export in both pooled probit and fixed-effect LPM estimates. However, productivity based on firm price (TFPQII) and demand shocks are not statistically significant in all specifications. The quantity based productivity (TFPQI) is significant in the pooled probity estimates, but its magnitude is much lower than the revenue productivity. Furthermore, once unobserved firm heterogeneity is controlled for, it becomes insignificant.

Again, these results disclose important information on the selection mechanism of firms: it is price and thus revenue productivity that drives the decision to export, but firm efficiency hardly plays a role. Still, it is not clear what does price comprises, but at least it can reflect costs, demand shock, quality or markup differences. The overall implication of these results is that Ethiopian firms select into foreign markets mainly by generating demand for their products, not necessarily by producing efficiently.

1.6.3. Price heterogeneity, Productivity, Demand and Export

This section exploits the variations in productivity, demand shocks and prices in order to better understand the underlying causes behind the differences observed in the link between export and revenue productivity, and export and physical productivity. To deepen this understanding, I establish the relationships between price, productivity, demand shocks and export by estimating the following equation:

$$lnPrice_{it} = \alpha + \beta_1 Z_{it} + \beta_2 \mathrm{lnEmpt_{it}} + \beta_3 lnAge_{it} + \lambda_t + \theta_k + \mu_i + \varepsilon_{it} \quad (1.8)$$

where Z_{it} represent the three productivity estimates ($TFPR_{it}$, $TFPQI_{it}$, $TFPQII_{it}$) and export status (EX_{it}) in a separate regressions. Controls include firm size ($\mathrm{lnEmpt_{it}}$), age ($lnAge_{it}$), and a full set of industry (θ_k) and year (λ_t) dummies and firm fixed-effects (μ_i). The model is estimated with pooled OLS and fixed effects. Subsequently, I examine the relationship between demand shock and productivity measures by placing the estimated demand shocks instead of price as a dependent variable. The prior here is that, since revenue is the product of physical productivity and price, if exporters have different demand structure than non-exporters, and thus set higher prices, the observed evidence based on revenue productivity reflects differences in demand, but not necessarily variations in efficiency

Table 1.13 reports the estimates from the regressions of log prices as a dependent variable. For each variable of interest (productivity and export status), the odd and even columns present the pooled OLS and FE estimates, respectively. However, the estimated results from OLS and FE are qualitatively the same. The results show that revenue productivity is positively correlated with firm-level prices, whereas physical productivity (physical efficiency) are negatively correlated with prices. The results are consistent to the findings of Foster, et.al (2008) that firm's price is negatively correlated with true productivity. On the other hand, the positive correlation between price and revenue productivity suggests that firms that charge higher price may feature high revenue-productivity.

The results also show that, on average, exporters charge higher prices than non-exporters. This implies that, using industry-average price to deflate firm-level sales under-deflates the revenue of exporters and thus overstates their revenue productivity relative to non-exporters. This result partly explains the finding in Section 1.6.1 that the productivity gap between exporters and non-exporters is larger in revenue productivity than in physical efficiency.

Table 1.14 presents the results on the results of the demand shock equation. Both the OLS and FE estimates show that while revenue productivity is positively correlated with shocks, physical efficiency and shocks are negatively correlated. This result is consistent with the finding in relation to price. In the OLS estimate, demand shock and export are positively correlated, but this relationship become insignificant in the fixed effect estimates. The overall results suggest that revenue productivity overstate the relationship between export and productivity because exporters have favourable demand condition that allows them to charge higher prices than non-exporters.

1.7. Further evidence and Robustness checks

This section provides robustness checks on the validity of the results reported above. First, it examines the export-productivity relationships along the entire distribution of the productivity

Table 1.13: Price, productivity, export and demand shock

	Dependent Variable: log Price									
	TFPR		TFPQII		TFPQI					
	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TFP_{it}	0.391***	0.181***	-0.196***	-0.317***	-0.625***	-0.623***				
	(0.047)	(0.038)	(0.033)	(0.017)	(0.022)	(0.016)				
Ex_{it}							0.472***	0.497***		
							(0.182)	(0.127)		
$lnDShock_{it}$									0.067***	0.071***
									(0.009)	(0.005)
$lnempt_{it}$	-0.254***	0.057	-0.050	0.062	0.194***	0.049	-0.142***	0.059	-0.114***	0.044
	(0.050)	(0.056)	(0.052)	(0.052)	(0.035)	(0.043)	(0.054)	(0.056)	(0.037)	(0.054)
$lnAge_{it}$	-0.082	-0.050	-0.170	0.012	-0.069	0.125	-0.094	-0.026	-0.109	-0.030
	(0.116)	(0.112)	(0.126)	(0.105)	(0.081)	(0.087)	(0.125)	(0.112)	(0.084)	(0.108)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	2832	2832	2832	2832	2832	2832	2832	2832	2832	2832
Plants	701	701	701	701	701	701	701	701	701	701
R-squ	0.213	0.185	0.208	0.293	0.556	0.511	0.167	0.183	0.266	0.240

Note: the dependent variable is the natural logarithm of price .Robust standard errors in parentheses. For the OLS estimates, the standard errors are clustered by firm. * p<0.10, ** p<0.05, *** p<0.01

Table 1.14: Demand shock, productivity and export

	Dependent Variable: Demand Shocks							
	TFPR		TFPQI		TFPQII			
	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFP_{it}	1.600***	1.366***	-2.455***	-2.415***	-0.589***	-1.010***		
	(0.247)	(0.146)	(0.109)	(0.049)	(0.146)	(0.080)		
Ex_{it}							1.788**	-0.027
							(0.715)	(0.495)
$lnlnempt_{it}$	0.498*	0.319	1.697***	0.360**	1.427***	0.432**	0.973***	0.480**
	(0.269)	(0.215)	(0.165)	(0.149)	(0.271)	(0.211)	(0.255)	(0.220)
$lnage_{it}$	1.371***	-0.171	0.446	0.302	1.318***	0.209	1.319***	-0.049
	(0.469)	(0.430)	(0.348)	(0.298)	(0.495)	(0.424)	(0.478)	(0.439)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	2832	2832	2832	2832	2832	2832	2832	2832
Plants	701	701	701	701	701	701	701	701
R-squ	0.265	0.079	0.618	0.558	0.236	0.109	0.222	0.041

Note: the dependent variable is the natural logarithm demand shock .Robust standard errors in parentheses. For the OLS estimates, the standard errors are clustered by firm. * p<0.10, ** p<0.05, *** p<0.01

measures. Second, given the methodological complications that TFP estimation involves, it verifies whether the results established above are robust when one use labour productivity instead of using TFP..

1.7.1. Heterogeneous effects and Alternative Productivity Measures

The analysis of export-productivity links based OLS estimates provides only a partial view of the relationships: how on average exporting is correlated with productivity. Furthermore, OLS estimator is sensitive to outliers and would results in biased estimates when variables have long-tailed distributions. As described in the detailed summary statistics of productivity measures (Appendix 1.B), exporters themselves are highly heterogeneous and some observations are far from the mean of the sample. Thus, the average relationships may miss crucial questions whether exporting is correlated with productivity differently at a different level of productivity and whether the export-productivity correlations are driven by outliers. In order to deal with this issue, I provide results based on quantile regression (QR). In order to make the quantile regression more informative about export-productivity correlations, I estimate the model at nine quantiles. This allow to examine productivity-export relationships from 1 % to 99 % of the productivity distribution. Furthermore, in order to verify whether the above results are driven by the methodological complications of estimating total factor productivity, I also compute the export-productivity relationships based on simple labour productivity, defined as output per unit labour.

Table 1.D1 (Appendix 1.C) presents the results. The lower panel of the table presents the Wald test statistics to test the null hypothesis that coefficients across different quantiles are equal. Column 1 productivity distribution. These findings match Wagner (2011) findings where the productivity presents the results obtained from the pooled OLS regressions. The export-productivity correlations at each quantile differ from the mean correlation obtained from OLS regression. Considering the specification based on revenue productivity, export coefficients are significantly different from zero across all quantiles, and the export premiums are larger at the lower and upper end of the premium of exporters on the upper and lower end of the distribution is larger than the median and thus results in a U-shaped export-productivity links across quantiles. Another interesting result emerges when we consider physical productivity and exporting correlations. At the lower end of the distribution, the coefficient of export is negative and insignificant. This coefficient turns to be positive and significant for firms above the median of the productivity distribution. This suggests that, least efficient exporting firms are not different from non-exporting firms. These results are robust when we consider labour productivity. In all models, however, the Wald test failed to reject the null

hypothesis that coefficients are equal across all the nine quantiles, at the conventional levels of significance.

Considering the export premium based on labour productivity, revenue based export premium is larger than efficiency based premium. This result is consistent with the previous finding based on TFP. The overall result suggest that, the revenue based measures of productivity contains both physical efficiency and demand components and separating prices and demand effects from the revenue productivity significantly reduces the presumed effects of exporting. This result is in line with the empirical finding of De Loecker (2011).

1.8. Conclusions

Based on data on Ethiopian manufacturing firms (from 2000 to 2009), this paper examines whether the empirical regularity that exporters are more productive than non-exporters is at least partly explained by price heterogeneity and demand differences across firms. Empirical studies established the superior performance of exporters based on productivity measures that are estimated assuming homogeneous prices within an industry. This is partly due to lack of firm-level price information. However, this approach may result in a bias on the estimated export premium. First, prices greatly differ across firms, even within narrowly defined industries. Second and most importantly, firms that sell abroad may face different demand and competitions than domestic firms, and thus we would expect them to set different pricing strategies. Thus, the traditionally estimated export premium would confound real productivity (output per unit input) and price components. Towards addressing this issue, I use a firm-level price to deflate sales in addition to industry-level deflator. Then I compare the total factor productivity measures estimated using sales deflated by firm-level price and industry-level deflator. I also computed quantity based productivity. Furthermore, I estimated demand shocks and investigate how this demand component is associated with export-productivity links. The results show that exporters are more productive than non-exporters not only because they produce more output per unit of input, but also face positive demand shocks and charge higher prices than non-exporters. The finding suggests that that the tradition of deflating sales by industry average price results in under-deflation of exporters' revenue and consequently higher revenue-based productivity. This in turn may lead us to overstate exporters' productivity premium. Furthermore, I find that, while revenue productivity and price explains firms' probability to export, quantity based productivity estimates hardly explain it. This suggests that, Ethiopian firms select into foreign markets mainly by generating demand for their products, not necessarily by producing efficiently.

Chapter 2

Product Quality, Firm Efficiency and Export: Evidence from Ethiopian Manufacturing Firms

2.1. Introduction

A large empirical literature has documented that firm-level differences in productivity are crucial to understanding differences in firms' exporting behaviour. The evidence strongly supports the self-selection of more productive firms into export markets (ISGEP, 2008; Wagner, 2012). From a theoretical perspective, Melitz (2003) models decision to export considering productivity as a single source of firm heterogeneity. The model predicts that high marginal cost (less efficient firms) are less likely to enter into international markets as they cannot generate enough revenues to cover foreign market entry costs, suggesting only the most productive firms find it profitable to export while less productive firms serve the domestic markets.

Several recent papers have introduced a new dimension of firm heterogeneity as a source of competitiveness in global markets: firms capacity to produce high-quality goods. Baldwin and Harrigan (2011) and Hallak and Sivadasan (2013) explores the links between product quality and decision to export by extending Melitz (2003) framework. Accordingly, because consumers are concerned about the quality of their consumption, lower-priced products are not necessary better placed to compete in international markets. Similarly, Kugler and Verhoogen (2012) investigate the the relationship between export and import decisions underlying the complementarity between the quality of inputs and outputs. Directly related to this paper, Gervais (forthcoming) explicitly introduces product quality and technical efficiency as the sources of heterogeneity across firms emphasizing on the relative importances of idiosyncratic technological differences and demand factors in shaping export outcomes. Manova and Zhang (2013) extend the heterogeneous firms framework to accommodate multi-product multi-quality firms, providing an insight that exposure to trade induce firms to adjust product mixes towards their core high-quality goods by dropping low-quality cheap products.

Using data on a panel of Ethiopian manufacturing firms, this paper examines whether export success results from firms ability to produce products efficiently at a lower marginal costs, or from the capacity to produce high-quality products. To achieve this objective, the paper examines the relationships between output prices, physical efficiency, input and output quality, and the separate effects of each of these factors on selection into export. It also investigates how and to what extent firms adjust their products' quality and within-firm product mixes when preparing to enter into foreign markets. To address these questions, the paper relies plant-product level quality estimated using a detailed product-level price and quantity information. Since quality is not directly observable, a common practice in trade literature is to proxy quality by means of unit values calculated over product groups. However, even if unit values do correlate with quality, a major limitation lies in the inability to distinguish from quality and cost factors. For instance, for a given product quality, efficient firms may find it optimal to charge lower prices.

This paper estimates quality by adapting the empirical procedure provided by Khandelwal (2010) rather than using price as a proxy for quality. This allows to better understand and quantify the separate effects of cost and quality competencies on export, However, it is worth noting that, while Khandelwal (2010) estimates the quality of US imported goods as evaluated by the US consumers, the measure of quality used in this paper captures the mean valuation of domestic consumer for the manufacturing products of Ethiopia. Therefore, quality in the present context reflects the preference of Ethiopian consumers, rather than the valuations of consumers in destination markets. Bearing this in mind, quality is broadly defined as the attributes of products that induce consumers to pay more for a given quantity. Specifically, conditional on price, firms that have largest market share are considered as high quality producers. Intuitively, this measure is in line with the view that consumers decide how much to purchase by comparing quality-adjusted prices (Baldwin and Harrigan, 2011). As such, if two firms charge the same price but have different market shares for a particular product, it implies that they sell different qualities of the product. Building up on this insight, this paper derives quality as a vertical component from nested logit demand function of Berry (1994) that comprises of both horizontal and vertical attributes of a product. The fact that this particular procedure of estimating quality requires the total quantity demand of each product in the domestic market, the import data of Ethiopia (defined at 8-digit Harmonized System Code (HS)) is carefully mapped with the product-level manufacturing data (defined at 6-digit).

The results show that high-price products are more likely to be exported. However, once price is adjusted for quality difference, products with higher quality-adjusted price are less likely to enter into foreign markets. Jointly these results suggest that the observed price-export relationship reflects quality differences. A direct examination of the relationships between quality and export reinforce the importance of quality in determining firm export decision while the effect of firm efficiency on export mainly operates through the quality channel. Furthermore, access to quality inputs from foreign markets enables firms to produce high-quality outputs, and thereby improves export performance. The results on the analysis of the dynamics of quality and product entry into foreign markets reveal that high-quality products self-select into export. Specifically, the trajectories of newly exported products show that quality upgrading took place three years prior to export entry. In the run-up phases of export entry, firms also change the composition of their product compositions by shifting their production towards their premium quality products that will be exported in the future.

This paper has several contributions. First, it distinguishes between firm efficiency and product quality that could alternatively explain firms participation into export. By doing so, it shed new light on the relative importances of increasing productivity efficiency and building quality production capacity to foster export and bring industrial development in developing countries. Second, it provides some insights in explaining the positive relationship between export-productivity links that has been observed in earlier works focusing on African firms (see for example, Bigsten et al. 2004, Van Biesebroeck 2005 and Amakom, 2012 for Sub-Saharan Africa, or Bigsten and Gebreeyesus, 2009 for Ethiopia). Third, even if using this procedure to estimate quality is not new to the literature, to the best of my knowledge, this is the first paper to obtain a plant-product level quality and to investigate its implication for firms' export behaviour in the context of Sub-Saharan African.

This study has also implications for the design of export promotion policies in developing countries. The evidence on the importance of quality suggests that rather than focusing on mass production of indistinguishable low-cost products, encouraging production of goods that are customized to targeted foreign markets, and meet the high-quality standards of international markets is essential. In this regard, the fact that quality production requires modern technologies and skilled labour, encouraging such investments is crucial. Furthermore, facilitating access to high-quality inputs would indirectly improve export performance by increasing output quality.

This paper fits within the new wave of literature that focuses on the role of product quality in shaping aggregate and firm-level trade flows. Based on the US import data Schott (2004) finds that unit values of the imported goods systematically correlated with the characteristics of the exporting country in which goods originating from developed countries have higher unit values. Similarly, based on within-exporters variations, Johnson (2012) documents that exporters selling in markets that are difficult to enter charge higher prices. It is also related to studies that focus on firm-level data and established that exporters on average charge higher prices than non-exporters suggesting quality differences (for example, Kugler and Verhoogen, 2012) studies that relate input quality with output quality (Kugler and Verhoogen (2012). Other studies also established that improving the quality of exported products is a necessary condition for developing countries' products to succeed in international markets (Chen et.al., 2008; Brooks, 2006). By proxying quality using expert ratings for the French Champagne industry, Crozet et al. (2011) find that high-quality firms have a higher probability to export, higher volume of sales and charge higher prices. They also find that idiosyncratic demand determines export performance.

This paper is directly related to the works of Gervais (forthcoming) that explicitly models the relationships between price, quality, firm efficiency and export, and Iacovone and Javorcik (2012) that investigates the pre-export behaviour of products. By estimating quality at the plant-level using US census data, Gervais (forthcoming) finds that prices are increasing in quality and decreasing in efficiency, but selection into export is mainly driven by quality. Using plant-product level data from Mexico, Iacovone and Javorcik (2012) find that a product that will be exported in the next period obtain a price premium (used as a proxy for quality) in the domestic market, but they find no evidence on post-export quality upgrading. Along the same lines, Lòpez ,2004) and Espanol (2007) find that in the process of expanding their presence on export markets Chilean and Argentinean firms undertake dedicated investments. This evidence supports the argument that access to foreign markets makes investments in new technologies profitable (Bustos, 2011); and firms innovate ahead of export entry with the anticipation of trade liberalization (Costantini and Melitz, 2007).

The paper also shares the intuitions of De Loecker (2011) and Smeets and Warzynski (2013), and the first chapter of the thesis. These studies find that export premium derived from revenue productivity confounds efficiency and demand factors as a result the superior revenue productivity of exporters indicates higher profitability rather than higher efficiency. This studies are complementary to the present paper since this paper emphasizes the importance of disentangling the role of efficiency and demand components (such as quality) to explain cross-product variations in export status.

The remainder of this chapter is structured as follows. Section 2.2 provides an overview of related literature that shapes the empirical framework of the chapter. Section 2.3 presents the data that has particular relevance for this chapter. While section 2.4 presents the empirical analysis, section 2.5 concludes.

2.2. Related Literature

The empirical framework of this paper builds on the literature that examines firms choice in input and output quality, their relationships with prices and firm efficiency, and the implications of these factors on firms' decision to export. The baseline Melitz (2003) framework considers firms as heterogeneous in terms of productivity, and given that a fixed cost is required to enter into foreign markets, only high productivity firms find it profitable to export. In this setup, even if quality is not modelled explicitly, high productivity is equivalent to the ability to produce high quality products at a given cost. More recently a growing body of literature directly examine the link between quality and export. This line of research has started with the observation that within a certain level of products classification there is a wide variation in unit values across trade partners. Accordingly, within goods categories, unit values increase with the exporters per capita income (Schott, 2004), and high income countries have relatively greater demand for the products of countries with high unit values (Hallak, 2006). These findings imply quality differences across products suggesting that skill and technology abundant countries supply higher quality products, and at the same time such high income countries import high-quality products. Using cross-country panel data, Hallak and Schott (2008) estimate quality and find a systematic correlation between export quality and exporters per capita income.

Firm-level empirical studies find a systematic relationship between output prices and export and import patterns. Using Chinese trade transaction data Manova and Zhang (2012) find that price variations are not only observed across firms but also within a firm exporting to different destinations, where exporting to distant (high income) markets allow firms to charge higher prices. Furthermore, across firms selling the same products, firms that charge higher export prices enjoy higher revenues in each market and export to more destinations. Similarly, studies find that, on average, exporters charge higher price than non-exporters for the same product implying quality differences (Hallak and Sivadasan, 2013; Kugler and Verhoogen, 2012). This pattern initiates the development of international trade models that introduce quality as a source of heterogeneity building up on the standard Melitz (2003) framework.

