Trade liberalisation, firm dynamics and export participation in Sub-Saharan Africa

S Esaku

orcid.org/0000-0002-2587-4092

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Promoter: Prof W F Krugell

PREFACE

When students get admitted into the University, they embark on an audacious and long journey that is full of surprises. At first, they are excited and proud to gain admission or to be accepted into the PhD program. But this excitement soon dissipates when they start to realize that the ideas they first had are more like "junk" so to say. They start to struggle with getting the ideal topic, defining the research question, writing the thesis statement and getting the relevant data to facilitate their research. All these tasks require effort and ample time to do them right.

For-instance, why is it important to explain the existence of self-selection or learning-by-exporting by firms and their relevance to our understanding of firm dynamics? Furthermore, why is it important to reconcile the observed existence of small and less productive firms in the export markets with the view that only the large and more productive firms engage in international markets? Similarly, how important is the use of firm-level data to evaluate the impact of trade liberalization on productivity and performance of firms? Knowing that most African countries undertook a series of reforms aimed at addressing poor economic outcomes and improving productivity and output growth, these questions may all be relevant to the academic world. A clear understanding of the inter-linkages and channels through which economic reforms can effect output growth and productivity becomes an interesting area for an economics student.

As a student, you now join a different family-the academic family, once you lose it you lose your family. The academic family has rules that must be adhered to if one is to succeed as a professional researcher. Rule (1): being honest- academic honesty is the epitome of every PhD study. Acknowledge the works of others and not taking them to be your own is the first rule that every successful academic student should adhere to. In your field of study, you cannot succeed unless you recognize that your predecessors made a noble contribution to the said field as well. Rule (2): managing time is important- please respect every deadline and appointment. Rule (3): avoid any distractions that may take your time. Remember, you have to prepare and deliver your lessons (if you are taking a part-time lecture job), guide students through their academic studies, supervise students' research projects and handle other academic roles that may be handed down to you from time to time. So, how will you manage all these puzzles? Will you cope with the demands of doing a PhD or you would opt for another Honors or Masters?

Though it seems doing a PhD is a long and torturous process, the support from your supervisor, colleagues and family is quite helpful. Your supervisor is a helpful source of inspiration and encouragement. His/her expert knowledge on the subject of your study, encouragement in pushing you to do more to improve understanding of the research question and insightful comments on your research topic should give you the motivation to continue. Similarly, your colleagues should be another source of inspiration and motivation. When you see those who have finalized with their PhDs articulate the subject matter with greater insights and they receive complements for their work, surely this is a clear indication that you too can make it against all the odds. If they can, so you can!

ACKNOWLEDGEMENTS

SUMMARY AND KEY TERMS

Advocates of trade liberalization argue that it has the advantage of introducing variety of products and economies of scale in production (Krugman, 1979; 1980). The standard trade model (Melitz, 2003) greatly centers on firm heterogeneity which gives explanations why firms serve heterogeneous markets (some serve the domestic market while others become exporters) even within narrowly defined industries. Firm-level data in both developed and developing countries shows compelling evidence suggesting that firm export participation is a rare activity and firms involved in international trade constitute a small fraction of firms across many countries (Bernard, Jensen, Redding and Schott, 2007). Taken together, the above facts suggest that exporting is a costly venture undertaken by the large and more productive firms. However, some empirical evidence has shown that exporters are not generally large and productive (Eaton et al., 2008) and that firm selection into the export markets can also be the result of deliberate endogenous effort by firms to increase firm-level investments (Rho and Rodrique, 2016) and reorganize the management of the production processes (Blum et al., 2011).

In this thesis, I have examined trade liberalization, firm dynamics and export market participation in the context of five selected Sub-Saharan African countries (Ghana, Kenya Nigeria, South Africa and Tanzania); using a unique dataset of Sub-Saharan African manufacturing firms. This study is different from previous studies in Sub-Saharan Africa in that most previous studies were country specific (Bigsten and Gabreeyesus, 2009; Granér and Isaksson, 2009; Njikam and Cockburn, 2011) among others. Studies examining Sub-Saharan Africa are scarce due to lack of data or incomplete data (Borel-Saladin, 2017; Austin et al., 2017). This thesis exploits the availability of data in five Sub-Saharan countries, spanning fourteen years, to examine the above topic. Using propensity score matching techniques and regression analysis, I provide explanation to three research questions: (1) how important are sunk costs in shaping export entry of new entrants? (ii) What explains the presence of small and low productivity firms in the export markets, (iii) What is the impact of trade liberalization on firm productivity in Sub-Saharan Africa? The main results show that: (i) Sunk costs of exporting are significant and influence the firm's decision to enter the export market and large firms are more productive and grow at faster rates before export market entry. (ii) Although firm productivity differences can be explained by self-selection factors as one channel, firm-level investment holds the key to a possible explanation to why small firms, with low productivity, venture into the export markets. (iii) Liberalizing trade enhances firm-level productivity in the traded sector with industries (textile, and food and bakery) regarded as more labor intensive, benefiting the most. These results are robust to the use of other measures of trade liberalization, like index of openness and trade freedom index.