Baldwin and Harrigan (2007) introduce preference for quality with the assumption that quality is a random draw for firms instead of productivity, and marginal costs are increasing in quality. The model predicts that more productive firms produce higher quality goods and charge higher prices. However, because consumers compare quality-adjusted price not just the observed price, high-quality/high-price products are more likely to competitive, more profitable as well as overcome trade costs than low-quality/ low-price goods. Kugler and Verhoogen (2012) model input and output quality as endogenous variables as determined by a random productivity draw. In this framework, they emphasize the relationship between export and import decisions showing the complementarity between the quality of inputs and outputs. On the other hand, Hallak and Sivadasan (2013) introduces quality as a second source of heterogeneity where firms differ exogenously along two dimensions: capacity to produce high-quality products for a given cost and ability to produce at lower costs for a given quality. In this model, firms can have advantage in either productivity or quality, but not in both. Thus, to the extent that unit trade costs are a decreasing in quality, high quality (and thus low productivity) firms are more likely to export. With the assumption that quality increases demand and involves additional production costs, exporters charge higher prices than equally-sized non-exporters.

Similarly, Gervais (forthcoming) extends the Melitz(2003) framework by explicitly introducing exogenous product quality and technical efficiency as the sources of heterogeneity across firms. This framework emphasizes on the relative importance of idiosyncratic technological differences and demand factors in shaping export outcomes. The model assumes that while consumers' preference is defined over product quality and quantity, production costs depend on the quality of output and firm's technical efficiency. In this setup, for a given price, quantity demanded is increasing in quality, and the variable costs of production are increasing in product quality and decreasing in efficiency. Firms decide whether or not to enter into foreign markets after drawing their technical efficiency and product quality that determines their profitability. As such, only firms that have a combination of technical efficiency and product quality that allow making a positive profit from exporting will enter into foreign markets. The model predicts that given efficiency and quality are substitutes in firms revenue, low-efficiency and high-quality producers can generate the same revenue as high-efficiency and low-quality producers. Accordingly, a firm with a combination of quality and efficiency level that allow to make positive profit in foreign markets will export, and therefore two firms that generate the same level of revenue can have the same export status independent of their level of quality and efficiency. Gervais (forthcoming) also argues that given price is increasing in quality and decreasing in efficiency, price could not be a good indicator for quality because high-efficiency and high-quality producers can charge the same price as low-efficiency and low-quality producers.

Further recognition on the dominance of multi-product firms scales down the analysis to a product level. This line of research emphasizes within-firm adjustments, and provides an insight that severe market competition induce firms to adjust their product mixes towards their cheaper products (eg.Bernard et al., 2010), More recently, Manova and Zhang (2013) argue that quality differentiation across products is an important feature of multi-product firms. They provide a theoretical framework that characterizes the multi-product multi-quality firms where firms vary their product quality by using different level of input quality. The model predicts that when firms expand their activities to foreign markets, they adjust their product mixes along the extensive margin by maintaining their high-quality expensive products and dropping low-quality cheap goods.

Building up on the literature described, the empirical analysis of this paper aims to establish the relationship between price, efficiency, input and output quality, and examine the separate effects of each of these factors on selection into export. As such, given that the main export destinations of Ethiopia are high income countries, it is expected that quality explains much of the variations in export performances of manufacturing products. Furthermore, with a prior that foreign materials are of superior quality than domestic ones in developing countries, firms that import raw materials would produce high-quality outputs. To the extent that foreign markets are demanding in quality, firms that have intention to export would customize their products and adjust their product composition prior to export entry.

2.3. Data and Main variables: Quality Estimation

The main interest of the chapter is to examine the importance of product quality relative to efficiency to determine the export performance of firms. Thus, it requires estimation of product quality for each product-firm pairs. This section presents a brief description of the data structure used to estimate product quality followed by the estimation procedure applied. Then, the estimated quality along with a descriptive statistics on the relationship between quality, export, efficiency and price is presented.

2.3.1 The Data

The data used for this analysis come from two sources: the annual Ethiopian Large and Medium Scale Manufacturing Enterprise Survey run by the Central Statistical Agency of Ethiopia (CSA) and data on import from Ethiopia Custom Authority (ECA). (See section 1.4 of chapter one for a detail description of the manufacturing data). Estimation of quality requires information on the total demand for each product in the domestic market; hence, I map the domestic manufacturing data with total import obtained from the Ethiopian Customs Authority, which provide with values and quantities of imported products up to the 8-digit level of the Harmonized System (HS8). By carefully mapping CSA and ECA data sets, I build total domestic demand for each 6-digit product contained in the firm-level survey. Table 2.1 gives an idea of the structure of the dataset: by combining the product code with the associated 4-digit ISIC code we construct a 6-digit classification that can be matched with the one used by the Customs Authority. .

Table 2.1: Example of the product-level manufacturing data structure

Beverage industry		
ISIC-4digit	Product code	Product description
1554	67	Liquor
1554	73	Wine
1554	77	Beer
1554	82	Mineral water

This paper focuses on manufacturing plants that operate in the food, beverages and footwear sectors. First, since the interest is the analysis of export activities, I concentrate on the sectors where export participation is relevant. Second, in order to exploit information on sales quantities when estimating product quality, the units of measurements across the manufacturing survey and the import data retrieved from the Customs Authority must be similar.[8] Furthermore using relatively homogeneous sectors may reduce the measurement errors in the estimations that require quantity information.

[8] For instance, due to the mismatch between the unit of measurement used in the manufacturing survey and in import data the wearing and apparel sector is dropped.

2.3.2. Estimating Product Quality

Since quality is not directly observable, a common practice in trade literature is to proxy quality by means of unit values calculated over product groups. However, even if unit values do correlate with quality, a major limitation lies in the inability to distinguish from quality and cost factors. Following the approach proposed by Khandelwal (2010), I estimate quality that reflects the preference of consumers once prices have been controlled for[9]. Based on the nested logit demand function of Berry (1994) that comprises of both horizontal and vertical attributes of a product, Khandelwal (2010) develop an empirical method to estimate product quality using price and quantity information (See Appendix 2.A for details).

Assume that each product h belongs to a group g that represent a nest. In what follows, the demand for a variety (j), which is defined as product h that belongs to firm , at time t depends on:

$$\ln(S_{jt}) - \ln(S_{ot}) = \alpha P_{jt} + \sigma \ln(S_{jt}|g) + \varphi_{jt} + \varepsilon_{jt} \qquad (2.1)$$

where S_{jt} is the overall market share of variety j and defined as $S_{jt} = {}^{q_{jt}}/_{M_t}$, where q_{jt} is the quantity of this variety produced domestically, and M_t is the industry size built by aggregating import (q_{ot}) and domestic production (q_{jt}), $M_t = \sum_j q_{jt} + q_{ot}$; S_{ot} is the outside variety, capturing the import alternative to the domestic variety and defined as ${}^{q_{ot}}/_{M_{it}}$. Furthermore, $S_{jt}|g$ is the nest share, that captures the market share of variety j within product h. Also, P_{jt} is the price of the variety; φ_{jt} is the unobserved (by the econometrician) characteristics of the variety and ε_{jt} is a time-varying stochastic term. In estimating the demand function, the unobserved characteristics are captured by variety dummies (φ_j) and time dummies (φ_t).

In matching the model with the data at hand, I use the maximum level of disaggregation (6-digit) to define a product h , and thus nest (g) is defined as as a 6-digit product class. Whereas variety j is defined as a plant-product (6-digit) pair. However, the finest level of product classification in the data is (6-digit) is more likely to combine a number of different

[9] Khandelwal (2010) estimate the quality of the US imports as evaluated by the US consumers. However, since the Ethiopian manufacturing data set does not provide information on export destinations, I borrow the approach to estimate plant-product level quality as perceived by the domestic consumers.

products into a single category referred as "hidden verities". For example, a large firm may have a greater market share (and so larger quality) due to the fact that it produces more unobserved (hidden) verities with in the product. To address this issue, I follow the intuition of Khandelwal (2010)[10] and control for firm size in demand equation as large firms are more likely to produce more varieties. Thus, a measure of quality that is adjusted for the presence of hidden varieties is estimated from the following demand function:

$$\ln(S_{jt}) - \ln(S_{ot}) = \alpha P_{jt} + \sigma \ln(S_{jt}|g) + \beta \ln emp_{it} + \varphi_{jt} + \varepsilon_{jt} \qquad (2.2)$$

where $\ln emp_{it}$ is the number of employees of firm i at time t. Then, quality (ϕ_{jt}) of a variety j at time t is defined as the sum of the estimates of variety fixed effect (φ_j) capturing the time invariant component of quality; year fixed effect (φ_t) capturing the common quality component, and variety-time specific deviation from the average (ε_{jt}):

$$\phi_{jt} \equiv \hat{\varphi}_j + \hat{\varphi}_t + \hat{\varepsilon}_{jt} \qquad (2.3)$$

It worth noting that since we estimate domestic demand, the quality measure shows the valuation of domestic consumers. For the sake of comparison, we estimate quality both with and without the correction for possible hidden varieties. Intuitively, *quality unadjusted for hidden variety* is measured as the market share of the variety once its price is controlled for, whereas *quality adjusted for hidden variety* is measured as the market share of the variety once its price and firm size are controlled for.

A simple regression of normalized market share of each variety on its price and nested share may yield inconsistent and biased estimates due to the potential endogeneity of price and nest share. This endogeneity may come from several sources. For instance, firms that foresee a demand shock may adjust their price accordingly. Also, if the marginal cost of producing a high-quality product is higher, firms will consider this information in setting their prices. Thus, simple OLS estimates of the demand function would results in a downward bias on the price coefficient. Moreover, the nest share, which partly constitutes the dependent variable, is also endogenous.

[10] In estimating quality for the US imports Khandelwal (2010) controls for population size of the source countries with the assumption that larger countries may simply have larger market shares because they export more unobserved product within a product group.

To the extent that the unobserved firm characteristics that affect price and other outcomes, such as quality, are time invariant, controlling for firm fixed effects in the regression would handle any endogeniety from this source. However, these unobserved firm characteristics may not be time-invariant and thus make the firm-fixed effect estimation insufficient for dealing with the endogenity that arises from the time-varying component of quality. For instance, firms may upgrade the quality of their products or face demand shocks over time. In order to obtain consistent estimates of demand parameters we use three instruments for price and nest shares. First we instrument prices with physical labour productivity, which is less likely to respond to demand shocks, but is correlated with prices through marginal costs (Foster et al., 2010). As recommended by Berry et al. (1995) the average price of products (sold by other firms) in the same nest is used as a second instrument for price. The price of competing varieties in the same market will influence the pricing decision of each variety, while the average market price of competitors is not directly related to firm-specific qualities. With the same logic, the nest share of each plant is instrumented by the nest share of its competitors.

To allow α and σ to vary across product groups, we estimate separate equations for each 3-digit sector (fruit and edible oil; pasta and sugar; beverages; footwear). The nesting parameter (σ) measures the consumers' preference correlation across varieties within a nest; the model reduces to a simple logit when within-nest utility correlations are zero.[11] For the sake of comparison, we estimate quality both with and without the correction for possible hidden varieties. Since results are qualitatively similar, in most of the analysis I will refer to the adjusted measure that is retrieved from equation (2.2)

2.3.3. Estimated demand parameters and quality

This section begins by providing the demand parameter estimates that are used to derive quality followed by the descriptive statistics of estimated quality. Table 2.2 presents IV/2SLS estimation of equations (1) and (2), controlling for industry and time fixed effects. Odd (even) columns report estimated parameters for the baseline (augmented) model that disregards (controls for) the presence of hidden varieties. The coefficient for firm size is

[11] The estimated coefficient of the nest share (σ) must be between 0 and 1 to be consistent with the utility maximization. On the one hand, if $\sigma>1$ then the model is consistent with the utility maximizing proposition for only some range of independent variables. On the other hand, if $\sigma<0$ then improving the attributes of a product results in a lower probability to be selected. Thus, a value of σ outside the (0, 1] range suggests a misspecification of the model.

positive and significant (except in the past and sugar sector), confirming the appropriateness of adjusting for hidden varieties. The coefficient of nested share is significant and within the 0 and 1 range. The results show that the food and the footwear industries display a higher degree of substitutability across varieties.

Table 2.2: Demand parameters: FE-IV/2SLS estimates

	Food				Beverages		Footwear	
	Fruit and edible oil		Pasta and sugar					
	1	2	3	4	5	6	7	8
α	-0.050**	-0.056***	-0.032**	-0.034**	-0.042**	-0.053**	-0.024***	-0.025***
	(0.022)	(0.022)	(0.012)	(0.012)	(0.021)	(0.024)	(0.004)	(0.004)
σ	0.865***	0.889***	0.726	0.709***	0.590***	0.516**	0.851***	0.861***
	(0.051)	(0.050)	(0.117)	(0.127)	(0.243)	(0.272)	(0.059)	(0.062)
ln(empl.)		0.387***		0.129		0.457*		0.085**
		(0.083)		(0.133)		(0.272)		(0.043)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry- FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj-R^2	0.430	0.330	0.031	0.64	0.24	0.24	0.60	0.83
Obs.	787	787	325	325	428	427	728	728
Hansen's J stat.	49.091	62.277	0.001	0.083	1.673	7.100	0.035	0.056
	(0.000)	(0.000)	(0.992)	(0.773)	(0.195)	(0.026)	(0.850)	(0.813)

Estimators employed are FE-IV/2SLS (estimated using xtivreg2 commands). All models include year dummies, and 4-digit ISIC dummies (coefficients not reported). Cluster-robust standard error in parentheses, ***, **, and * indicate statistical significance at 1% and 5% and 10% levels, respectively

2.3.4 Quality and export: preliminary evaluation

Before examining the role of quality in explaining price and export margins, this section gives a highlight of the estimated quality. Table 2.3 presents the descriptive statistics of variety-level log quality, price and firm efficiency by export status. In general, the hidden variety adjusted quality is larger than the unadjusted quality for all groups, but the variance of these two measures of quality is not significantly different. The table shows that, on average, exported products have higher price and quality than non-exported groups, and also firms that export at least one of their varieties are more efficient than non-exporters. From the standard deviations, one can also observe a considerable variation in all the variables within and between exporters and non-exporters. However, the within-exported products variations are larger than the within-non-exported ones. Furthermore, the there is more variability in quality than in price. This indicates the likely that using price as measures of quality underestimates the variability of quality across groups and thus underestimates the export-quality links. In general the table shows a substantial heterogeneity in prices and product quality even within narrowly defined group of firms.

Table 2.3. Summary statistics

	All		Exported		Non-Exported	
	Mean	SD	Mean	SD	Mean	SD
lnPrice	2.04	1.60	2.43	1.70	2.00	1.59
lnQuality(unadjusted)	-0.99	2.14	0.34	2.68	-1.14	2.02
lnQuality(adjusted)	0.170	2.19	1.63	2.93	0.01	2.03
lnPLQ	7.21	2.36	7.94	2.53	7.13	2.32

Note: lnLPQ is a firm-level physical labour productivity (quantity per unit labour) used to capture firm efficiency. lnQuality(unadjusted) refers to quality unadjusted for hidden variety and lnQuality(adjusted) is quality adjusted for hidden variety. Prices and quality are measured at product level.

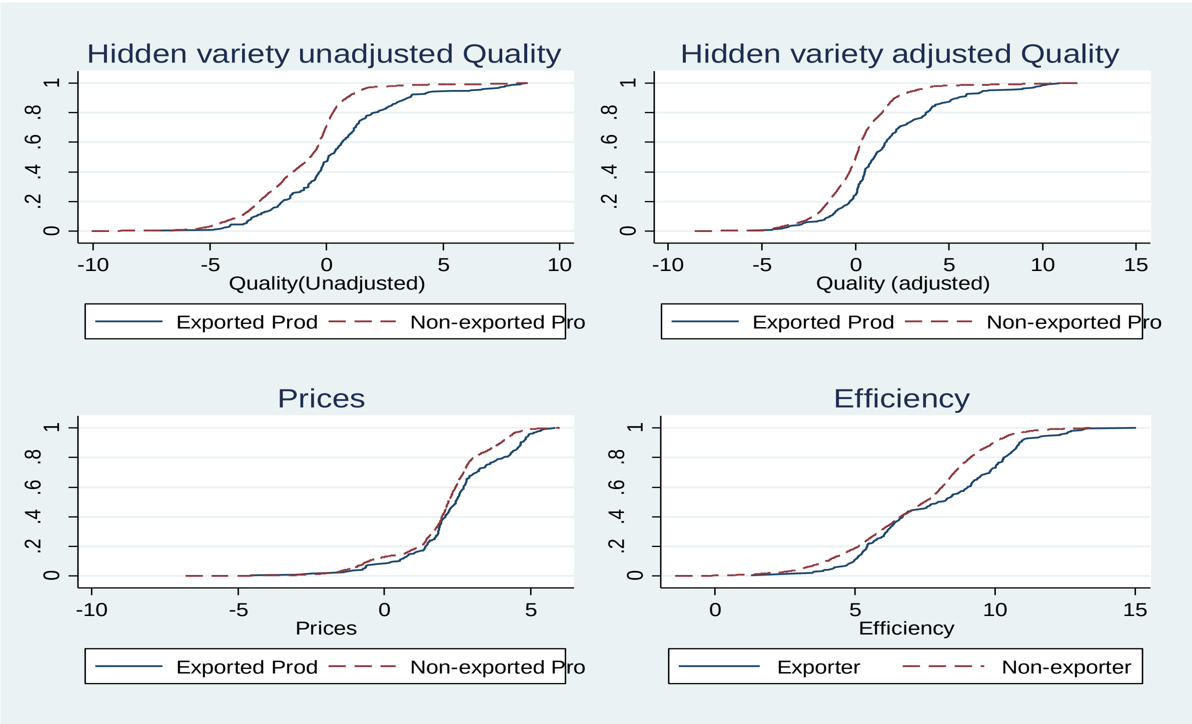


Fig 2.1: Distributions of quality, prices and efficiency

Figure 2.1 displays the cumulative distribution of quality, prices and efficiency. It is clear that independent of controlling for hidden variety, the quality distribution of exported varieties stochastically dominates distribution of non-exported varieties, suggesting that exported varieties command higher quality than non-exported ones. However, this difference seems insignificant on the upper and lower distribution of quality. Considering prices and efficiency, exported varieties still dominate non-exported varieties, but the difference in prices and efficiency is less significant than the difference in quality.

The above statistics corroborates the expectation that firms are heterogeneous in quality and exporting is associated with higher quality. However, the main focus is in examining how quality is related with firm efficiency, price and export (import) which is addressed in the next sections.

2.4. Econometric Analysis

The main interest of this paper is to examine the relationships between output prices, physical efficiency, input and output quality, and the separate effects of each of these factors on products selection into export. Furthermore, it examines the dynamics of products prior to entry into foreign markets. Thus, the empirical analysis is organized in four steps. First, it establishes whether exported products command higher price and to what extent this price premium is explained by quality differences between exported and non-exported products. Second, the relative importance of firm efficiency and product quality in determining probability to export is examined. Third, the dynamics of the relationship between export entry and product quality is examined. Finally, the determinants of quality output with a particular emphasis on access to quality inputs and firm efficiency is presented.

2.4.1 Do exported products command higher prices? What explains this price premium?

Most of the literature examining the export premium and the decision to export focus on productivity as a main driver for self-selection of firms into export. This paper instead focuses on prices and product quality. Thus, I start the analysis by examining if exported products on average have higher prices than non-exported products and whether this price difference captures product quality difference. To this end, I estimate the following equation:

$$lnP_{jit} = \alpha + \theta Ex_{ijt} + \beta_1 lnQual_{jit} + \beta_2 lnLPQ_{it} + \eta_i + \gamma_j + \lambda_t + \varepsilon_{ijt} \qquad (2.4)$$

where j, i, t, indices product, firm and year, respectively; lnP_{jit} capture the natural logarithms prices; Ex_{ijt} indicates the export status of a product and equals one if the firm exports the product and zero, otherwise; $lnQual_{jit}$ is quality; $lnLPQ_{it}$ is firm-level physical efficiency (physical output per unit labour); η_i, γ_j and λ_t indicate firm, product and time fixed effects, respectively. It is worth noting that price is constructed by dividing the total sales value of each variety of a firm by its quantity sold. Thus, for products that are sold both in domestic and foreign markets, the price reflects the average of domestic and foreign markets prices of the product. The main interest of this analysis is the sign and coefficient of θ, which captures the average price difference between exported and non-exported products. Observations at the firm-variety-year level may not be independent either across products within firm-year or across years within firms. Thus, in estimating equation 2.4, I allow some arbitrary correlations across varieties and years within firms by clustering errors at firm level. The fact that the model includes firm and product fixed effects, the identification of the coefficients of price, quality and productivity is based on within-product variation. However, since there might be time variant firm characteristics that can simultaneously affect firms pricing strategy, export decision, efficacy and investments in quality, caution is needed in interpreting the results.

Table 2.4. Output price premium of exported products

	(1)	(2)	(3)	(4)	(5)	(6)
Export	0.194**	0.205***	0.031	0.016	0.010	-0.001
	(0.081)	(0.073)	(0.102)	(0.104)	(0.088)	(0.089)
lnLPQ		-0.150***			-0.317***	-0.312***
		(0.034)			(0.032)	(0.031)
Qual (unadjusted)			0.423***		0.529***	
			(0.037)		(0.037)	
Qual (adjusted)				0.458***		0.555***
				(0.037)		(0.036)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.003	0.027	0.189	0.221	0.287	0.318
N(Observation)	2656	2622	2608	2608	2585	2585
N(Group)	476	476	475	475	474	474

Notes: The table reports the OLS regression results using price as a dependent variable. Productivity and import status are defined at firm level where as price, export status and quality are defined at product level (6-digit product class). Quality (adjusted) refers to estimated quality controlling for hidden varieties whereas quality (unadjusted) refers to quality estimated without controlling for hidden varieties. lnLPQ refers to log of quantity-output per unit labour. Robust standard errors, adjusted for clustering at firm level are in parenthesis. N(Group) and N(Observation), respectively, indicate the number of clusters and number of pooled sample (firm-variety-year) in each regression. ***, **, and * indicate statistical significance at 1% and 5% and 10 % levels, respectively.All the regressions include constants.

Table 2.4 presents the price premium of exported varieties. Column 1 presents the base line specification controlling for product, year and firm fixed effects. The result show that exported products have higher prices than non-exported products. This result is robust after controlling firm efficiency (column 2). It indicates that exported products command about 20 % higher prices than non-exported products. This price difference may arise due to difference in market powers, demand shocks or product quality. To the extent that the observed price difference is driven by quality differences, we would expect that controlling for quality wipes out the price differences. This expectation seems to be confirmed by the results in columns 3 and 4. When quality (either hidden variety adjusted or unadjusted quality) is included in the baseline specification, the prices of exported products is not significantly different from non-exported products. Price difference remains statistically insignificant in richer specifications that control both quality and efficiency (Columns 5 and 6).

Turning to firm efficiency, results show that prices are decreasing in efficiency and increasing in quality. This correlation is robust in specifications that control for both productivity and quality (Columns5 and 6). These results are in line with the theoretical predictions and empirical findings (using US manufacturing plant data) of Gervais (forthcoming). To sum up, exported products have higher prices than non-exported products, and this price difference reflects variation in quality.

2.4.2. Decision to Export: firm efficiency or product quality?

The analysis of the above section shows that exported products feature higher-prices and have superior quality than non-exported products. This section turns into the core focus of the paper: establishing whether selection into foreign market is driven by firms ability to produce high-quality products bearing the additional costs required or by their ability to produce efficiently at lower costs. Therefore, the probability to export product j of firm i at time t is modelled as:

$$\Pr(Ex_{jit} = 1) = \alpha + \beta_1 lnQual_{jit} + \beta_2 lnP_{jit} + \beta_3 lnLPQ_{it} + \eta_i + \gamma_j + \lambda_t + \varepsilon_{jit} \qquad (2.5)$$

where $j, i,$ and t indices product, firm and time, respectively ; Ex_{jit} is indicator of export status and takes 1 if positive exports of product j is reported; $lnQual_{jit}$ is quality; lnP_{jit} is price; $lnLPQ_{it}$ is firm-level physical labour productivity (efficiency); η_i, γ_j and λ_t indicate firm, product and year fixed effect, respectively; ε_{jit} is a stochastic error. It is more likely that the error term (ε_{jit}) is correlated both across products in the same firm or across firm-products over time. To address this issue, the error terms are clustered at firm level. The main interest is to estimate the separate contributions of price, efficacy and product quality in determining the probability to export.

Table 2.7 presents the results from probit estimations of equation 2.5. Columns (1) to (4) reports the effects of quality, productivity, and price when each of these variables is included in separately. Higher-quality and high-price products are more likely to be exported, but the efficiency of a firm is not correlated with the probability that one of its products will be exported.

Next, I further the analysis on the relative importance of cost efficiency versus capacity to produce high-quality inputs while incurring additional costs by disentangle the cost component embedded in price. This is carried out by adjusting price for quality difference as in Khandelwal et al., (2013). Specifically, quality adjusted price is defined as the log difference between prices and quality indices ($lnP_{jit} - lnQual_{jit}$). In what follow, I examine the effect of quality-adjusted price on the probability to export. Intuitively, quality adjusted price captures differences in marginal costs of production. However, it is worth noting that in the presence of imperfect markets, price may also capture differences in firms' ability to set price above marginal costs.

Columns 5-7 present the results of this exercise[12]. Column 5 shows that products that have high quality-adjusted prices are less likely to be exported. This result is robust when both quality and quality-adjusted prices are controlled simultaneously (Column 6 and 7). This result is in line with the theoretical prediction of Baldwin and Harrigan (2011) that consumers' purchase decision depends on quality-adjusted price rather than observed price where products with high quality-adjusted prices are less likely to succeed in a market. In order to check the robustness of this result, columns 7 and 8 directly include both quality and price simultaneously. Once quality is controlled for, price no more explains the probability to export, while quality remains positive and significant. Furthermore, efficiency appears to be insignificant. These results in general confirm the results based on quality-adjusted prices, although stronger result is observed in the quality-adjusted prices. The overall result of this section suggests that for a given quality, products that charge higher prices are less likely to enter into foreign markets. In other words, even if cost efficiency *per se* does not matter, only firms that can produce high quality goods efficiently will enter into foreign markets.

[12] To save space , the table presents only the results based on quality-adjusted price constructed from hidden variety adjusted price. However, the results are consistent when we consider quality-adjusted price constructed using hidden variety unadjusted quality.

2.4.3. Dynamics of products and entry into export

Results in the previous sections establish that exported products have superior quality and higher quality products are more likely to be exported. However, the analysis based on contemporaneous relations reveals little information on the dynamics of product quality before entry into foreign market. This section first explores whether and when firms quality upgrading took place prior to export entry and then investigates how firms adjust their product compositions while preparing to export. There are several reasons why one expects firms may improve their quality before entering into foreign markets. First, for firms in developing countries, such as Ethiopia, entry into foreign market requires meeting the quality standards of foreign markets. Indeed, satisfying foreign market quality standards and keeping pace with the raising demand for quality products in international markets are the major challenges that limit developing countries' firm success in foreign markets (Chen et al., 2008, WTO, 2005). Second, recent empirical studies document that forward-looking firms in developing countries make investments and change their production technology prior to export entry Lòpez and Alvarez, (2005). In the same vein, Iacovone and Javorcik (2012) find direct evidence that Mexican firms upgrade their product quality before entering into foreign markets.

Taking the stock of the above, I start by examining whether firms adjust their products quality in the run up phases of entry into foreign markets. This exercise is carried out by adapting the approach of Bernard and Wagner (1997) that has been widely used in empirical studies investigating the self-selection of productive firms into export. This paper considers quality rather than productivity as a means that vehicle firms into export. Accordingly, if higher quality products self-select into foreign markets, future exported products should command higher quality than non-exported products several years prior to their entry into export. The empirical strategy, thus, involves regressing quality dated at $t-s$ on export status at time$t$. Specifically, the following specification is estimated

$$lnQual_{jit-s} = \alpha + \theta Ex_{jit} + \sum_{r} \beta_r X_{it-s} + \eta_{ji} + \gamma_{kt} + \varepsilon_{ijt-s} \qquad (2.6)$$

Table 2.5: Products selection into export

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Quality(Unadjusted)	0.250***					0.280***		0.253***	
	(0.074)					(0.070)		(0.095)	
Quality (adjusted)		0.251***					0.279***		0.257***
		(0.073)					(0.069)		(0.097)
lnLPQ			0.044			-0.042	-0.035	-0.032	-0.028
			(0.105)			(0.106)	(0.106)	(0.104)	(0.103)
ln price				0.135***				0.030	0.019
				(0.057)				(0.079)	(0.082)
Quality-adjusted price					-0.005**	-0.005**	-0.005**		
					(0.002)	(0.002)	(0.002)		
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-Square	0.039	0.040	0.019	0.021	0.016	0.052	0.053	0.045	0.045
Log pseudolikelihood	-682.907	-682.702	-686.58	-701.972	-647.988	-608.525	-608.342	-663.230	-663.194
Number of Clusters	424	425	424	424	418	417	417	423	423
Number of obs	2365	2365	2372	2406	2278	2257	2257	2342	2342

Notes: The table reports the coefficient estimates of Probit models. The dependent variable indicates whether product j at time t is exported; it is equals to 1 if positive export is reported and zero otherwise. Except productivity (which is defined at firm level), all variables are defined at product level (6-digit product class). Quality (adjusted) refers to estimated quality controlling for hidden varieties whereas quality (unadjusted) refers to quality estimated without controlling for hidden varieties. lnLPQ refers to log of output (volume) per unit labour. Quality-adjusted price is defined as the difference of log price to log quality. Robust standard errors, adjusted for clustering at firm level are in parenthesis. N(Group) and N(Observation), respectively, indicate the number of clusters and number of pooled sample (firm-variety-year) in each regression. ***, **, and * indicate statistical significance at 1% and 5% and 10 % levels, respectively.. All the regressions include constants and time dummies.

Where, j, i, t indicate product, firm and time, respectively; $lnQual_{jit-s}$ is log of quality at time $t - s$; Ex_{jit} is a dummy equals to one for a newly exported product and zero otherwise. The model also includes plant-product fixed effects (η_{ji}), industry-year fixed effects (γ_{kt}). X_{it-s} captures time variant firm characteristics: log of efficiency (physical labour productivity), log of firm size (captured by number of employees) and log of plant age. Here a "newly exported product" is defined as a product that was not exported at least for three consecutive years prior to entry. Thus, the analysis is based on sub-samples that did not enter into foreign markets in years $t - 3$, $t - 2$, and $t - 1$, but some of these products enter into export at time t. The interest lies on the coefficient of Ex_{jit} in which a positive and significant coefficient implies that a product that enters into export market at time t outperform at time $t - s$ years back than products that are not exported at time t. It is, however, important to note that the results do not establish causal relationships.

While preparing to enter into export markets, firms may not only upgrade the quality of their products but also may change their product mixes. For example, in order to benefit from larger market potentials in foreign countries, firms may undertake within-firm adjustment by shifting resources to products that will have demand in foreign markets. Using this insight, this section also examines how and whether firms adjust their product compositions in the run up to export entry. Specifically, the trajectory of the share of future exported product is examined by running the following specification

$$Share_{jit} = \alpha + \theta Ex_{jit} + \sum_{r} \beta_r X_{it-s} + \eta_{ji} + \gamma_{kt} + \varepsilon_{ijt-s} \qquad (2.7)$$

Where $Share_{jit}$ captures the share of product j of firm i in the total sales of the firm. Specifically, it is defined as $Share_{jit} = {Sales_{jit}} / {\sum_{j=1}^{h} Sales_{jit}}$, where $Sales_{jit}$ is the sales value of each product j of firm i at time t, and $\sum_{j=1}^{h} Sales_{jit}$ is the total sale of firm i at time t. Other variables are defined as in equation 2.6.

Quality Upgrading

Table 2.6 presents the results of the dynamics of quality prior to export entry. I run two variant of specification 2.6. First, baseline specifications that controls for industry-year fixed effect and time-variant plant characteristics (columns 1, 3 and 5). In order to address the possibility that the pre-entry advantage of newly exported products would be driven by a selection mechanism that operates through firm-product specific factors, the second specification includes plant-product fixed effects, in addition to firm-level time variant controls (columns 2, 4 and 6). The results show that high-quality products self-select into export. This is robust to controlling for firm-product fixed effects. A closer look at on the timing of quality upgrading indicates that firms upgrade their future exported products three years prior to exporting the products. Specifically, future exported products have 27 % higher quality margin three years prior to entry than products that will not be exported. The previous sections establish that quality is increasing in price. Here, similar to quality, I investigate the dynamics of products price (lnP_{jit-s}) in relation to entry into export. As shown in Table 2.6, it appears that future exported products command higher price than products that will not be exported three years prior to entry. This suggests that firms charge higher prices for their future exported higher quality products even in the domestic markets. However, this ex-ante price differences is largely explained by plant-product effects.

The patterns of product upgrading observed here corroborate with the findings of Iacovone and Javorcik (2012) for Mexican firms. Using price premium as a proxy for quality, they find that future exported products show superior quality one year prior to entry. The difference in the time gap between quality upgrading and export entry for Ethiopian and Mexican producers is interesting. This can be interpreted that while Mexican firms can easily enter into export markets once they meet the standards required by their targeted foreign markets, Ethiopian producers may face other obstacles to enter into foreign markets even after upgrading the quality of their products. In fact, this paper uses quality rather than price premium for the analysis. To check the robustness of the above results and to make direct comparison with the findings for Mexican firms, I provide further evidence using "Price Premium" instead of quality. Following Iacovone and Javorcik (2012), price premium ($PrPrem_{jit}$) of product j of firm i at time t is defined as the price (P_{jit}) of the product j relative to the average price of all varieties of product j. More specifically it is measured as follows, $PrPrem_{jit} = {P_{jit}} \Big/ {\frac{1}{N}\sum_{i=1}^{N} P_{jit}}$.

In what follow, the pre-entry evolution of price premium is examined by re-running equation 2.6 using the logarithm of computed price premium as a dependent variable. Again Table 2.6 presents the results. In the baseline specification (columns 5), newly exported products show about 17% higher price premium than non-exported varieties three years prior to entry. This result remains significant, although marginally (at 10 %), in a model that controls for plant-product effects (column 6). In general, it is observed that the dynamics of product's price and price premium follow the pattern of quality premium, but the evidence is stronger for quality.

The long lag between quality upgrading and entry into foreign markets is intuitive. For Ethiopian producers which are loosely connected to international markets, one expect that it would take longer time to start exporting even if firms improve the quality of their products. This is because once they meet quality standards, it may take time to establish foreign market distribution networks, finalize necessary deals and start the actual export business. Nevertheless, it is evident that quality premium products started to be sold for the high-end domestic markets with a higher price premium prior to entry into foreign markets.

Within-firm adjustments

Similar to quality, firms adjust their product mixes prior to entry into export markets (Table 2.6). Specifically, they increase the share of their future exported products in the run-up phases of exporting, and this adjustment took place two years prior to entry. For example, in the baseline specification (column 5), the share of future exported product is 10% point larger than products that will not be exported. This result is robust after controlling for plant-product fixed effects (at 10 % level of significance) (column 4). Given that only high-quality products succeed in foreign markets, this result implies that access to trade induce firms to shift their production resources from low-quality cheap products to their premium products that could compete in international markets. Similarly, using detailed Custom data from China, Manova and Zhang (2013) find that firms that enter into foreign markets adjust their product compositions by focusing on their core-competency high quality products while dropping cheap low-quality products.

To sum up, the findings imply that firms export those products with better attributes and alter the composition of their production in favour of future exported products. This finding is consistent with the self-selection hypothesis of high quality products into foreign markets. However, a closer look at the timing of the emergence of quality premium shows that those products that have higher quality premium in the domestic markets three years prior to entry enter into foreign markets. Whereas, two years before entering in international markets, firms increase the share of the future exported product relative to other products. Combining these findings, it seems that in preparation to get into export firms make sequential decisions regarding quality and production composition adjustments. Once higher quality is assured for a particular product it follows that firms shifts the production structures within the products in favour of high quality products which are planned for export markets.

Table 2.6 Product dynamics and entry into export

	S=1		S=2		S=3	
	(1)	(2)	(3)	(4)	(5)	(6)
$lnQual_{jit-s}$	0.156	0.0671	-0.0197	0.0618	0.278**	0.272***
	(0.124)	(0.134)	(0.153)	(0.146)	(0.140)	(0.104)
lnP_{jit-s}	0.303**	0.0310	0.187	-0.0435	0.357**	0.237
	(0.154)	(0.126)	(0.168)	(0.120)	(0.148)	(0.147)
$lnPPrem_{jit-s}$	0.023	-0.165	-0.004	-0.131	0.170**	0.141*
	(0.135)	(0.110)	(0.134)	(0.145)	(0.077)	(0.082)
$Share_{jit-s}$	0.013	-0.0318	0.151***	0.0924*	0.038	-0.018
	(0.064)	(0.064)	(0.053)	(0.050)	(0.051)	(0.046)
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Plant characterstics	Yes	Yes	Yes	Yes	Yes	Yes
Plant-product FE	No	Yes	No	Yes	No	Yes

Note: P-values of t-tests are in brackets below estimates and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (robust standard errors are used). Plant characteristics are efficiency (physical labour productivity(lnLPQ)), firm size (captured by number of employees) and plant age

2.4.4. Producing high-quality products: access to quality inputs and firm efficiency

The evidence so far emphasizes the relevance of product quality behind the selection of some products into export while the others sold in domestic markets. This section aims to establish the relevance of firm efficiency and access to quality inputs in determining firms' production of high-quality output. The following equation establish the relationships

$$lnQual_{jit} = \alpha + \tau Imp_{it} + \beta lnLPQ_{it} + \theta Ex_{ijt} + \eta_i + \gamma_j + \lambda_t + \varepsilon_{ijt} \quad (2.8)$$

where j, i, t, indices product, firm and year, respectively; $lnQual_{jit}$ capture the natural logarithms quality; Imp_{it} is firm-level import status equals one if the firm imports raw material and zero otherwise; Ex_{ijt} indicates the export status of a product and equals one if the firm exports the product and zero otherwise; $lnLPQ_{it}$ is firm-level physical efficiency (physical output per unit labour); η_i, γ_j and λ_t indicate firm, product and year fixed effects, respectively. The main interest of this analysis are the relationship between quality and import (captured by τ) and the relationship between quality and firm efficiency (captured by β). In estimating the model, the errors are clustered by firm. The identification of coefficients is based on within-product variations.

Table 2.7: Determinants of output quality.

	Unadjusted for hidden variety		Unadjusted for hidden variety	
	1	2	1	2
Imp_{it}	0.155***	0.117**	0.156***	0.340***
	(0.055)	(0.056)	(0.055)	(0.098)
$lnLPQ_{it}$	0.310***	0.309***	0.286***	0.119**
	(0.035)	(0.340)	(0.035)	(0.056)
Ex_{ijt}		0.336***		0.285***
		(0.099)		(0.033)
$Firm\ FE$	Yes	Yes	Yes	Yes
$Product\ FE$	Yes	Yes	Yes	Yes
$Year\ FE$	Yes	Yes	Yes	Yes
$Rsqured$	0.107	0.117	0.222	0.318
$N(Observation)$	2585	2585	2679	2585
$N(cluster)$	474	474	474	474

Notes: The table reports the OLS regression results using quality as a dependent variable. Productivity and import status are defined at firm level where as price; export status and quality are defined at product level (6-digit product classes). lnLPQ refers to log of output (volume) per unit labour. Robust standard errors, adjusted for clustering at firm level are in parenthesis. N(Group) and N(Observation), respectively, indicate the number of clusters and number of pooled sample (firm-variety-year) in each regression. ***, **, and * indicate statistical significance at 1% and 5% and 10 % levels, respectively. The table reports adjusted R-square All the regressions include constants.

Table 2.7 presents the results from regressions using hidden variety unadjusted quality unadjusted and hidden variety adjusted quality as a dependent variable. However, the results are qualitatively and quantitatively similar in the two specifications. The result in column1 shows that, on average, firms that import raw materials produce 15 % higher quality product than firms that do not import. Similarly, the quality of output is increasing in firm efficiency. This result is robust in specifications that control for export status of firms (column 2). Furthermore, exported products have about 30 % quality premium.

These results are consistent with the findings by Verhoogen (2008) for Mexican firms that more productive firms produce high-quality products than less productive firms and input quality is associated with output quality. Kugler and Verhoogen (2012) provide theoretical explanations for this relationship. Accordingly, more efficient producers have a comparative advantage of using high-quality inputs and thus produce high-quality outputs. Assuming fixed costs associated with quality production, they also propose that since efficient firms produce at large scale, the per unit cost of quality production is lower for efficient firms. Thus, it is less costly for efficient producers to producing high quality outputs. The positive relationship between the import of raw materials and quality of output is also intuitive. Producing high-quality output requires modern technologies, skilled labour and high-quality inputs. However, as it is the case in many developing countries, it is hardly possible for Ethiopian producers to get these inputs in the domestic market. Given that imported raw materials from developed countries are higher quality, firms that use imported raw materials are expected to produce higher quality outputs than non-importers.