Overall, although the standard trade model by Melitz (2003) is tractable in explaining most of the features observed in firm-level data, it omits crucial conscious efforts of firms to increase their probability of entering the export markets. At the policy level, exporting per se may not result into welfare gains unless it is followed by the right policies that promote rather than restrict trade.

Key terms: Firm behavior, Liberalization, Export Led, Firm Growth, Manufacturing
JEL: D22; F13; F14; L25; L60

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CHAPTER 1: INTRODUCTION

1.1 Motivation

How do sunk costs of exporting shape the firm's export market entry and participation dynamics? How does trade liberalization present opportunities and challenges for firms in Sub-Sahara Africa? How do firms respond to trade liberalization episodes, and what impact does trade liberalization have on productivity and export market participation? What explains the much observed firm heterogeneity? These questions have generated a new research discourse in international trade literature. Previously, these questions would be addressed using the Heckscher-Ohlin framework (each country will export the product produced using the country's abundant factor of production) or in the comparative advantage framework (each country will export a product it produces at a relatively lower cost than its trading partners) (Melitz and Trefler, 2012). These classical trade theories were advanced to explain trade between two countries, in which a set of countries, export products in another group of industries but at the same time importing goods in another group of industries, in what came to be known as the inter-industry trade. However, international trade literature has progressed to include intra-industry trade, where trade is increasingly being carried out within firms that operate in narrowly defined industries (Melitz, 2003). With the availability of firm-level data, researchers can now assess a number of testable theories using the available firm-level data or micro-data. For-instance, micro-data has made it possible to examine the following relationships: the relationship between sunk costs and selection into exporting as ably emphasized by Roberts and Tybout (1997), the impact of free trade on reshuffling resources and firm productivity growth (Pavcnik, 2002; Melitz, 2003), how international trade shapes the fortunes of multi-product firms (Eckel and Neary, 2010; Bernard et al., 2011), gaining understanding of firm export market dynamics (Eaton et al., 2011a; Eaton et al., 2011b; Albornoz et al., 2011; Eaton et al., 2008), product quality (Hallak and Schott, 2011; Manova and Zhang, 2012; Kugler and Verhoogen, 2012), and technology upgrading (Bustos, 2011) among others.

Theoretically, the standard trade model (Melitz, 2003) greatly centers on firm heterogeneity which gives explanations why firms serve heterogeneous markets (some serve the domestic market while others become exporters) even within narrowly defined industries. On the empirical front, firm-level data in both developed and developing countries shows compelling evidence suggesting that firm export participation is a rare activity and firms involved in international trade constitute a small fraction of firms across many countries (Bernard, Jensen, Redding and Schott, 2007). A number of explanations have been advanced to explain why exporting is rare among firms; notably, the existence of sunk costs of export market entry (Roberts and Tybout, 1997). Exporting involves covering fixed costs (sunk), in addition to variable costs related to initiating trade in the export markets; these may be related to setting production plants, identifying a sales agent or setting up a distribution channel, among others. These costs are sizeable and may only be covered by more productive and established firms (Roberts and Tybout, 1997) and explain why some firms remain to serve the domestic markets (non-exporters) while others engage in export markets (exporters). Subsequently, the large and more productive firms self-select into the export markets because they possess superior characteristics before initiating exporting activity (Bernard and Jensen, 1999; 2004) and that exporting is a source of increased productivity- learning-by-exporting (De Loecker, 2007). Taken together, the above facts suggest that exporting is a costly venture undertaken by the large

and more productive firms. However, some empirical evidence has shown that exporters are not generally large and productive (Eaton et al., 2008) and that firm selection into the export markets can also be the result of deliberate endogenous effort by firms to increase firm-level investments (Rho and Rodrique, 2016) and reorganize the management of the production processes (Blum et al., 2013). Moreover, the evidence on both self-selection and learning-by-exporting is conflicting as shown by Clerides et al. (1998) and Bernard and Jensen (1999).