2.5. Conclusions

Using a rich panel data set from Ethiopian manufacturing firms, this paper examines the role of product prices, quality and firm efficiency in explaining the export decision of firms; and the dynamics of quality upgrading and export market entry. The standard heterogeneous firms' trade models assume productivity as a single source of heterogeneity and predict that firms' choice of price is proportional to their marginal costs. This suggests that since exporters are more efficient than non-exporters, they more likely set lower prices than non-exporters. However, this prediction is at odds with the recent findings in the literature that exporting is associated with higher prices. This pattern is also observed in Ethiopian data. In exploring this puzzle, this paper first examines the underlying reasons why exporters charge higher prices than non-exporters and then the implication of this mechanisms for firms export decisions. To organize the analysis, I relay on recent developments in heterogeneous firms literature that introduce quality as an additional source of heterogeneity.

The richness of the data allows constructing a quality index using price and quantity information. The estimated quality indicates the difference in the preference of consumers from closely related products that is not explained by price differences. Using these plant/product-level measures of quality to investigate the drivers of price and export status variations across-products. The results show that while quality is increasing in price and efficiency, price is decreasing in efficiency. Furthermore quality is the most important factor in determining firms export decision and the effect of efficiency on export comes through quality channel. Further evidence shows that high-price products are more likely to be exported. However, once price is adjusted for quality difference, products with higher quality-adjusted price are less likely to enter into foreign markets. Based on an analysis of the dynamics of quality and product entry, I find that high-quality products self-select into export. Specifically, the trajectories of exported products show that quality upgrading took place three years prior to export entry. In the run-up phases of export entry, firms also change the composition of their production in favor of future exported varieties. In overall results emphasize the importance of product quality for developing firms' success in foreign markets. Furthermore, there is a clear indication that the notion of price competitiveness to succeed in foreign markets is tempered by the presence of quality differences suggesting that what matters for firm's competitiveness in international market is quality-adjusted price.

Chapter 3

Product Quality, Access to Finance and Export: Evidence from Ethiopian Firms

3.1. Introduction

The presence of important upfront sunk costs associated with export suggests that financial factors could play an important role in shaping a firm's decision to enter foreign markets. Using data on a panel of Ethiopian manufacturing firms, this paper investigates the channels through which bank credit affects export participation. More specifically, we look at the interplay between access to financial resources, investment, and product quality.

In fact, in many developing countries where financial markets are not well developed, access to external finance is often identified by firms as a major obstacle to their operation (Kuntchev et al., 2013). The fact that the manufacturing sector of developing countries is often dominated by small firms contributes to worsen the problem of credit access. On the one hand, it is more challenging for small firms to generate enough liquidity from their operation to finance investment, so that they need to relay more on external sources. On the other hand, small firms have less assets to pledge as collateral and may appear more opaque to external investors, making it more likely that they are excluded from financial markets. Taken together, these two facts imply that access to external financial resources is especially important in determining the decision to export for firms operating in developing countries.

The paper engages with two streams of the international trade literature. First of all with the studies that investigate the relationship between finance and export. From the theoretical point of view, a few extensions of the standard Melitz (2003) model have incorporated financial factors as an additional source of heterogeneity, predicting that the presence of financial frictions may affect export participation (see for instance Manova, 2013 and Chaney, 2013). From an empirical perspective, following the pioneer study of Greenway et al (2007) that establishes that the UK exporting firms are more likely to be financially healthy, a large literature has addressed this issue, reaching somewhat conflicting results (see for instance Bellone et. al, 2010; Stiebale, 2011; Minetti and Zhu, 2011). In the context of developing countries, Berman and Héricourt (2010) find that access to finance is an important determinant of entry intro export, while Ngo (2015) suggests that it only matters for (Ghanaian) firms featuring an intermediate productivity level.

A second relevant stream of the literature is the one that documents the importance of product quality in explaining a large part of the difference we observed in the export behavior of firms, especially in developing countries (Chen et.al., 2008; Brooks, 2006). In fact, while the baseline Melitz (2003) model assumes that export is solely determined by exogenous productivity –and market selection in only based on (lower) prices- a number of subsequent works recognize that lower-priced products are not necessarily better placed to compete in international markets (Baldwin and Harrigan, 2011) and introduce quality as a second source of heterogeneity (Hallak and Sivadasan, 2013). Furthermore, the assumption of exogenous productivity that characterizes the baseline Melitz's (2003) framework finds little support in the context of developing countries, where exporting is represents a long term growth plan that entails investment in new technologies, human capital and improved intermediate inputs (Lòpez, 2004). Technological upgrade is crucial to meet the high quality standards required in many foreign markets relative to the domestic one. For instance, Wangwe (1995) presents detailed evidence based on six sub-Saharan countries that support this hypothesis. Along the same lines, Lòpez and Alvarez (2005) and Espanol (2007) find that in the process of expanding their presence on export markets Chilean and Argentinean firms undertake dedicated investments. Moreover, Iacovone and Javorcik (2012) report that Mexican firms upgrade their product quality before entering into foreign markets.

The interaction between finance and quality has been explored in a number of recent contributions. Fan et al. (2015) argue that tighter credit constraints force firms to reduce product quality. In fact, in their sample of Chinese firms they find that credit constrained enterprises set lower prices because they produce low quality exports. Bernini et al. (2015) analyze the behavior of a large sample of French manufacturing firms and provide convincing evidence about the existence of a negative causal relation between a firm's leverage and export quality. Moreover, they link the negative impact of leverage on quality with the idea that the agency cost of debt determines suboptimal investment. Last, Crinò and Ogliari (2015) focus on the interplay between cross-country differences in financial development and sector-specific dependence on external finance to explain the large variation in the quality of exports that one observes across industries and countries. They conclude that changes in average quality are a key mechanism through which financial development affects trade.

In this paper we follow a similar route, but bring the argument to the level of firms. In particular, we exploit firm-level measures of quality and access to finance to examine how the interplay between bank credit and product quality determine the export participation of a sample of Ethiopian manufacturing firms. In so doing we manage to distinguish between the direct and indirect effects of finance on export. The need to face important upfront costs associated with technical upgrading, together with the presence of an underdeveloped financial market, make access to financial resources a critical issue for Ethiopian firms.

The main results show that while the availability of finance exerts limited *direct* effect on export decision, bank credit determines the average quality of goods sold by firms. This suggests that access to finance is only relevant for quality upgrading if firms use the available credit for investment. Furthermore, we find that quality drives exporting and the effect of finance on export depends on the average level of product quality: access to finance is more relevant for firms producing high-quality goods. Overall, our results suggest that, in addition to its direct effect on a firm's ability to pay the sunk entry costs, financial resources affect export decisions through their impact on product quality.

The paper thus shed new light on the multiple constraints that limit industrial development in Africa. First of all, we confirm that quality is an important source of heterogeneity among firms and it plays an especially important role in determining the ability of local firms to enter foreign markets. Finance and quality are therefore among the sources of the productivity difference between exporters and no exporters that has been observed in empirical works focusing on African firms (see for example, Bigsten et al. 2004, Van Biesebroeck 2005 and Amakom, 2012 for Sub-Saharan Africa, or Bigsten and Gebreeyesus, 2009 for Ethiopia). To the best of our knowledge, this is the first paper that takes into account the interplay between product quality, access to bank credit and export market participation in the context of African firms.

The remainder of the paper is organized as follows. Section 3.2 presents background information about Ethiopian financial market and the measure of credit constraints. While section 3.3 presents the plant-level quality index, section 3.4 specifies the empirical models. Section 3.5 discusses the results, and section 3.6 concludes

3.2 The Ethiopian Financial Market and Access to finance

Our interest in this paper is to examining the interplay between access to finance and product quality in determining firms' selection into export. This section provides background information about the financial sector development of Ethiopia followed by the description of the financial constraints faced by Ethiopian firm. Then we present a review of literature on measuring proxies for financial status of firms followed by our proxies of financial constraints along with the descriptive statistics.

3.2.1. **Ethiopian financial market overview**

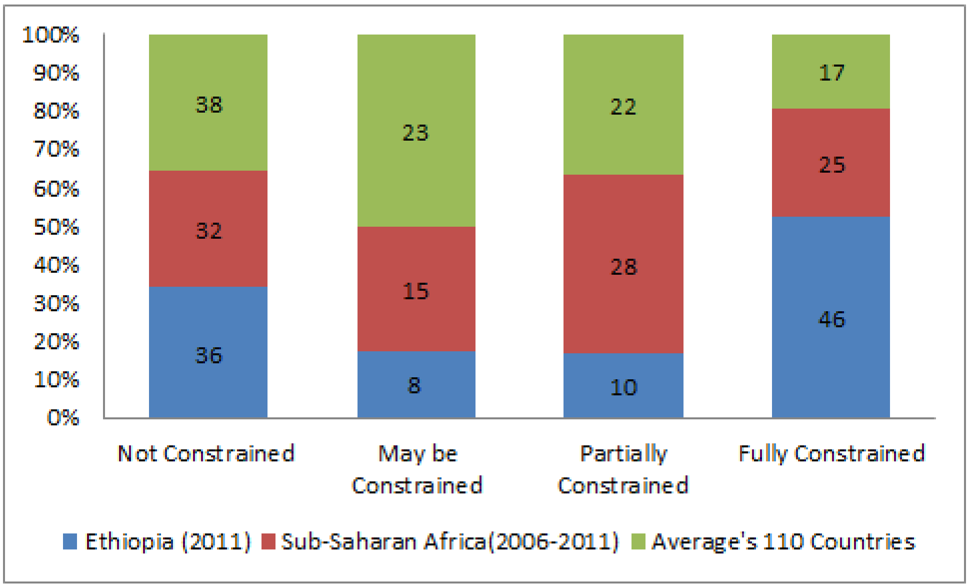
Currently the Ethiopian financial sector is mainly composed of 19 banks (3 public and 16 domestic private); 15 insurance companies (14 private and 1 public); 31 microfinance institutions that operate throughout the country. However, the banking sector dominates the financial sector, accounting for more than 80% of the total asset of the financial system (Zewdu, 2014). The overall development of the financial sector of Ethiopia is below the average of sub-Saharan African countries. High concentration, low private credit, saving and less liberalization process, and substantial liquidity characterize the financial sector of Ethiopia (See Table A1 at the Appendix). Furthermore, the participation of foreign financial institutions is strictly barred.

The fact that stock exchange and capital markets do not exist in any form and the banking sector dominates the financial system, access to finance in Ethiopia is mainly through banking. However, access to finance and financial services is limited. As of 2012, the population per bank branch was 63,644, and one third of bank branches were located in the capital (Addis Ababa) indicating very limited access to financial services and its severity in the rural parts of the country. Moreover, only 8 % of the population had bank account. The contribution of micro finance institutes is also limited serving only 2.9 million people.

One of the major features of the Ethiopian banking sector is substantial involvement and dominance of the state. Historically, the three state owned commercial banks take the larger share of the financial market assets of the country. Despite the rise in the share of private banks in the total bank assets from 6.4% in 1996 to 30 % in 2006, the share of the public banks remained high (70 % as of 2006) (See Table A2 at the A appendix). However, it worth to note that there is encouraging trend in recent years in the investment of the local private sector in the banking industry which brought a rapid expansion of private banks. For example, Zewdu (2014) shows that in the last 10 years, on average, the capital of the private banks grows annually by 28.2 % (from 33.2% in 2003/04 to 49.3% in 2011/12). Still, in terms of the overall activities of the banking sector, the single state-owned commercial bank of Ethiopia (CBE) plays a significant role, accounting for about 70% of mobilizing the sector resource as of May 2013 (IMF, 2013).

While the progress in the banking sector of Ethiopia in recent years is encouraging, there is a growing concern that the low development of the financial market in general coupled with the substantial involvement of the state in the market limits the availability of credit for the private sector. Indeed, recent trends show that credit expansion for the private sector has slowdown. For instance, credit to nongovernment sector grew by 22 % in 2012/13. However, only 20% of this expansion went to the private sector while the remaining 80 % is allocated to public enterprises (IMF, 2013). Furthermore, given the very limited resource available from the local economy, the complete absence of foreign banks worsens the availability of credit for the private sector. As a result, financial constraint remains the major obstacles for business in Ethiopia.

Figure 3.1: Firms' access to external finance



Source: The World Bank 4th Ethiopia Economic Update (2015)

Figure 3.1 shows that 64 % of Ethiopian firms are credit constrained compared with 68 % in sub-Saharan Africa and 62 % in other parts of the word. However, the degree of financial constraint for firms in Ethiopia is more significant where 46 % of Ethiopian firms are fully constrained compared with 25 % in sub-Saharan Africa and 17 % in other countries. This suggests that, most firms in the country either do not have access to finance at all, or their application for loan is rejected, or even they do not apply for loan as they cannot afford the costly terms and conditions of the financial institutions.

3.2.2. Measuring financial constraints

Internal cash flow and external funds can be used to finance the various activities of firms. In fact, there are numerous theories that analyse alternative capital structure of companies, where the packing order theory of capital as popularized by Myers and Majluf (1984) has been the most influential one. According to this theory, the finance options available for firms range from internal cash flow to equity, and companies prioritize the source of finance based on the costs of financing. In the world of market imperfections and adverse selection, businesses prefer internal over external finance, and debt is placed first instead of equity if external finance is required. Taking into account these alternative sources of finance, there is a large body of literature that aim to identify firms financial status focusing on corporate investment demand. Fazzari et al., (1988) propose that when firms are financially constrained, investment decision would not only be guided by the net present value of the planned investment, but also by the availability of internal funds. The basic assumption in this proposition is that the sensitivity of investment to cash flow should be higher for firms that have a larger gap between internal and external costs of funds. In this view, the degree of financial constraints faced by firms can be measured by examining the cross-sectional differences in the sensitivity of investments to cash flow changes. As such, firms are considered as constrained if their investment is sensitive to cash flows where sensitivity is measured by the coefficient obtained by regressing investment on cash flow controlling for investment opportunities.

Despite the popularity of the sensitivity approach to identify the financial status of firms, Kaplan and Zingales (1997) provide both theoretical and empirical arguments that cast doubt about its validity as a good indicator for financial constraints arguing that the sensitivity of investment to cash flow could not necessarily characterize firms' optimal investment decision under financial constraints. They support their argument with an empirical evidence that more constrained firms investments are less sensitive to the variability of cash flow or vice versa. More recently, Almeida et al., (2004) propose an identification of mechanism of the financial status of firms based on demand for cash, rather than demand for investment. They argue that while cash saving is sensitive to cash flow for constrained firms, there is no systematic correlation between cash saving and cash flow for unconstrained firms. This argument is based on the idea that firms that expect future constraints prepare themselves by hoarding cash today, however the optimal cash policy for unconstrained firms is indeterminate. This is because while cash hoarding is costly for constrained firms as it reduce current profitable investments (and thus should balance their liquidity and investments), unconstrained firms neither have use for cash nor face the costs of hoarding cash (and thus their cash policy is indeterminate).

Despite the vast literature that proposes internal finance as an alternative to external finance, this is unlikely for many small firms in developing countries that may have limited ability to generate enough internal funds to finance their investments. In particular, the fact that exporting is associated with additional fixed costs that would be incurred before firms realize the export revenue makes it more difficult to finance the costs of exporting from internal sources as it may worsen the working capital problem that exporters face. Related to this, using data from nine African countries, Van Biesebroeck (2005) finds that many African firms operate below their full capacity mainly because of financial constraint, and this further limits their ability to enter into foreign markets. On the other hand, exporting allows firms to exploit their economies of scale as it provides more demand and facilitates access to credit. The findings of Van Biesebroeck (2005) highlight a vicious circle problem that African firms face related to export and finance. On the one hand, limited access to finance limits firms ability to produce at full capacity and thus to generate enough internal fund. On the other, exporting requires finance, and firms can only exploit their economies scale if they export. Thus, financing export activities from internal cash flow is hardly possible for African firms, and access to external finance is important to break the vicious circle.

Taking into account the discussion above, in this paper we identify constrained firms based on whether firms have access to bank credit or not. The information contained in the survey allows us to build two indicators of financial access. The first measure is derived from the subjective perception of firms whether they have access to bank credit. The second one is based on the sources of new working capital reported in the survey. Both indicators are dummy variables: *access to bank credit* ($AcBkCr$) takes value 1 if the plant does not perceive bank credit as a problem; similarly, the *credit financing for working capital* ($WoCaFi$) is set to 1 if bank credit is listed as a source of new working capital. The rational for using working capital finance is that exporting involves a longer shipping time and thus, longer lag time until a firm receives payments for its exporting. This increases exporting firms' need for financing working capital relative to non-exporters.

Table 3.1 presents some descriptive statistics for the subjective assessment on whether lack of bank credit represents an important limitation to establishment activities, as well as the fraction of working capital financed by banks. According to column 1 roughly 25% of plants report a problem of access to finance: smaller firms are more likely to feel constrained, whereas there is no significant difference across age groups. Columns 4 to 9 present the extent of firms' dependence on banks to finance their working capital. The general picture that emerges from the table shows very limited availability of bank finance their size and age: less than 20% of firms have a fraction of their new working capital financed by banks (see column4). Moreover, even for those firms able to secure credit, less than 10% of working capital is financed by banks (on average).

When firms are grouped by size, small firms (10 to 20 employees) have the lowest degree of access to bank credit, 16% against 20% (19%) for medium (large) firms. If we look at firms that secure loans, the amount of credit obtained varies across size and age groups: medium-sized plants finance a higher fraction of working capital from banks relative to both small and large establishments.

Looking at the distribution between age groups, it seems that young firms are more dependent on bank finance and finance larger fraction of their capital from banks. On average, around 25% of young and 17% of mature firms depend on bank finance for working capital. Analogously, while 14% of young firms' working capital comes from banks, only 9% of old firms' capital is financed by banks. One possible reason can be banks do have limited capacity to extend large amount of credit in general and thus they can only finance a small fraction of the working capital requirements of larger firms. This seem in line with the observation of Rajan and Zingales (1998) that firms relay on external sources of finance early in their life-cycle, while later on they are more likely to generate enough resources on their own.

Panel B of Table 3.1 presents the tests for equality of means across the three size classes and between young and mature firms. It is evident that the averages for each of the variables of interest are not equal across age and size groups at 1% level of significance. The exception is the statistically insignificant difference of the percentage of firms that report credit problem across age groups. In general, the data show that Ethiopian manufacturing firms have very limited access to external finance and the problem of capital is more pervasive for young and small firms. This low external finance dependence of firms is a mirror image of the overall low development of banking sector in the country.

Table 3.1. Access to bank finance by firm size and age

Size (employees)	*% of firms with working credit problem (mean)*			*% of firms with access to bank credit for working capital (mean)*			*% of working capital financed from banks (mean)*		
	(1) All	(2) Young	(3) Mature	(4) All	(5) Young	(6) Mature	(7) All	(8) Young	(9) Mature
Panel A: Descriptive statistics									
10-19	25.77	27.35	26.09	16.40	25.36	13.66	8.08	13.01	6.92
20-99	23.63	25.07	24.46	20.25	27.59	19.86	11.74	16.51	11.38
>=100	21.09	18.97	21.45	19.24	19.36	19.30	10.24	10.81	10.33
Total	24.24	25.76	24.64	18.25	24.76	17.02	9.76	13.53	9.22
Panel B: Tests for equality of the means									
Between size classes									
F	11.88	4.34	7.76	16.01	5.15	35.02	32.66	5.53	40.44
Prob>F	0.000	0.001	0.004	0.000	0.059	0.000	0.000	0.004	0.000
Between young and mature									
t- statistics	-1.122			-8.900			-7.594		
Pr(|T| > |t|)	0.261			0.000			0.000		

Note: this table presents the percentage of firms with the subjective perception of credit constraint and the observed availability of finance for working capital from banks by size and age. Panel A is the statistics and Panel B is the test of the equality of the statistics between the three size classes and between young and mature firms. The first three columns present the percentage of firms in each size class that report lack of credit as a major constraint for their current operations. The second three columns present the percentage of firms in each size class that finance the fraction of their working from banks. Analogously, the last three columns present the mean percentage working capital financed from banks. Young firms are those that have been in business not more than10 years and mature firms are those that exist for more than 10 years in business at the year of observation. "All" refer to the combination of young and matured companies. The test statistics for the equality of mean between size classes is based on one way Anova test and the test for equality of mean between young and mature firms is two-sample t test with unequal variances.

3.3. Plant-level product quality

Our interest in this chapter is to examine the interplay between product quality and access to finance in determining firms selection into export. The chapter relays on quality estimated in chapter three. However, the analysis of this chapter is at firm-level while the quality estimated in the previous chapter is at firm-product level. Thus, this section presents the construction of firm-level quality index followed by its descriptive statistics.

A plant-level measure of quality is obtained as a weighted average of the estimated quality of all varieties produced by the establishment in each period, where weights are given by the share of each variety in total plant sales. Table 3.2 presents the descriptive statistics of firm-level quality by different sector and firm groups, hidden variety unadjusted quality in the first four columns and hidden variety adjusted quality in the last four columns.

Table 3.2 Estimated firm-level quality across industry and firms

	Hidden Variety Unadjusted					Hidden Variety Adjusted				
category	Mean	Median	SD	Min	Max	Mean	Median	SD	Min	Max
by sector										
Food	-1.73	-1.99	1.99	-10.06	8.29	-0.58	-0.53	1.96	-8.58	9.19
Beverage	-0.58	-0.60	3.24	-6.74	8.64	1.76	1.62	3.28	-4.53	12.15
Footwear	-0.10	-0.14	0.86	-2.52	6.20	0.25	0.18	0.88	-2.17	6.78
by export status										
Non-Exporter	-1.05	-0.56	2.06	-10.06	8.64	0.05	0.04	2.07	-8.58	12.15
Exporter	0.51	0.18	2.64	-7.12	8.57	1.82	1.01	2.87	-5.63	10.92
by size (employment)										
1st quartile	-1.87	-1.84	1.68	-10.06	3.54	-0.86	-0.17	1.55	-8.58	4.03
2nd quartile	-1.44	-0.86	2.09	-8.89	7.94	-0.51	-0.20	1.88	-7.29	12.15
3rd quartile	-1.18	-0.35	1.87	-6.92	3.63	-0.35	0.04	1.45	-5.45	5.94
4th quartile	0.13	0.08	2.26	-5.50	8.64	1.59	1.14	2.47	-3.95	11.03
All	-0.87	-0.46	2.19	-10.06	8.64	0.25	0.12	2.25	0.12	12.15

Notes: The table presents the mean, median, standard deviations, minimum and maximum of the estimated firm-level quality (adjusted and unadjusted for hidden varieties) by sector, export status and firm size. The firm level quality is constructed as a weighted average of the quality of each variety of the firm using the share of each variety from the total sale of the firm as a weight. We trimmed estimated quality at 1% below and above to avoid the influence of extreme values on the statistics.

In general, the hidden variety adjusted quality is larger than the unadjusted quality for all groups, but the variance of these two measures of quality across different groups is not significantly different. Hence, the remaining analysis of this paper is largely depend on the hidden variety adjusted quality which takes into account the biases due to the unobserved differences in number of varieties that a firm may produce.

We observe a considerable heterogeneity in quality across firm groups. Exporters, on average, produce higher quality products than non-exporters. Looking at the variation, there is higher heterogeneity of quality within exporters than non-exporters. We also see that larger firms produce, on average, higher-quality products, although firms in the upper quartile of the size distribution display the largest within-group variation in quality. The overall message is that there is substantial heterogeneity in product quality even within narrowly defined industries. In the following sections we examine the factors that explain this differences and how this heterogeneity in quality coupled with access to finance affect firms behavior in international markets.

3.4. Empirical Analysis

3.4.1 Preliminary evidence on the link between finance, quality and export

In this section we provide some preliminary evidence on the link between finance, quality and export based on the entire distribution of quality. Figures 3.2-3.4 plot the cumulative distribution function of quality for different groups of firms: exporters Vs non exporters; constrained Vs unconstrained (based on the two different definitions we adopt). In Figure 3.2 we can see that exporting firms feature a higher level of quality relative to non-exporters. The same applies to unconstrained firms based on their subjective perception of access to bank credit, while no significant difference emerges when we classify firms as constrained if bank credit is not a source of finance for new working capital (Figure 3.4).

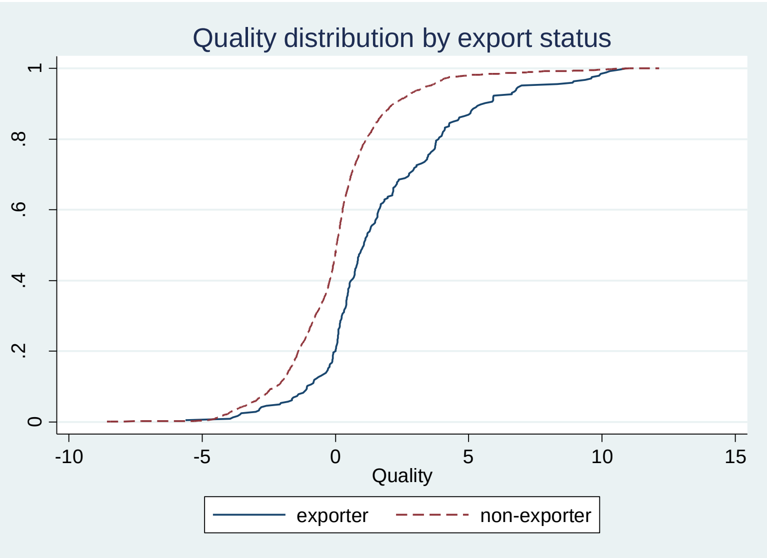


Fig 3.2. Quality distribution of exporters and non-exporters.

As working capital is less likely to be used for the long-term investment associated with technological and quality upgrading, this last result is not counterintuitive. To formally test for any difference in the distributions we run Kolmogorov-Smirnov test for stochastic dominance on the different groups of firms; we consider one year at a time to accommodate the assumption of independence of the observations. Results (not displayed but available upon request) remain unchanged and suggest that quality may indeed represent an important channel through which finance affects the export behavior of firms. In the following sections we dig deeper into this relationship by presenting econometric evidence that allows us to control for other relevant factors.

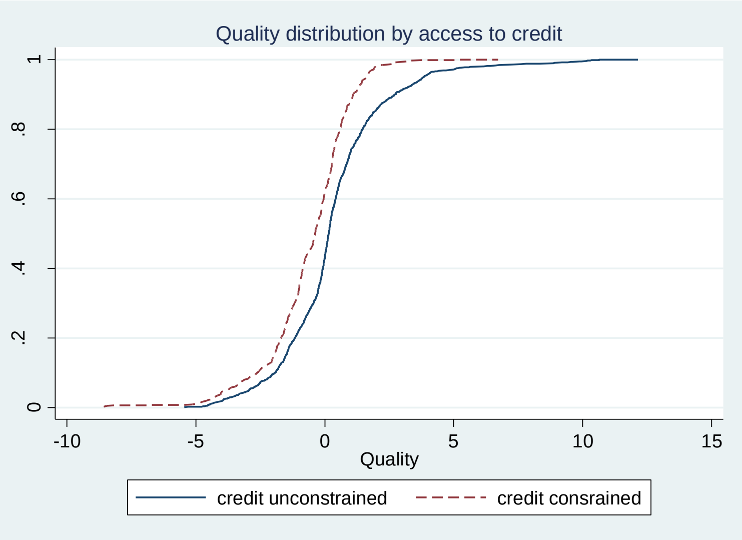


Fig 3.3. Quality distribution by access to credit and working capital from banks.

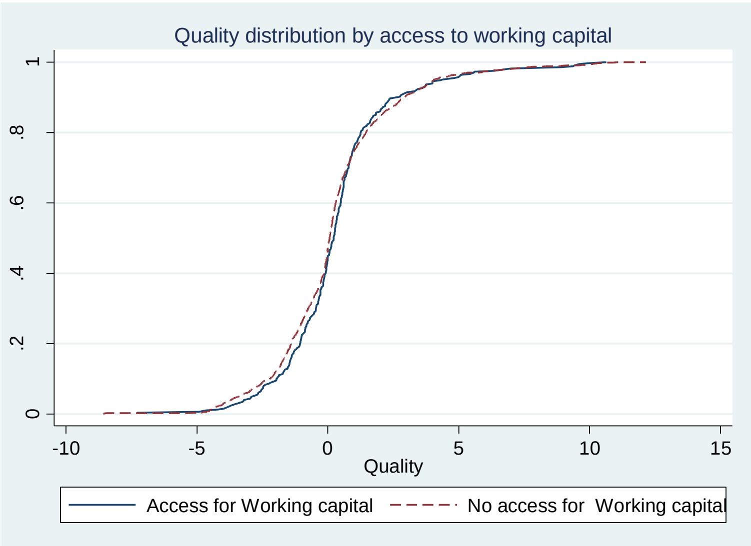


Fig 3.4 Quality distribution of exporters and non-exporters by access to credit from banks

3.4.2. Econometric Analysis

The econometric analysis of this paper focuses on identifying the direct and indirect effects of access to finance on firms participation to export. In doing so, we follow the following strategy: first we test for the presence of "sunk costs" of export for Ethiopian firms by looking at hysteresis as a signal for the presence of sunk costs. Second, we examine the indirect effects of finance on a firm's probability to export through its impact on quality and on the associated investment needs.

3.4.2.1. Access to bank finance, Export and Quality

To test whether exporting involves sunk costs and credit access has a positive effect on a firm's export propensity, we estimate a dynamic probit model containing lagged export status among the regressors. Thus, defining $EX_{it} = 1$ if firm i export at time t and $EX_{it} = 0$ if it does not export, the dynamic model becomes:

$$EX_{it} = \begin{cases} 1 & if \quad \beta_1 EX_{it-1} + \beta_2 \mathrm{FIN_{it}} + \gamma Z_{it} + \eta_i + \eta_k + \eta_t + \varepsilon_{it} > 0 \\ 0 & otherwise \end{cases} \qquad (3.1)$$

where EX_{it-1} is lagged export status and it is meant to account for the persistence of exporting due to the presence of large sunk costs (Roberts and Tybout 1997). FIN_{it} stands for the indicator of access to financial variable, either access to bank credit ($AcBkCr$) or credit financing for working capital ($WoCaFi$). We add a full set of industry (η_k) and year (η_t) fixed effects, we control for a number of firm-specific characteristics (Z_{it}) deemed to be important in the literature (for example see Bernard and Jensen, 2004). These variables are the logarithms of total employment ($lnEmpt$) of the firm to capture firm size; physical labour productivity ($lnPLP$)[13] to capture firm efficiency; age ($lnAge$) to capture firms market experience; and a dummy for foreign ownership ($Foreign$).

There are two important issues that has to be solved in estimating this dynamic specification of export decision: first, the "initial condition" in which the likelihood function of the dynamic specification is conditional on the initial value of the dependent variable at time $t=0$, represented as EX_{i0}. Since the initial period in the sample data does not coincide with the initial period of the dynamic process, obtaining consistent estimates requires a special treatment of EX_{i0}. Second, the presence of time-invariant, unobserved firm-specific characteristics that affect export decisions (denoted as η_i). Since η_i is most likely correlated with EX_{i0}, applying standard maximum likelihood estimation would lead to inconsistent estimates. To deal with these issues, we follow the approach proposed by Wooldridge (2005), which models the unobserved time-invariant heterogeneity (η_i) as a function of EX_{i0} and the time-average of all exogenous covariates.[14] Accordingly, the unobserved heterogeneity is modeled as:

[13] Physical labor productivity (quantity per unit labor) is used instead of revenue productivity, since using revenue productivity to capture efficiency confounds price (quality) and efficiency, and thus would make difficult to identify the separate effect of quality in the subsequent analysis (see De Loecker, 2011)

[14] Wooldridge (2005) proposes modelling the time-invariant unobserved heterogeneity as a function of the initial value of the dependent variable and all past and future values of exogenous regressors. However, given

$\eta_i = \beta_0 \text{EX}_{i0} + \tau \overline{Z}_{it} + \alpha_i$

where $\overline{Z}_{it}$ denote the time-average of a set of exogenous variables defined as $\overline{Z}_{it} = T^{-1} \sum_{t=1}^{T} Z_{it}$; $(\alpha_i / EX_{i0}, \overline{Z}_{it}) \sim Normal(0, \sigma_{ai}^2)$ and independent of EX_{i0} and η_i.

Given the assumption of the conditional distribution of firm's unobserved heterogeneity we can write the probability to export as

$$EX_{it} = \begin{cases} 1 & if \quad \beta_1 EX_{it-1} + \beta_2 \text{FIN}_{it} + \gamma Z_{it} + \eta_k + \eta_t \beta_0 \text{EX}_{i0} + \tau \overline{Z}_{it} + \alpha_i + \varepsilon_{it} > 0 \\ 0 & Otherwise \end{cases} \quad (3.2)$$

This model then can be estimated using the standard random effect probit models. Our main interest lies on the coefficients of past export status (β_1) and of access to finance (β_2). In presence of sunk costs, we expect $\beta_1 > 0$. Furthermore, if access to finance directly affects firms decision to export, expect a positive coefficient for access to finance ($\beta_2 > 0$).

So far, past export status and access to finance are regressed on the current export status of firms. This way we can examine if sunk cost is relevant for Ethiopian firms and if so whether access to bank finance directly affects firms' probability to export. The aim here is, however, to set the ground for further investigation of the indirect effect of finance through its effect on firms' preparation to export. Despite the large evidence testifying for self-selection of the best firms into export (based on exogenously given productivity), the underlying mechanism behind the selection process is not always clear. Indeed, Bernard and Jensen (2004) underline the importance of investigating how firms obtain the characteristics that allow them to enter into foreign markets. Lòpez (2004) argues that the selection process is a result of conscious investment by forward looking firms, an hypothesis that finds support in subsequent works by Espanol (2007) and Iacovone and Javorcik (2012).

In order to examine the indirect effect of finance, we look at firm activities that are related with current export status and at the same time require substantial start up sunk costs: namely quality and investment. First, we verify how these variables are associated with exporting and then we investigates the role of access to finance in determining investments and quality upgrading. In what follow, we include investment ($Invt$) and quality ($Quality$) each at a time in export decision equation (3.2):

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our small sample size, this specification would leave us with too few degrees of freedom and we therefore only use past values as done in Stiebale (2011).

$$EX_{it} = \begin{cases} 1 & if \quad \beta_1 EX_{it-1} + \beta_2 \mathrm{FIN_{it}} + \beta_2 X_{it} + \gamma Z_{it} + \eta_i + \eta_k + \eta_t + \varepsilon_{it} > 0 \\ 0 & Otherwise \end{cases} \qquad (3.3)$$

Where X_{it} represents $Invt$ and $Qualit$ alternatively. $Invt$ is defined as a dummy variable that takes one if the firm has invests in fixed assets and zero otherwise. $Qualit$ is a firm-level quality measure. Other variables are defined as in equation (4). In estimating these equations, we proceed in several steps : first we estimate the pooled probit model (with clustered standard errors by firm); next, by assuming that the plant-specific effects are uncorrelated with the regressors, we estimate the a random-effect probit model; to account for the possibility that some plant-specific characteristics may be correlated with the controls, we also estimate a linear probability model with plant fixed-effects; last, in order to control for the biases due to initial condition and unobservable firm heterogeneity simultaneously, we present the result following Wooldridge (2005) approach as described above. Our expectation is that the sign of β_2 should be positive and significant. In an extension of the model, we introduce interactions to allow the effects of finance to vary across the distribution of quality.

3.4.2 Quality, Investment and Finance

Towards examining the indirect channels through which financial constraints distort firms export, in this section we test if access to bank finance is related to the factors that could drive export participation, namely product quality. This is because, to the extent that quality is a driver of export, access to finance may affect firms decision to export through its effect on investments in quality. Based on French firms, for example, Bernini et.al,(2015) find that the leverage affects firms competitiveness in international markets through its effect on export quality. In understanding the mechanisms through credit affects firms exporting behavior, recently theoretical and empirical literature extends the standard firm heterogeneous model by introducing quality and financial factors (Fan et.al, 2015; Crinò and Ogliari, 2014). In these models, financial frictions affect firms export behavior by inducing them to adjust the choice of quality. Indeed, Fan et.al, (2015) find that credit constrained Chinese firms set lower prices because they produce low quality exports. We investigate whether access to finance affects firms quality production, and thus export decision, by running the following baseline specification:

$$Quality_{it} = \gamma Z_{it} + \beta \mathrm{FIN_{it}} + \eta_i + \eta_k + \eta_t + \varepsilon_{it} \qquad (3.4)$$

where $Quality_{it}$ represents firm-level quality; FIN_{it} captures our two proxies for access to bank finance: either access to bank credit $(AcBkCr)$ or the availability of bank finance for working capital $(WoCaFi)$; Z_{it} is a vector of time-varying firm characteristics that can potentially affect quality production, including firm size (captured by employment), firm efficiency (captured by physical labour productivity), firm age, foreign ownership and investment on fixed assets. We also control for firm-fixed effects (η_i), industry-fixed effects (η_k) and time fixed-effects (η_t); ε_{it} is the error term. In estimating this model, first we exploit the variation across firms by controlling for year and industry fixed effects along with time-variant firm characteristics. Then, we estimate the model with firm-fixed effect. In the baseline specification, errors are clustered at firm-level to address potential correlation of error terms within each firm over time.

Our interest is in the coefficient of our proxy for access to bank finance (β). Upgrading the products attributes entails upfront costs that are difficult to finance from internal cash flows. As these costs are often investments in R&D and new technologies, and have to be incurred long before the outcome revenue is realized, firms become more dependent on external finance in upgrading their product quality. One may expect that access to finance may only be relevant for quality upgrading if firms use the available credit for investment, and therefore credits for working capital is not relevant to explain variations in quality. However, regardless of its use, working capital may play a role for firms investment in quality. The need for working capital and investments may compete for the same financial resource of the firm. Thus, access to working capital from banks may allow firms to allocate some internal resources to investments that could have been used for working capital should the firm not been financed it from banks. Thus, we expect that the coefficient of the proxy for access to bank credit is positive,($\beta > 0$), but more strong coefficient for access to credit that can directly be used for investment.

3.5. Results

3.5.1. Export and access to credit

The interest here is to study the link between export decision and access to finance. To get some perspectives on the persistency of exporting and the effects access to finance, we first present the results without considering the potential biases due to firm-specific effects. Table 4 presents pooled Probit (columns 1 and 2) and random effect (RE) (columns 3 and 4) estimates of equation 4. We find that firms that export in the previous period are more likely to export in the current period. The positive and significant effect of export experience is robust in the random effect probit estimates. Turning to access to finance indicators, we do not find a significant effect of access to bank credit on the probability to export (columns 1 and 3). However, the financing of working capital from banks is marginally significant at 10%.

As expected, in all specifications firm size is positively and significantly correlated with the probability to export. On the other hand, we do not find a significant coefficient for firm efficiency. This result is consistent with the recent empirical evidence that selection into export is rather by profitability, but not by efficiency (See for example, De Loecker and Goldberg, 2014). As well, firm age and foreign ownership do not seem have a significant effect on the probability to export (although the coefficients are positive). The possibility

Table 3.3: Average marginal effect on the probability to export

	Pooled Probit		RE	
	(1)	(2)	(3)	(4)
Exp_{it-1}	0.135***	0.166***	1.763***	2.068***
	(0.011)	(0.012)	(0.254)	(0.226)
$AcBkC$r	0.014		0.079	
	(0.013)		(0.283)	
$WoCaFi$		0.023*		0.358*
		(0.012)		(0.209)
$lnEmpt$	0.027***	0.025***	0.704***	0.529***
	(0.005)	(0.005)	(0.132)	(0.104)
$lnEfficiency$	-0.001	0.003	-0.004	0.038
	(0.002)	(0.003)	(0.052)	(0.045)
$lnAge$	0.001	0.011	0.065	0.184
	(0.008)	(0.009)	(0.206)	(0.180)
$Foreign$	0.013	0.014	0.267	0.149
	(0.014)	(0.018)	(0.303)	(0.265)
$Year\ FE$	Yes	Yes	Yes	Yes
$Industry\_FE$	Yes	Yes	Yes	Yes
N	1584	1627	1584	1627
pseudo R^2	0.589	0.617		
N_clust	248	264		
Log likelihood	-177.537	-208.593	-171.195	-202.022
Rho			0.439	0.368
sigma_u			0.884	0.763

Note: the dependent variable is dummy for export. For the standard probit estimates, robust clustered standard errors in parenthesis. * p < 0.10, ** p < 0.05, *** p < 0.01

that the effect of access to credit is insignificant because of the high persistency of export leads us to investigate also static models without including lag of export status (the results not reported). Even in these flexible specifications, access to bank credit remains insignificant, but working capital turns to be more significant. The overall result suggests the importance of sunk cost of export for Ethiopian firms. Nevertheless, only access to bank finance for working capital plays a direct role. As we pointed out above, if there are significant unobserved firm-specific effects, the above specifications will yield inconsistent estimates. To correct this bias, we begin by estimating the linear probability fixed-effect models (FE-LPM) as it is common in the literature (for example, Bernard and Jensen, 2004). However, given the binary nature of our dependent variable, this result may be misleading. Furthermore, it does not take into account the initial condition bias that arises as we specify a dynamic model. Thus, we further estimate a dynamic random effect probit estimates that controls for the unobserved firm heterogeneity and initial conditions simultaneously (Wooldridge 2005).