1.2 Brief definition of the problem

Trade liberalization has been suggested to be the key driver to economic growth and development in some economies of East Asia (Rao, 1998). According, some of the countries in this study (Kenya, Tanzania, Ghana and Nigeria) have undertaken significant trade reforms aimed at dismantling restrictions to trade. Proponents of trade liberalization argue that it provides a country with variety of goods, knowing that consumers lover variety (Krugman, 1980). Correspondingly, various studies have also shown that trade liberalization and export-oriented development strategy is important for developing countries because of the wider market and contact with international customers and producers (Bernard and Jensen, 1995). However, if trade liberalization generates productivity growth or economic growth and development, why are some countries that have implemented trade reforms still poor, with low productivity growth rates? With the availability of firm-level data, theoretical models have been developed to test various aspects of these data and provide enriching insights on how international trade affects firms, product quality, skills, productivity and other variables. Forinstance, following the early empirical work by Bernard and Jensen (1995; 1999) on firm heterogeneity and the importance of sunk costs of exporting (Roberts and Tybout, 1997) and theoretical model by Melitz (2003), research in international trade has progressed to document key stylized facts on exporters; documenting the productivity differences between exporters and non-exporters and the rare nature of exporting activities among others. Additionally, previous research shows that exporters are large, productive, capital intensive and self-select into export markets, improve their productivity levels (Bernard and Jensen, 1999; De Loecker, 2007). However, Eaton et al. (2008) show that exporters are not generally large and productive as shown by Colombian exporters. Moreover, self-selection and learning-by-exporting remain open as some studies have found conflicting evidence of these hypotheses.

1.2.1 The overall objective of the study

The study examines trade liberalization, firm dynamics and export market participation among five selected Sub-Saharan African countries using unique dataset spanning thirteen years. The overall objective is structured into specific objectives following each article.

Specific objectives
  i. To examine the importance of sunk costs in shaping export entry of new entrants.
 ii. To develop a model that may explain the presence of small and low productivity firms into the export markets
iii. To examine the impact of trade liberalization on productivity growth in Sub-Saharan Africa.

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Research questions
   i.   How important are sunk costs in shaping export entry of new entrants?
   ii. What explains the presence of small and low productivity firms in the export markets?
   iii. What is the impact of trade liberalization on firm productivity growth?

1.3 Key findings from the study

In this thesis, I have organized three independent but interconnected empirical papers that examine trade liberalization, firm dynamics and export market participation in the context of Sub-Saharan Africa. I use a unique dataset of Sub-Saharan African manufacturing firms from the five countries; Kenya, Tanzania, Ghana, Nigeria and South Africa to answer the overall research objective of this thesis. These countries were selected because of data availability and the presence of a sizeable manufacturing sector. As is with most Sub-Saharan African countries, firm-level data is not available easily and this poses a challenge to most researchers (Borel-Saladin, 2017; Austin et al., 2017). Moreover, these five countries may reflect what happens in manufacturing sectors of most Sub-Saharan African countries.

The first chapter of this thesis gives the motivation of the study; while the second chapter is the first empirical paper. In this empirical paper, I use insights from the Melitz (2003) model and Roberts and Tybout (1997) framework to develop a simple analytical framework to study firm dynamics and export market participation in the context of Sub-Saharan Africa manufacturing firms. Firm-level data in developed and developing countries show compelling evidence to suggest that firm export participation is a rare activity. Empirical evidence shows that firms that engage in international trade constitute a small part of firms across many countries. If engaging in international trade provides a firm with a larger market for its products and greater profits, then we would expect a high level of export participation. What then explains the low level of export participation among firms, and can the observed pattern in the firm-level data be generalized to African manufacturing context as well? Several studies show that export participation is influenced by the existence of sunk export entry costs. Firms that intend to engage in international markets must first incur costs related to researching the tastes and preferences of their customers, setting up production plants, sales and distribution channels and other costs. These costs may never be recovered regardless whether the firm reverses its decision to sell products in the international market (Roberts and Tybout, 1997). Thus firms who participate in foreign trade should be large and productive to meet the costs related to breaking into international markets, what has come to be known as self-selection. Thus firms export as a consequence of improved firm efficiency and productive capacity, inducing the firm to reach out to the international markets. In this case, only the large, more productive and in some cases, experienced firms engage in the international markets.