Table 3.4 presents the results. The results from the FE-LPM (column 1 and 2) are consistent with the pooled probit estimates. We find that lagged export is positive and significant. Access to bank credit remains insignificant. What is interesting here is that, when we exploit within-firm variation, access to working capital become statistically more significant. Columns (3-6) present the results from the Wooldridge method. It is important to note that this approach cannot yield estimates for time-invariant covariates (as the time average of these variables is the same as their value), so that we do not include the time average of foreign ownership and firm age. Also the model assumes exogeneity of right-hand side variables. Since access to finance may be endogenous to export participation, we estimate the model both with and without the time average of access to finance (see columns 3 and 4, and 5 and 6, respectively).

We find strong evidence that both lagged and initial export status drives the current probability to export. Both measures of access to finance appear to be uncorrelated with export propensity in the specifications that include its mean value (Columns 3 and 4). However, in the models that does not include the mean value of finance, access to working capital turns to be significant at 10 % (column 6). In all the specifications, plant size is positive and statistically significant. Some of our findings are consistent with the work by Berman and Héricourt (2010) and by Stiebale (2011), who find no significant effect of financial constraints on export decision.

Table 3.4: Average marginal effect from dynamic random effect model (controlling for firm-specific heterogeneity and initial condition simultaneously)

	Fixed Effect LPM		FE & initial export status (Woodridge, 2005)			
	(1)	(2)	(3)	(4)	(5)	(6)
Exp_{it-1}	0.296***	0.375***	1.555***	1.806***	1.552***	1.809***
	(0.026)	(0.027)	(0.254)	(0.238)	(0.254)	(0.238)
$AcBkCr$	-0.005		-0.100		-0.003	
	(0.016)		(0.325)		(0.291)	
$WoCaFi$		0.033**		0.347		0.369*
		(0.015)		(0.235)		(0.220)
$lnEmpt$	0.040***	0.023**	0.603***	0.450***	0.597***	0.449***
	(0.010)	(0.010)	(0.176)	(0.162)	(0.177)	(0.162)
$lnEfficiency$	-0.000	0.001	0.003	0.044	0.004	0.044
	(0.003)	(0.003)	(0.059)	(0.055)	(0.059)	(0.055)
$lnAge$	-0.015	0.004	-0.036	0.133	-0.045	0.134
	(0.020)	(0.021)	(0.226)	(0.206)	(0.228)	(0.206)
$Foreign$	0.003	0.014	0.268	0.125	0.277	0.126
	(0.026)	(0.025)	(0.312)	(0.284)	(0.314)	(0.284)
Exp_{t0}			1.282**	1.208**	1.331**	1.199**
			(0.550)	(0.517)	(0.559)	(0.515)
$AvgAcBkCr$			0.561			
			(0.846)			
$AvgWoCaFi$				0.212		
				(0.778)		
$AvglnEmpt$			0.131	0.134	0.164	0.134
			(0.218)	(0.199)	(0.215)	(0.199)
$AvglnEfficiency$			-0.107	-0.060	-0.090	-0.059
			(0.141)	(0.122)	(0.141)	(0.121)
$Year\ FE$	Yes	Yes	Yes	Yes	Yes	Yes
$Industry\_FE$	Yes	Yes	Yes	Yes	Yes	Yes
$Firm\_FE$	Yes	Yes				
N	1584	1627	1559	1600	1559	1600
Ll	625.106	586.832	-165.199	-196.075	-165.421	-196.112
Rho	0.257	0.308	0.450	0.436	0.462	0.436
sigma_u	0.105	0.124	0.905	0.880	0.927	0.880

Note: the dependent variable is dummy for export. Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The main result from this section is the presence of substantial sunk entry costs into export, access to bank credit does not directly affect export decisions. Still, working capital have a marginal positive effect. This poses an interesting question: in the presence of large export entry costs, why access to finance in the form of bank credit is not correlated with export decision? We contend that the results may be driven by two factors; (a) access to bank credit may rather affect export participation indirectly through their effect on the drivers of exporting. This is because, especially for firms in developing countries, exporting requires external finance to sustain additional upfront costs associated with technology upgrading, product customization, and quality upgrading. Thus, given that firms often use bank credits for investments, we may expect that availability of finance affects export through its effect on quality upgrading. or (b) financial factors may be relevant only for some type of firms, more specifically firms that could have been entering into export should it not been financially constrained. In the next sections we systematically address these propositions by looking at the sources of export persistency and whether these sources of persistency are correlated with financial variables.

3.5.2. Export, quality and investment

Table 3.5 presents the results from equation (4.3) that establishes how firms investment and quality is associated with export in a dynamic export decision model. The main interest here is the coefficient of investment. Again, we start with a pooled probit model (columns 1 and 2). In this model, we find that investment is associated with export in the specification that do not control for access to credit (column 2). This is robust in the RE and dynamic specification that controls for both initial export and firm-fixed effects (column 4 and 8, respectively). However, when we control for access to credit, the effect of investment vanishes. To the extent that access to credit is used for investments, this result is less surprising. Because including both credit and investment that more likely capture the same thing would leave little space for the identification of the separate effects. We also find no significant coefficient of investment in the fixed effect LPM. However, given that investment is measures as a dummy and firms less likely to change their investment behavior very often, the results based on within-firm variation should be treated with caution.

Concerning access to finance, despite the marginal significance of access to working capital, access to credit remains insignificant. Furthermore, lagged and initial export status, and firm size remain significant similar to the results reported above.

Table 3.6 presents the marginal effect of quality on propensity to export. In columns (1-4) we present the baseline estimations from pooled probit and RE. In most of the baseline specifications, the coefficients of product quality are positive and strongly significant, the exception is column (2). In subsequent columns (5-6 and 7-8, respectively) we augment the

Table 3.5: Export, investment and quality

	Pooled Probit		RE		Fixed Effect LPM		FE & initial export status	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exp_{it-1}	0.135***	0.166***	1.766***	2.109***	0.295***	0.374***	1.549***	1.812***
	(0.011)	(0.011)	(0.253)	(0.229)	(0.026)	(0.027)	(0.253)	(0.241)
$AcBkC\text{r}$	0.012		0.062		-0.006		-0.135	
	(0.012)		(0.284)		(0.016)		(0.326)	
$WoCaFi$		0.022*		0.376*		0.034**		0.380
		(0.012)		(0.208)		(0.015)		(0.237)
$Invt$	0.014	0.040***	0.352	0.562**	0.021*	0.018	0.355	0.481*
	(0.010)	(0.014)	(0.255)	(0.246)	(0.012)	(0.013)	(0.275)	(0.278)
$lnEmpt$	0.025***	0.021***	0.652***	0.457***	0.038***	0.022**	0.541***	0.385**
	(0.005)	(0.004)	(0.135)	(0.104)	(0.011)	(0.010)	(0.182)	(0.167)
$lnEfficiency$	-0.001	0.002	-0.009	0.030	-0.001	0.000	-0.002	0.038
	(0.002)	(0.002)	(0.052)	(0.045)	(0.003)	(0.003)	(0.059)	(0.056)
$lnAge$	0.003	0.014	0.097	0.215	-0.016	0.002	0.013	0.226
	(0.009)	(0.009)	(0.208)	(0.178)	(0.020)	(0.021)	(0.234)	(0.213)
$Foreign$	0.012	0.010	0.217	0.084	0.003	0.013	0.232	0.103
	(0.013)	(0.016)	(0.309)	(0.268)	(0.026)	(0.025)	(0.321)	(0.292)
Exp_{t0}							1.348**	1.247**
							(0.561)	(0.515)
$AvgAcBkC\text{r}$							0.571	
							(0.859)	
$AvgWoCaFi$								-0.110
								(0.826)
$Avginvt$							0.354	1.082
							(0.826)	(0.789)
$AvglnEmpt$							0.099	0.022
							(0.241)	(0.215)
$AvglnEff.$							-0.128	-0.105
							(0.146)	(0.127)
$Year\ FE$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Industry\_FE$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Firm\_FE$	No	No	No	No	Yes	Yes		
N	1584	1627	1584	1627	1584	1627	1559	1600
pseudo R^2	0.591	0.625						
N_clusters	248.000	264.000						
Log likelih	-176.764	-204.149	-170.206	-199.260	626.886	587.936	-163.978	-192.188
Rho			0.444	0.343	0.260	0.307	0.458	0.427
sigma_u			0.894	0.722	0.106	0.124	0.919	0.864

Note: the dependent variable is dummy for export. For the standard probit estimates, robust clustered standard errors in parenthesis. * p < 0.10, ** p < 0.05, *** p < 0.01

Table 3.6: Export, quality and finance

	Pooled Probit		RE		Fixed Effect LPM		FE & initial export status	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exp_{it-1}	0.130***	0.162***	1.660***	1.886***	0.287***	0.359***	1.460***	1.633***
	(0.011)	(0.012)	(0.257)	(0.242)	(0.026)	(0.027)	(0.257)	(0.249)
$AcBkC\text{r}$	0.011		0.052		-0.007		-0.078	
	(0.012)		(0.291)		(0.016)		(0.329)	
$WoCaFi$		0.023**		0.389*		0.033**		0.381
		(0.011)		(0.219)		(0.015)		(0.241)
$lnQuality$	0.004*	0.004	0.151**	0.139**	0.021***	0.018***	0.154**	0.196***
	(0.003)	(0.003)	(0.065)	(0.058)	(0.005)	(0.004)	(0.078)	(0.069)
$lnEmpt$	0.024***	0.022***	0.617***	0.480***	0.031***	0.019*	0.544***	0.412**
	(0.005)	(0.005)	(0.135)	(0.113)	(0.011)	(0.010)	(0.181)	(0.167)
$lnEfficiency$	-0.001	0.002	-0.019	0.017	-0.001	0.000	-0.002	0.034
	(0.002)	(0.002)	(0.052)	(0.048)	(0.003)	(0.003)	(0.059)	(0.056)
$lnAge$	0.005	0.014	0.160	0.283	-0.018	0.002	0.063	0.223
	(0.009)	(0.009)	(0.220)	(0.202)	(0.020)	(0.021)	(0.237)	(0.223)
$Foreign$	0.013	0.013	0.266	0.160	-0.003	0.012	0.281	0.154
	(0.014)	(0.018)	(0.315)	(0.282)	(0.026)	(0.025)	(0.322)	(0.298)
Exp_{t0}							1.434**	1.401**
							(0.580)	(0.571)
$AvgAcBkC\text{r}$							0.323	
							(0.870)	
$AvgWoCaFi$								0.330
								(0.842)
$AvglnQuality$							0.026	-0.138
							(0.145)	(0.125)
$AvglnEmpt$							0.051	0.182
							(0.245)	(0.235)
$AvglnEff.$							-0.153	-0.089
							(0.149)	(0.138)
$Year\ FE$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Industry\_FE$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Firm\_FE$	No	No	No	No	Yes	Yes		
N	1584	1627	1584	1627	1584	1627	1559	1600
pseudo R^2	0.594	0.619						
N_clust	248.000	264.000						
Loglike.	-175.777	-207.311	-168.176	-198.645	635.826	597.360	-162.047	-191.597
Rho			0.473	0.454	0.267	0.309	0.469	0.499
sigma_u			0.947	0.911	0.107	0.123	0.939	0.997

Note: the dependent variable is dummy for export. For the standard probit estimates, robust clustered standard errors in parenthesis. * p < 0.10, ** p < 0.05, *** p < 0.01

baseline models with firm fixed-effects, and initial condition and firm-fixed effects. We find that, even after controlling for firm-fixed effects, higher quality products are more likely to be exported. This result is not affected when we introduce initial export status. For example, in the model that controls for firm-specific heterogeneity and initial condition simultaneously (column 8), we find that a one standard deviation increase in quality (s.d. = 2.25 in the overall sample) is associated with a 44% increase in the probability to export. This is in line with our expectation that good quality products self-select into export.

Turning to the coefficients of our financial variables, the results are mostly in line with our previous findings. What is new here is that access to working capital become more significant in pooled probit and fixed effect LPM (at 5%). Access to bank credit remains insignificant. The coefficients of the lagged and initial export status and firm size are positive and significant even after controlling for quality. But firm efficiency, among the other variables, remains insignificant. This result is similar to our finding in previous sections. This suggests that the selection into foreign market is mainly driven by firms ability to generate demand for their products, for example by producing quality products, but not necessarily by producing at lower costs (See for example, Gervais, forthcoming).

As firms are quite heterogeneous in quality and quality is the main determinant of export, it seems that the interplay between access to finance and quality matters for export. In particular, financial factors may be relevant only for firms that could have been exporting should it not been financially constrained. We test this proposition by introducing interaction terms between access to finance quality. More precisely, we build four mutually exclusive indicators that group plants according to the quartiles of the distribution of quality. In this way we do not impose a linear relationship and let the data speak as freely as possible. The estimating equation for probability to export becomes:

$$EX_{it} = \begin{cases} 1 & if \quad \gamma Z_{it} + \vartheta Quality_{it} + \sum_{s=1}^{4} \psi^s \left(FIN_{it} \times QQ_{it}^s\right) + \eta_k + \eta_t + \varepsilon_{it} > 0 \\ 0 & Otherwise \end{cases} \quad (3.5)$$

Where QQ_{it}^s (s=1,…4) are dummies that take value 1 plant *i* belongs to the *s-th* quartile of the distribution of quality, Z_{it} contains the usual firm-specific characteristics that act as additional controls, and we include a set of industry (η_k) and time (η_t) dummies. If access to finance is disproportionately associated with export of high-quality products, we expect $\psi^4 > \psi^3 > \psi^2 > \psi^1$.

Table 3.7: Heterogeneous effect of access to finance on propensity to export

	Access to Bank Credit		*Credit financing for working capital*	
	(1)	(2)	(3)	(4)
$Quality_{it}$	0.184***	0.102*	0.251***	0.132**
	(0.061)	(0.057)	(0.062)	(0.058)
$Finance_{it} \times QQ_{it}^4$	0.603**	0.192	0.630***	0.522***
	(0.246)	(0.278)	(0.209)	(0.200)
$Finance_{it} \times QQ_{it}^3$	0.142	0.160	-0.061	0.081
	(0.226)	(0.270)	(0.240)	(0.250)
$Finance_{it} \times QQ_{it}^2$	-0.087	0.007	0.122	0.358
	(0.317)	(0.344)	(0.257)	(0.275)
$Finance_{it} \times QQ_{it}^1$	0.046	0.020	0.111	0.303
	(0.277)	(0.342)	(0.306)	(0.309)
$lnEmpt$		0.501***		0.473***
		(0.074)		(0.065)
$lnEfficiency$		-0.006		0.005
		(0.032)		(0.034)
$lnAge$		0.094		0.160
		(0.174)		(0.172)
$Foreign$		0.298		0.272
		(0.273)		(0.262)
Year FE	Yes	Yes	Yes	Yes
IndustryFE	Yes	Yes	Yes	Yes
No. obs.	2271	2165	2243	2151
Pseudo R^2	0.193	0.362	0.208	0.377

Note: the dependent variable is dummy for export. Clustered roboust standard errors in parenthesis. * p < 0.10, ** p < 0.05, *** p < 0.01

Table 3.7 presents the results[15]. The four columns, in their respective order, represent the effect of access to credit(working capital) with(without) controlling for firm characterstics. Plants producing high-quality goods are more likely to be exporters. Considering the interaction, the general pattern is that access to bank finance is only associated with a higher propensity to export for plants featuring the highest average quality.

Figure 3.5 shows a visual apperciation of the hetrogenious (marginal) effects of access to finance on the probablity to export. The four plots, in their respective order, represent the four columns of Table 8. All the three of the plots, except plot B, show a common patters that as we move to the upper quartile on the quality distribution, the effect of access to finance become significant. This suggests a non-linear effect of access to credit on the probablity to export. Specifically, for those firms with the capacity of producing high-quality products,

[15] Since firms are less likely to jump from one quartile to the other each year, we do not estimate firm-fixed effect models.

additional access to finance results in higher probablity to export. This result is stronger for working capital as it remains statistically significant even after we control for firm characterstics (see panel D of Figure 3.5). This is perhaps intutive. As we have observed in the above section, access to working capital appeared not relevant for explaining quality since it is not related to investment.

However, for firms that have already achieved certain level of quality standard, such as required by international markets, access to working capital could allow these firms to have more funds at their disposal to cover upfront costs associated with exporting, and therefore increase their probablity to export. This result coincides with the notion that quality upgrading is a pre-requisite for developing-country firms to enter into foreign markets (see for example, Chen et.al., 2008). It is also in line with the theoretical argument by Chaney (2013), where liquidity matters for exporting only for firms within a medium range of productivity. Emprically, Ngo (2015) confirms this prediction for Ghanian firms.

3.5.3 Quality, investment and finance

So far we find no effect of access to credit on probability to export and some evidence on the importance of access to working capital. Rather, export market participation is driven by product quality. This is the case no matter if we control for firm-specific heterogeneity. Investment is also seems to have a reasonable effect. Towards examining the indirect channels through which financial constraints distort firms export, in this section we test if access to bank finance and investment determine product quality.

Table 3.8 presents the results of the quality equation for pooled OLS (columns 1-5) and fixed-effects (columns 6-10). Columns (1) and (2) present the effect of access to bank credit and the effect of access to working capital. We find a strong and positive correlation between access to credit and product quality. In column (3) we use investment instead of access to finance and find that firms that invest produce higher quality products. These results are robust in a richer specification that includes access to credit and investment simultaneously, although investment become less significant (See column 4). However, the coefficient of working capital is not significant.

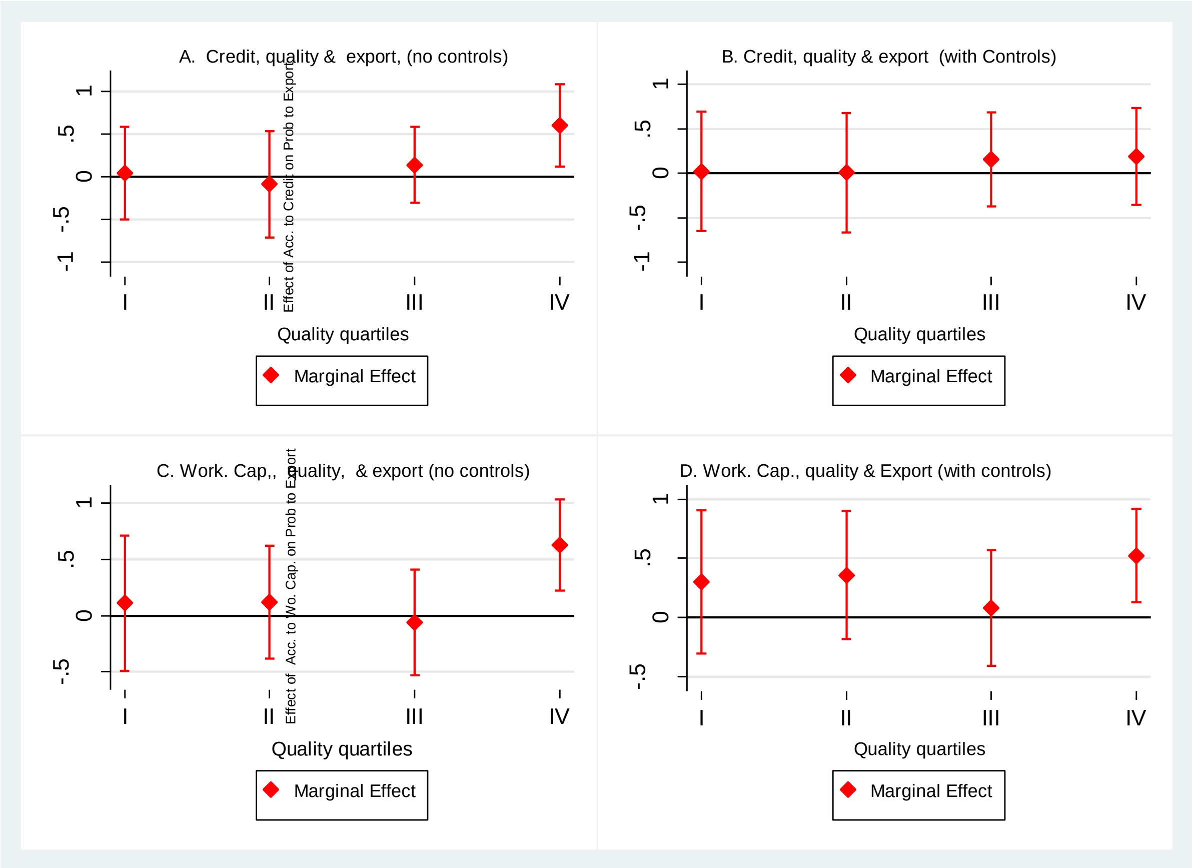

Figure 3.5. Marginal effect of access to bank credit on the probability to export conditional on quality level. The graph presents the point estimates together with 95 % confidence intervals.

Given that firms tend to use working capital finance in order to fill short-term liquidity gaps between production and revenue collection periods, this result is not surprising. Since quality upgrading by its nature requires substantial investments and thus it is only some types of credits that go to investment may affect product quality. To verify this possibility we extend the model by including an interaction between investment and access to credit (column 5). We find that firms that have access to credit and invest to produce high quality products than other groups (including firms that have access to credit but do not use it for investment).

Considering the fixed effect estimates, despite some drops in the significance of access to credit, the overall pattern is similar to the pooled OLS results. In the baseline specifications, access to credit and investment are positively associated with quality at 10% and 5% level of significance, respectively (columns 6 and 8). Once we control for investment and access to credit simultaneously, credit turns to be insignificant, however investment become more significant (at 1 % level of significance). This indicates that these two variables are the same sources of variations in determining quality. This suspicion is further verified by the positive and statistically significant coefficient that we find for the interaction between investment and access to credit (column 10).

The control variables deserve some comment as well: firm size and efficiency are positively and significantly associated with producing higher-quality goods in all the pooled OLS models. Even after controlling for firm fixed-effects, firm size remains significant. However, the significance of firm efficiency vanishes especially when we control for access to finance indicators; but the coefficient remains positive. The overall result suggests that while credits associated with investment improves quality, working capital credits do not.

The above section presents the average relationship between quality and access to finance. However, given the significant heterogeneity of firms in quality (See, Section 3.2), the conditional mean relationship gives only the partial view of the relationship. We suspect that the relationship between access to finance and quality may vary over the quality distribution. To address this issue, we apply a newly developed estimator of fixed-effect quantile regression proposed by Canay (2011) to estimate the relationship between access to finance and quality at quantiles of quality distribution. In this method the fixed effect are considered as a location shifter in which they affect all quantiles similarly. This approach involves two steps. First, the data is transformed to eliminate the unobservable firm heterogeneity and then the standard quantile regression is performed on the transformed data (See Appendix C for details).

Table 3.9 presents the estimates from fixed-effect quantile regressions on the relationships between access finance and product quality. The coefficients on the different quantiles represent the marginal changes in quality at each conditional quantile due to marginal changes in access to credit. The lower panel of the table presents the Wald test statistics to the equality of coefficients across quartiles. The quantile regression results for access to credit are positive and statistically significant in all quantiles, but not at the 90%. This suggests that for those firms that produce high quality products, additional access to credit results no gain in quality improvement. The tests on the equality of the estimated coefficients across the significant quantiles show no significant differences. However, independent of quantiles considered, we find no significant association between product quality and access to working capital. The overall result is in line with our previous finding in the mean specification that while access to bank credit affects quality, access to working capital does not.

Concerning the controls, firm size is positively and significantly associated with product quality across all quantiles. However, the effect other control variables shows some variabilities across quantiles. While efficiency is more important at the lower quartile, age and foreign ownership are significant at the upper quartile.

3.5.4 Reverse causality

So far, we assume strict erogeneity of access to finance for firms export decision and quality production. However, plants may be more likely to report binding financial constraints because they export or produce higher-quality products. Still, since we our quality estimates capture consumers preference, and thus are the demand side estimates (Feenstra and Romalis, 2014), quality can be considered as exogenous to firms perception about their need for finance. This is because, despite the financial status of firms, the demand reflects the consumers true preference (see for example, Fan et al, 2015). Despite this possibility, we apply instrumental variable (IV) estimations using two instrumental variables.

The first IV is firms' connections with government. This variable is a valid instrument because where financial markets are underdeveloped and public banks are important (as in Ethiopia), politically connected firms have more access to finance (Khwaja & Mian, 2005). To capture government connections, we use a dummy for firms that do not report government rules and regulations as major obstacles to their operations. The second instrument is external shocks to firms' cash flow as in Gorodnichenko & Schnitzer (2013). We capture the external shocks using a dummy variable equals one if firms report frequent machine breakage as limiting their operations. This is because machine breakage involves costs associated with repairing or replacement, and thus predicts whether firms face financial difficulties. However, it is reasonable to believe that these variables have little direct impact on firms export and quality upgrading decisions.

Table 3.8: Quality, Finance and Investment

	Pooled OLS					Fixed Effect				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$AcBkCr$	0.459***			0.452***	0.243*	0.125*			0.118	-0.032
	(0.120)			(0.120)	(0.142)	(0.073)			(0.072)	(0.095)
$WoCaFi$		-0.067					0.016			
		(0.124)					(0.080)			
$lnEmpt$	0.705***	0.769***	0.718***	0.679***	0.675***	0.467***	0.327***	0.347***	0.450***	0.449***
	(0.090)	(0.076)	(0.080)	(0.090)	(0.089)	(0.049)	(0.054)	(0.048)	(0.049)	(0.049)
$lnEfficiency$	0.100***	0.134***	0.131***	0.096***	0.095***	0.019	0.024	0.036***	0.017	0.017
	(0.030)	(0.035)	(0.033)	(0.030)	(0.029)	(0.014)	(0.016)	(0.014)	(0.014)	(0.014)
$lnAge$	-0.284	-0.267	-0.202	-0.267	-0.265	0.135	0.080	0.008	0.127	0.136
	(0.176)	(0.190)	(0.180)	(0.176)	(0.175)	(0.102)	(0.115)	(0.100)	(0.101)	(0.101)
$Foreign$	0.250	0.229	0.175	0.250	0.245	0.173	0.033	0.163	0.165	0.156
	(0.289)	(0.303)	(0.274)	(0.287)	(0.287)	(0.126)	(0.142)	(0.124)	(0.125)	(0.125)
$Invt$			0.186**	0.181*	-0.195			0.119**	0.165***	-0.066
			(0.093)	(0.097)	(0.172)			(0.059)	(0.059)	(0.111)
$Invt * AcBkCr$					0.484**					0.303**
					(0.189)					(0.124)
$Year\ FE$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Industry\_FE$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Firm\_FE$	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
N	2165	2151	2623	2165	2165	2165	2151	2623	2165	2165
N_clust	409	432	477	409	409					
Log likelihood						-2774.91	-3020.159	-3655.41	-2769.977	-2766.24
rho						0.716	0.701	0.693	0.716	0.717

Note: The dependent variable is average quality of goods produced by each plant. For the pooled OLS estimates the standard errors are clustered by firm. Robust Standard errors in parentheses , * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.9: Quality and access to finance – FE quantile regression

	Access to Bank Credit					Credit Financing for Working Capital				
	Quartile (%)									
	10	25	50	75	90	10	25	50	75	90
$Finance$	0.124**	0.112***	0.115***	0.128***	0.053	0.043	-0.021	0.013	-0.012	-0.001
	(0.062)	(0.029)	(0.020)	(0.024)	(0.060)	(0.071)	(0.051)	(0.022)	(0.038)	(0.063)
$lnEmpt$	0.373***	0.415***	0.460***	0.492***	0.550***	0.196***	0.234***	0.323***	0.355***	0.404***
	(0.040)	(0.015)	(0.010)	(0.015)	(0.018)	(0.021)	(0.021)	(0.010)	(0.019)	(0.028)
$lnEfficiency$	0.026*	0.042***	0.017***	0.009	0.007	0.036**	0.040***	0.024***	0.026**	0.018
	(0.015)	(0.008)	(0.005)	(0.007)	(0.008)	(0.014)	(0.008)	(0.005)	(0.010)	(0.013)
$lnAge$	-0.045	0.073**	0.136***	0.246***	0.247***	-0.064	0.015	0.080***	0.272***	0.269***
	(0.060)	(0.029)	(0.008)	(0.027)	(0.050)	(0.060)	(0.040)	(0.018)	(0.049)	(0.070)
$Foreign$	-0.046	-0.086	0.177***	0.452***	0.552***	-0.336**	-0.015	0.042	0.093	0.345*
	(0.140)	(0.110)	(0.061)	(0.113)	(0.207)	(0.151)	(0.131)	(0.034)	(0.124)	(0.207)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2165	2165	2165	2165	2165	2151	2151	2151	2151	2151
	test [q10=q25=q50=q75]:AcBkCr					*test [q10=q25=q50=q75 =q90] :WoCaFi*				
	Prob > F = 0.9362					*Prob > F = 0.7809*				

Note: the dependent variable is quality transformed to control for fixed effects. Bootstrapped standard errors in parenthesis. * p < 0.10, ** p < 0.05, *** p < 0.01

In order to check the robustness of the previous findings, we present the IV estimation results for the baseline quality equation (equation 7).[16] Table 3.10 presents the results. The null hypothesis of the Hansen's J test of overidentifiying restrictions are not rejected, suggesting the validity of our instruments. On the other hand, the GMM C test statistics are significant only for access to credit, rejecting the null hypothesis that access to credit is exogenous. However, we fail to reject the exogeneity of working capital. The overall IV results validate our previous finding that access to credit affects firms product quality, but working capital do not.

Table 3.10: Quality and Access to Finance – IV GMM

	(1)	(2)
$AcBkC$r	2.061**	
	(0.870)	
$WoCaFi$		-0.109
		(0.234)
$lnEmpt$	0.636***	0.025***
	(0.048)	(0.005)
$lnEfficiency$	0.075***	0.000
	(0.023)	(0.002)
$lnAge$	-0.272***	0.010
	(0.075)	(0.015)
$Foreign$	0.116	0.001
	(0.181)	(0.028)
Industry-FE	Yes	Yes
Year FE	Yes	Yes
Hansen's J *	1.955	2.564
Chi-sq(1) P-val	(0.1620)	(0.1093)
GMM C **	3.931	0.353
Chi-sq(1) P-val	(0.0476)	(0.5523)
N	2165	1627
R^2	0.324	0.569
Loglikelihood	-4140.989	303.397

Note: The dependent variable is firm-level quality. Hansen's J * is Hansen's J Chi2 test statistics for overidentifying restrictions. GMM C ** GMM C test statistics for exogeniety of access to finance indicators. Robust Standard errors in parentheses * p<0.10, ** p<0.05, *** p<0.01

[16] Use of an IV strategy for the export decision equation is complicated by the fact that we have both a binary dependent variable (export) and a binary endogenous variable (finance) because the standard IV probit is consistent only when the endogenous regressors are continuous. When the endogenous variable is binary, the latent error in the first stage regression cannot be correctly estimated and generates a bias (Lewbel et.al, 2012. They also warn against using a linear probability model and suggest identifying a very exogenous variable (e.g.age) on top of the usual instruments and we are working on it.

3.6. Conclusions

Recent studies have documented suggest that quality matters a lot for export and, moreover, that firms need to make conscious investment decisions aimed at upgrading their product quality before entering foreign markets. The implication is that, in addition to its direct effect on firms ability to pay upfront entry costs, access to finance may affect export decisions through its effect on investment. Since firms in developing countries have typically limited internal revenue and operate in underdeveloped financial markets, financial resources are especially important in shaping the decision to export.

Using information on a panel of Ethiopian manufacturing firms, this paper has examined the direct and indirect effects of access to finance on export participation. In particular it has investigated the interplay between credit constraints, product quality and export.

The data allows us to construct a quality measure that relaxes the common assumption that unit values (or prices) fully capture quality differences.

Our main results confirm the presence of substantial sunk costs associated with exporting. Despite this, bank finance does not appear to have a strong *direct* effect on export participation. On the other hand, both present and past product quality is robustly associated with export status, and quality upgrading requires substantial investment. Therefore, bank credit is relevant for export only insofar as it is channeled to the fixed investments required to enhance quality.

An important implication of our work is that improving financial conditions and access to bank credit can help firms to move from low- to high-quality products, enhance their ability to access foreign markets and therefore improve the overall export performance of the economy.

Chapter 4

Conclusions and Policy Implications

4.1. Introduction

It is widely believed that access to foreign markets fosters the industrialization process and aggregate growth of developing countries through technological spillovers and allowing to exploit the economies of scale. The fact that countries do not trade but firms do, recent studies scales down the analysis of trade at firm (product)-level. Following the same line, this dissertation builds on the theory of firm heterogeneity and trade literature with a broad goal of understanding better the determinants of Ethiopian firms' export success. An important question in the current theoretical and empirical trade literature is whether the capacity to produce products efficiently at a lower marginal costs or the ability to produce high quality goods leads to export success. This paper distinguish the relative importance of these factors by examining productivity-efficiency and product quality variations across firms and their relationships with firms export and import decisions. As such, the thesis deepen the understandings on the determinants of export success, and offers insights that guide the designing of export promotion policies in developing countries such as Ethiopia. This section summarizes the main findings of the thesis and forwards policy implications derived from the analysis.

4.2. Concluding remarks

The joint reading of the three chapters of the thesis tells an important message that the success of Ethiopian firms in international market is mainly driven by demand factors in which only firms that able to attract demand for their products succeed in foreign markets. However, despite the presumed relevance of firm productivity efficiency to drive export, there is no strong evidence that this apply for Ethiopian firms. A further analysis of the demand factors unveil the crucial role of product quality upgrading in determining firms' entry into export markets. Still, efficiency is associated with quality production. Moreover, access to high-quality raw materials from foreign markets is indirectly associated to exporting by enabling firms to produce high-quality output. Further evidence indicates that once firms upgrade the quality of their products, they sell it at the high-end domestic market before entering into foreign markets.

The results also show that producing high quality products prior to export entry is associated with access to credit, specifically to finance investments in new technologies. Nevertheless, access to finance has a heterogeneous effect on firms export performance, where financing firms that produce above a certain quality threshold has a more significant effect. On the one hand, the presence of substantial sunk costs of export limits the export participation of Ethiopian firms. One the other, exporting from Ethiopia is costly and the severity of credit constrained for Ethiopian firms is higher than firms in any other parts of the world.

4.3. Policy Implications

The major findings of the thesis as summarized above imply the following policy implications.

A shift from quantity to quality competitiveness strategy: while improving production would enable firms to produce goods more cheaply, the robust findings of thesis indicate that quality upgrading is more important for Ethiopian firms to compete in global markets. However, much of the current industrial policies of Ethiopia emphasize on meeting quantitative targets such as output growth and productivity improvements[17]. Although, improving productivity is crucial to increase aggregate output of the manufacturing sector, and to succeed in cost-based competitions in international markets, there seem to be a significant gap between current capability of Ethiopian firms and the sources of competitiveness in international market. Given the existence of competent rival economies in international markets that have already built least-cost mass production capacity (such as China), improving productivity (and thus quantity) alone is not enough to succeed in foreign markets. Thus, in order to increase the competitiveness of firms in international markets, the country should focus on building its own brands by producing high-quality specialized products rather than competing directly with mass produced goods. Indeed, since the main destinations of Ethiopian exports are high-income economies that are characterized by demand for high-quality, building quality competitiveness seems the right direction to go forward. The robust results on the limited importance of productivity efficiency in directly determining the export participation of firms reaffirm the need to shift policy directions from quantity to quality. Therefore, rather than emphasizing on the production of indistinguishable low-cost products that promise low profit margins, producing products that are customized to targeted foreign markets, and meet the high-quality standards of international markets is essential.

[17] See Gebreeyesus (2013) for a detail industrial policy evaluation of Ethiopia.

Supporting targeted investments and access to high-quality inputs: achieving the leading status in quality production requires skilled labour and specific investments in new technology and production techniques. However producers in many developing countries including Ethiopia face limited capital, technology and skills required to produce high quality products. Thus, policy measures that aim to improve the skills of workers, increase the accessibility of modern technologies, encourage R&D are essential. For instance, establishing technological and research centers directly linked to the manufacturing sector, identifying the skills required in particular sectors and designing education and training strategies accordingly could be some policy directions. Similarly, the results of the thesis indicate that access to quality inputs indirectly affects export performance through increasing output quality. Given the limited availability of quality inputs in the domestic markets, improving access to foreign inputs through targeted import liberalization would be an important policy direction. It is also important to give due attention to strengthen the capacity of domestic raw material producers. In this regard, creating strong backward-forward strategic linkages between output producers and input suppliers would help to identify the input quality required by the producers while ensuring markets for the suppliers.

Measures to decrease the costs of export: Given the evidence that costs associated with export limit firms entry into foreign markets, reducing the regulatory obstacles, shortening custom processes, providing foreign market information, including standards of a specific market, and increasing transport infrastructures would substantially decreases costs associated with export and thereby improve export performance.

Equal emphasis on the domestic market**:** the current manufacturing export-promotion strategy of Ethiopia declared priority sectors, and provides generous incentives inducing producers to exclusively target foreign markets. However, the pattern uncovered in the thesis imply that there is no direct jump from production to export, rather firms first learn from domestic markets prior to entering into foreign markets. Specifically, the results show that Ethiopian firms require time (about three years) to enter into export even after achieving a certain level of output quality. In the meantime, these successful firms sell their products at a premium price in the domestic market and shift their production to their high-quality products before they start exporting. This suggests that, increasing the policy scope from few pre-identified export-oriented industries to encouraging import-substitute industries that have large demand in domestic market would allow these producers to experiment and improve the quality of their products in the domestic market, and thereafter enter into foreign markets. Indeed, given that the quality measure used in the analysis reflects the valuation of the domestic consumers, achieving success in the domestic market is a good indicator and a starting point to compete in global markets.

Policy support based on in-depth study*:* given substantial within-industry heterogeneity in various performance indicators of firms, any support mechanisms that aim to promote export should go beyond sectorial identification. It is essential to further identify a specific group of producers that could effectively exploit the supports provided and strengthen their capacity to compete in international markets. In fact, providing a general support may shelter less-competent firms from healthy market competition forces. The evidence that access to finance has a non linear effect on export participation based on quality distribution substantiates this suggestion.

Integration of industry, finance and trade policies: in general, improving the export performance of a country requires an integrated policy framework that ranges from providing capacity building supports for producers to negotiating beneficial trade agreements in the global stages. Specific to the analysis of the thesis, it has been observed that achieving high quality or having access to finance in itself is not good enough to succeed in international markets, but financing firms with capacity to export is more successful. Thus, a coordinated mobilization of financial and technological resources, strengthening firms' capacity along with facilitating trade is essential.

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Appendices

Appendix A

Additional Data and Estimation Results for Chapter 1

Appendix A.1 Production Function Estimates

Table A.1.1: Production function estimates – Sales deflated by industry deflator (revenue productivity -TFPR)

	Food and beverage			*Textile and Apparel*			*Leather and Tanning*		
Sales deflated by Industry deflator	OLS (1)	FE (2)	SYS-GMM (3)	OLS (1)	FE (2)	SYS-GMM (3.)	OLS (1)	FE (2)	SYS-GMM (3.)
$\ln L_{it}$	0.277***	0.288***	0.312**	0.222***	0.373***	0.268**	0.243***	0.211**	0.335**
	(0.054)	(0.076)	(0.145)	(0.082)	(0.092)	(0.115)	(0.084)	(0.086)	(0.140)
$\ln K_{it}$	0.091**	0.004	0.076*	0.100**	0.065	0.181***	0.069	-0.001	0.197**
	(0.047)	(0.024)	(0.044)	(0.051)	(0.063)	(0.063)	(0.043)	(0.048)	(0.092)
$\ln M_{it}$	0.285***	0.233***	0.282***	0.175***	0.136***	0.227***	0.076**	0.112***	0.128**
	(0.031)	(0.430)	(0.082)	(0.039)	(0.047)	(0.054)	(0.035)	(0.039)	(0.054)
Year dummies	*Included in all models*								
AB Test AR(1)			0.000			0.008			0.005
AB Test AR(2)			0.757			0.089			0.951
Hansen Test-P values			0.321			0.947			0.961
Observations	1271	1271	1271	442	442	442	437	437	437

Notes: estimators employed are OLS and FE- within and System GMM. All models include year dummies,(coefficients not reported). We report *P*-values for all test statistics. Robust standard error in parentheses, ***, **, * indicate statistical significance at 1% , 5% and 10 % level respectively.

Table A1.2: Production function estimates – Sales deflated by firm-level prices (TFPQII)

	Food and beverage			*Textile and Apparel*			*Leather and Tanning*		
Sales deflated by *Firm price deflator*	OLS	FE	SYS-GMM	OLS	FE	SYS-GMM	OLS	FE	SYS-GMM
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2.)	(3)
lnL_{it}	0.333***	0.179	0.669***	0.340*	0.453*	0.447**	0.105	0.143*	0.020
	(0.101)	(0.126)	(0.185)	(0.187)	(0.251)	(0.202)	(0.104)	(0.076)	(0.130)
lnK_{it}	0.132**	0.050	0.127**	0.006	0.075	0.029	0.147***	-0.044	0.377***
	(0.060)	(0.051)	(0.054)	(0.070)	(0.070)	(0.102)	(0.046)	(0.079)	(0.143)
lnM_{it}	0.243***	0.030***	0.200***	0.251***	0.176*	0.262**	0.186***	0.214***	0.240**
	(0.052)	(0.068)	(0.069)	(0.080)	(0.099)	(0.116)	(0.059)	(0.058)	(0.096)
Year dummies	*Included in all models*								
AB Test AR(1)			0.000			0.002			0.003
AB Test AR(2)			0.142			0.189			0.799
Hansen Test-P values			0.329			0.944			0.966
Observations	1255	1255	1255	435	435	435	437	437	437

Notes: estimators employed are OLS and FE- within and System GMM. All models include year dummies,(coefficients not reported). We report *P*-values for all test statistics. Robust standard error in parentheses, ***, **, * indicate statistical significance at 1% , 5% and 10 % level respectively.

Table A1. 3: Production function estimates-Physical total factor productivity (TFPQI)

	Food and beverage			*Textile and Apparel*			*Leather and Tanning*		
Physical output	OLS	FE	SYS-GMM	OLS	FE	SYS-GMM	OLS	FE	SYS-GMM
	(1)	(2)	(3)	(1.)	(2)	(3)	(1)	(2)	(3)
lnL_{it}	0.455***	0.268**	0.477***	0.163**	0.108	0.333**	0.151(	0.183*	0.211*
	(0.094)	(0.105)	(0.145)	(0.069)	(0.219)	(0.160)	(0.089)	(0.102)	(0.123)
lnK_{it}	0.048**	0.097***	0.038	0.042	0.097	0.122	0.113***	0.028	0.183***
	(0.022)	(0.037)	(0.075)	(0.061)	(0.058)	(0.078)	(0.042)	(0.086)	(0.069)
lnM_{it}	0.213***	0.169**	0.208**	0.186***	0.198***	0.194**	0.194***	0.242***	0.164*
	(0.049)	(0.074)	(0.094)	(0.064)	(0.068)	(0.077)	(0.054)	(0.060)	(0.091)
Year dummies	*Included in all models*								
AB Test AR(1)			0.000			0.001			0.001
AB Test AR(2)			0.843			0.576			0.890
Hansen Test-P values			0.146			0.968			0.985
Observations	1266	1266	1266	437	437	437	435	435	435

Notes: estimators employed are OLS and FE- within and System GMM. All models include year dummies,(coefficients not reported). We report *P*-values for all test statistics. Robust standard error in parentheses, ***, **, * indicate statistical significance at 1% , 5% and 10 % level respectively.

Appendix A.2: Detail Summary Statistics of Productivity and Price

Table A2.1: The Percentiles distributions of TFPR

TFPR	***Exporters***			***Non-Exporters***		
	Percentile	Smallest	Largest	Percentile	Smallest	Largest
1%	703.42	284.45		338.01	27.37	
5%	2254.06	343.004		701.86	44.56	
10%	3525.60	634.58		1137.47	90.26	
25%	7167.65	635.76		2436.24	97.69	
50%	17391.06			5522.84		
75%	34437.53		171099.4	12470.63		116901
90%	51677.19		176556.3	24760.96		126994.6
95%	76325.3		207581.9	37345.28		146322.5
99%	164905.4		229834.7	66991.49		174708.3
Number of Observations	437			2546		
Skewness	15.203			3.667245		
Kurtosis	274.16			24.273		
Mean	25175.37			10359.26		
Std.Dev.	27205.21			14116.99		
Kolmogorov-Smirnov test for equality of distribution functions			P-values			
H_0:equality of distributions					0.000	
H_0: Exporters are more productive					1.000	
H_0: Non-exporters are more productive					0.000	

Table A2.2: The Percentiles distributions of TFPQII

	Exporters			Non-Exporters		
TFPQII	Percentile	Smallest	Largest	Percentile	Smallest	Largest
1%	29.79	1.37		61.48	0.206	
5%	340.34	3.36		290.28	1.94	
10%	1132.33	4.028		738.77	7.52	
25%	3578.44	15.49		2871.44	8.13	
50%	12934.14			11472.16		
75%	97129.82		5330723	63107.27		2.66e+07
90%	365475.1		5616862	350827.9		3.07e+07
95%	941897.3		5782755	979845.1		3.71e+07
99%	5013691		2.90e+07	5183925		4.24e+07
Number of Observations	438			2523		
Skewness	3.214			13.10866		
Kurtosis	19.182			208.6411		
Mean	267718.9			314590.1		
Std.Dev.	1546655			1969561		
Kolmogorov-Smirnov test for equality of distribution functions				P-values		
H_0:equality of distributions					0.176	
H_0: Exporters are more productive					0.927	
H_0: Non-exporters are more productive					0.088	

Table A2.3: The Percentiles distributions of TFPQI

TFPQI	***Exporters***			***Non-Exporters***		
	Percentile	Smallest	Largest	Percentile	Smallest	Largest
1%	21.73	7.67		12.04	0.227	
5%	82.15	9.08		32.75	0.678	
10%	259.04	12.37		62.84	0.680	
25%	817.35	18.53		168.65	0.684	
50%	2592.32			575.71		
75%	11508.46		86410.48	2458.48		178733.3
90%	30260.96		96864.06	10973.47		179548.2
95%	43863.97		104342.5	24856.09		187083.2
99%	81099.92		136978	89667.18		1007917
Number of Observations	437			2538		
Skewness	3.164			23.81778		
Kurtosis	16.17			852.9283		
Mean	10003.91			5563.767		
Std.Dev.	16946.88			26209.01		
Kolmogorov-Smirnov test for equality of distribution functions				P-values		
H_0:equality of distributions					0.000	
H_0: Exporters are more productive					0.962	
H_0: Non-exporters are more productive					0.000	

Table A2. 4: The Percentiles distributions of price

	Exporters			*Non-Exporters*		
Firm price	Percentile	Smallest	Largest	Percentile	Smallest	Largest
1%	0.0149	0.0024		0.0017	0.00018	
5%	0.0316	0.0070		0.0080	0.00024	
10%	0.0681	0.0077		0.0226	0.00029	
25%	0.2162	0.0144		0.1094	0.000342	
50%	0.675			0.6154		
75%	1.143		913.928	1.1644	143.418	
90%	2.595		1825.759	2.4035	161.496	
95%	6.903		1861.072	4.046	669.791	
99%	166.808		3773.206	13.371	8713.553	
Number of Observations	437			2523		
Skewness	13.538			49.6997		
Kurtosis	204.285			2486.154		
Mean	21.651			5.1228		
Std.Dev.	223.252			174.047		

Kolmogorov-Smirnov test for equality of distribution functions	P-values
H_0:equality of distributions	0.000
H_0: Exporters charge higher prices	0.681
H_0: Non-exporters are more productive	0.000

Appendix A3 : Quantile Regression on the Link Between Export and Productivity

Table A3.1: Export premium

Dependent Variables	Pooled OLS	*Quantiles* 1%	5%	10%	25%	50%	75%	90%	95%	99%
TFPR	0. 95***	1.20*	0.82**	0.66**	0.69**	0.73 **	0.97**	0.89**	1.22**	1.33**
	(0.128)	(0.33)	(0.14)	(0.11)	(0.091)	(0.07)	(0.06)	(0.09)	(0.13)	(0.16)
TFPQII	0.61**	-2.45	-0.083	0.726**	1.09**	1.07**	0.91**	0.25	0.20	-1.05
	(0.208)	(1.12)	(0.44)	(0.255)	(0.11)	(0.09)	(0.14)	(0.18)	(0.30)	(0.50)
TFPQ	0.77**	-0.17	0.094	0.20	0.33	0.71**	0.50**	0.138	0.138	1.01*
	(0.182)	(0.45)	(0.23)	(0.18)	(0.18)	(0.13)	(0.09)	(0.11)	(0.84)	(0.34)
LPR	1.15**	1.66**	0.91**	1.36**	1.15**	1.01**	0.76**	0.99**	1.05**	1.15**
	(0.07)	(0.27)	(0.172)	(0.15)	(0.09)	(0.07)	(0.08)	(0.11)	(0.10)	(0.20)
LPQII	0.58**	-1.36	0.02	0.64	1.05**	0.82**	0.50*	0.29	-0.138	-0.34
	(0.13)	(1.17)	(0.31)	(0.31)	(0.12)	(0.12)	(0.16)	(0.22)	(0.26)	(0.66)
LPQI	0.53**	-0.051	0.23	0.17	0.47	0.61**	0.55**	0.072	0.18	1.48*
	(0.10)	(0.37)	(0.17)	(0.15)	(0.21)	(0.13)	(0.12)	(0.12)	(0.19)	(0.41)

Tests of coefficient equality across QR with different quantiles (P-values)

Null Hypothesis	TFPR	TFPQII	TFPQI	LPR	LPQII	LPQI
Joint equality of all quantiles	0.40	0.06	0.10	0.36	0.02	0.04
Q01=Q50	0.48	0.07	0.12	0.28	0.20	0.18
Q01=Q75	0.73	0.09	0.20	0.13	0.27	0.21
Q01=Q99	0.87	0.68	0.11	0.52	0.67	0.07
Q05=Q50	0.74	0.06	0.06	0.78	0.05	0.18
Q05=Q75	0.59	0.10	0.16	0.63	0.23	0.26
Q01=Q99	0.26	0.32	0.12	0.64	0.64	0.11

Notes: The reported values are export premium computed as $exp(coefficient) - 1$ bootstrap standard errors in parenthesis * p<0.10, ** p<0.05, *** p<0.00. All regressions controls for size, age, year and sector. The lower panel of the table reports the test for equality of coefficients across different quantiles. The null hypothesis is coefficients are equal.

Appendix B
Quality Estimation Strategy for Chapter 2 and Chapter 3

Appendix B.1: The discrete choice model and nested demand systems

This section describes how the estimated demand model is derived from the nested logit model. Consider a set of *j=1,…,J* product varieties, and *l=1,…,N* consumers, at time t. The indirect utility of consumer l for product j at time t is a function of the characteristics of the product and of consumer's tastes: $U(X_{jt}, \xi_{jt}, P_{jt}, v_i; \theta_d)$, where X_{jt} is a vector of observed product characteristics that evolve over time, ξ_{jt} represents a vector of product characteristics that the econometrician cannot observe but producers and consumers consider when making their decisions, P_{jt} denotes the price of each product, v_i and θ_d capture consumer-specific terms affecting utility. As in Berry (1994) the (log of) indirect utility can be specified as

$$U_{ljt} \equiv X_{ijt}\beta - \alpha P_{jt} + \xi_{jt} + \varepsilon_{ij} \equiv \delta_{jt} + \varepsilon_{ij} \tag{B.1}$$

where $\delta_{jt} = X_{ijt}\beta - \alpha P_{jt} + \xi_{jt}$ is the average utility from product variety j, ξ_{jt} captures the mean of the unobserved component of utility and is interpreted as the vertical attribute (unobserved quality) of variety j common across all consumers, ε_{ij} represents consumer-specific unobserved features (horizontal attribute) and the coefficient of price captures the marginal utility of consumption of the outside variety.

Based on the assumption that the error term ε_{ij} is independently and identically distributed (iid) across product varieties and consumers as type-I extreme value distribution, we can form the traditional market shares multinomial logit (MNL) model. For an infinite number of consumers ($l = 1, \dots, \infty$), the market share of variety j can be written as:

$$S_{jt} = \frac{e^{\delta_j}}{\sum_1^j e^{\delta_{j'}}} = \frac{e^{(X'_{jt}\beta - \alpha P_{jt} + \xi_{jt})}}{\sum_{j'=1}^{J} e^{(X'_{j't}\beta - \alpha P_{j't} + \xi_{j't})}} \tag{B.2}$$

Equation (B.2) represents the probability of choosing variety j among all other varieties. Economic theory suggests that consumers choose the variety that gives the highest utility. Moreover, this particular framework assumes that consumers have inelastic conditional demands whereby either they buy their most preferred product *j=1,…,J* or they buy the outside variety, *j=0*. By normalizing the mean utility of the outside good to zero, the share of the outside variety can be written as:

$$S_{0t} = \frac{e^{(0)}}{\sum_1^j e^{\delta_{j\prime}}} = \frac{e^{(0)}}{\sum_{j'=1}^{J} e^{(X'_{j't}\beta - \alpha P_{j't} + \xi_{j't})}} \tag{B.3}$$

Once we find the market share of each variety demand can be estimated by "inverting" the market-share equations to find the implied mean level of utility for each variety (see for example Berry 1994). By combining equation (B.2) and (B.3), we can write the observed market share of each variety j relative to the outside variety $j=0$ as:

$$\ln\left({}^{S_{jt}}\!/_{S_{ot}} \right) = X'_{jt}\beta - \alpha P_{jt} + \xi_{jt} \tag{B.4}$$

The simple MNL model assumes independence of irrelevant alternatives, implying the same substitution pattern for all varieties. The nested logit model relaxes this assumption by allowing for correlation across varieties belonging to the same exogenously defined group (nest). Suppose that all varieties are grouped into exhaustive and mutually exclusive groups g. The nested specification assumes a higher degree of substitutability for products in the same nest than across different nests. Define the set of varieties in group g as g_g, then the indirect utility of consumer i derived from variety $j \in g_g$ at time t can be written as :

$$U_{ijt} \equiv \delta_{jt} + \zeta_{igt} + (1-\sigma)\, \varepsilon_{ij}, \text{ with } 0 \leq \sigma < 1 \tag{B.5}$$

where ζ_{igt} captures deviations from average utility due to different preferences across consumers for different nests (g), whereas ε_{ij} captures preference heterogeneity for varieties within the same nest. The nested logit model gives the following linear equation for a set of product varieties (see Berry, 1994):

$$\ln\left({}^{S_{jt}}\!/_{S_{ot}} \right) = X_{jt}\beta + \alpha P_{jt} + \sigma \ln\left(S_{jt|g}\right) + \xi_{jt} \tag{B.6}$$

S_{jt} represents the share of product j over all varieties, whereas the nested share $S_{jt|g}$ is its share within its nest g; similarly, S_0 is the share of the outside variety

Appendix C

Additional Data and Estimation Strategy for Chapter 3

Appendix C1: Ethiopian Financial Market Development Indicators

Table C1.1: Key financial indicators for Ethiopia and other African countries

	Ethiopia	Kenya	Tanzania	Uganda	Sub-Saharan Africa	Rank of Ethiopia in East Africa	Rank of Ethiopia in SSA
Liquid liabilities (%, 2004)	44.6	39.2	21.2	19.7	29.8	1/4	4/27
Commercial –central bank (%, 2004)	50.4	90.0	87.5	50.0	67.2	3/4	33/40
Private credit (%, 2004)	19.1	24.5	7.5	6.1	27.1	2/4	5/27
Gross domestic savings (% of GDP, 2005)	3.6	9.3	9.7	7.1	9.2	4/4	29/42
Financial liberalization index (10-100, 2007)	20.0	50.0	50.0	70.0	48.2	4/4	38/38
Financial openness index 1.12 (closed)-1.93(free)(1997)	1.2	n.a.	n.a.	n.a.	1.44	n.a.	17/17
Bank concentration	87.9	58.9	67.2	62.6	80.7	1/4	5/10

Source: Kiyota et.al. (2007).

Notes on the definitions of indicators: *Liquid liabilities:* Ratio of liquid liabilities to GDP in 2004 (% of GDP). *Commercial –central bank* :Ratio of deposit money bank claims on domestic nonfinancial real sector to the sum of deposit money bank and Central Bank claims on domestic nonfinancial real sector in 2004. *Private credit* :Private credit by deposit money banks to GDP in 2004 Gross domestic saving (GDP less total consumption) in 2005 (% of GDP). *Financial liberalization index* : measure of banking security as well as independence from government control (0 = the lowest freedom; 100 = the highest freedom). *Financial openness index* : The composite index of coding of rules, regulations, and administrative procedures affecting capital flows for a total of 27 individual transactions in the current and capital accounts of the balance of payments (1.12 = the most closed; 1.93 = the most opened). B*ank concentration :* Assets of three largest banks as a share of assets of all commercial banks in 2004 (%).

Table C1.2. Asset of Ethiopian Banks (1998-2006)

	1998	1999	2000	2001	2002	2003	2004	2005	2006
State owned banks	93.6	90.7	88.1	86.1	83.1	79.9	78.5	74.1	69.6
Commercial bank of Ethiopia	83.0	79.3	74.6	73.9	71.7	69.8	66.3	70.2	66.3
Development bank of Ethiopia	10.6	11.4	9.8	8.9	8.3	7.4	9.7	n.a.	n.a.
Constructionand business bank	n.a.	n.a.	3.7	3.3	3.1	2.7	2.5	3.9	3.3
Private banks	6.4	9.3	11.9	13.9	16.9	20.1	21.5	25.9	30.4
Dashen bank	2.4	3.1	3.3	3.8	4.8	5.7	6.3	7.2	8.4
Awash International bank	2.1	2.4	2.9	3.1	3.6	4.0	4.2	4.7	5.5
Abyssinia Bank	1.0	1.8	2.7	3.1	3.7	3.8	3.8	4.4	5.2
Wegagen Bank	0.9	1.7	1.9	2.0	2.1	2.6	2.7	3.4	4.2
United bank	n.a.	0.3	0.5	0.7	1.0	1.4	1.6	2.3	3.0
Cooperative Bank of Oromia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.3	0.4
Nib International Bank	n.a.	n.a.	0.6	1.2	1.7	2.6	3.0	3.7	3.7

Source: Kiyota et.al. (2007)

Appendix C.2: Fixed Effect Quantile Regression

In this appendix we describe the Canay (2011)'s strategy that we use in estimating quntile regression controlling for firm-specific unobservable heterogeneity. In this method the fixed effects are considered as a location shifters in which they affect all quantiles similarly. The procedure involves transforming the data in order to eliminate the firm-specific fixed effects.

Consider a quality equation

$$Y_{it} = X'_{it}\theta_u + \alpha_i + \varepsilon_{it}, \quad E(\varepsilon_{it} \mid X_i, \alpha_i) = 0 \qquad \text{(C. 1)}$$

Where Y_{it} captures quality, X_{it} stands for the set of variables that capture access to finance and other firm-specific time varying characteristics, α_i is a firm fixed-effect and ε_{it} is standard error term.

Canay (2011) suggests two-step procedure which is consistent and asymptotically normal when both n and T go to infinity. The first step involves defining α_i as $\hat{\alpha}_i \equiv \mathbb{E}_T\left[Y_{it} - X'_{it}\hat{\theta}_u\right]$, where $\mathbb{E}_T[.] = T^{-1}\sum_{t=1}^{T}[.]$, and $\hat{\theta}_u$ is a standard within estimator of θ_u. In the second step the dependent variable is transformed as $\hat{Y}_{it} \equiv Y_{it} - \hat{\alpha}_i$ and followed by running the standard quantile regression on the transformed variable for different quantiles (τ). Then the two-step estimator $\hat{\theta}(\tau)$ become $\hat{\theta}(\tau) \equiv \ argmin_{\theta \in \odot} \ \mathbb{E}_{nT}\left[\rho_\tau(\hat{Y}_{it} - X'_{it}\theta)\right]$.