Therefore, firms seeking to engage in export markets not only incur per-unit costs like tariffs and iceberg transport costs, but also face sunk costs (Robert and Tybout, 1997). These costs influence the firm's decisions whether to sell its products in the domestic or export markets, and cannot be recovered if the firm decides not to export again. This implies that firms desiring to enter export markets must prepare by making the necessary investments to cope with the demands of the export market. In this case, firms entering export markets for the first time must determine their original productivity from a usual distribution, such that a firm who breaks into

international market with a low productivity draw cannot change its productivity and will be forced to withdraw from the export market. This established fact is compatible with the view that only large and more productive firms engage in international markets owing to the fact that they are initially more productivity (Hopenhayn, 1992; Melitz, 2003). However, some studies have shown that exporters are not generally large (Eaton et al., 2008) and that even small and inexperienced firms also venture into the international markets, a pattern that is consistent with sequential export market entry (Albornoz et al., 2012). Using propensity score matching techniques introduced into the trade literature by Wagner (2002), I test the key assumptions of the empirical framework on export market participation by Sub-Saharan African exporters. I trace firms for a period of five years before export market entry and after export entry to study ex ante and post entry firm dynamics and export market participation of new exporters. By tracing new exporters over a long horizon, I am able to systematically study how sunk costs of entry into export markets affect the productivity of new exporters. I define new exporters as follows: firms that did not export for atleast one year prior to year t, export in year t, and export in atleast one year (traced to five years) are new exporters. The main results show that Sub-Saharan African exporters are different from non-exporters and that sunk costs of exporting are significant and influence the firm's decision to enter the export market and large firms are more productive and grow at faster rates before export market entry. In the run up to export market entry, new entrants increase their performance characteristics and their growth rates improve rapidly. After entry, new entrants improve their performance further and expand their presence in the export markets by growing at faster rates than never entrants (Eaton et al., 2008)

In Chapter 3, I use models by Arkolakis (2016) and Wu and Miranda (2015), and insights from Erickson and Pakes (1995) to develop a theoretical model and an analytical framework to explain the existence of small exporters in the international markets. Empirical research shows the persistent nature of exporting and how exporters enter foreign markets sequentially, beginning with nearby export markets and growing into the distant markets gradually (Albornoz et al., 2012). Moreover, Eaton et al. (2008) observe that new exporters are small and enter export markets first, by selling small quantities to neighboring countries to gain experience of exporting to distant and advanced markets. If sunk costs are important and that only the large and more productive firms undertake export activity, what would explain the entry of small exporters into export markets and how can we reconcile this pattern with the self-selection hypothesis? Some studies have attempted to account for this observed phenomena using endogenous growth theory to posit that firm-level enhancing activities do explain the observed pattern in the micro-data. These studies specify firm productivity and link it to firm-level productivity enhancing activities like engaging in research and development (R&D), innovation, firm-level investment in physical capital, technology upgrading, or investment in workers' training to give a possible explanation of their importance in export market entry (Aw, Roberts and Winston, 2007; Aw, Roberts and Xu, 2011; Bustos, 2011; Damijan, Kostevc and Polanec, 2010; Rho and Rodrigue, 2016; Wu and Miranda, 2015). However, I use a different path to account for the export market entry of small firm and their participation in international markets, as observed in the micro-data. The main results indicate that firm-level investment activities increase the productivity of firms, including those firms who are small, thereby raising their odds of export market entry. Moreover, firm-level investment increases annual productivity growth rates of new entrants and continuing exporters by 123.8 percent and 256.5 percent respectively. Consequently, non-exporting firms who invest in firm-level activities have a high probability of becoming exporters than firms who

do not invest. Similarly, I also find that firms who engage in exporting activity have a high probability of investing in productivity enhancement. This paper establishes that, although firm productivity differences can be explained by self-selection factors as one channel, firm-level investment holds the key to a possible explanation to why small firms, with low productivity, venture into the export markets. This study establishes a clear indication that when firms invest in physical capital, especially plant and equipment, they gain capability to produce effectively and so more productive firms produce more output at lower unit costs as postulated in my theoretical model. I view firm-level investment as a strong catalyst to improving the performance and survival of exporting firms in the export market, clearly indicating that there is investment premium that accrues to firms that engage in firm-level investment.

In Chapter four, which is my third empirical paper, I examine the impact of trade liberalization on the evolution of firm-level productivity using Kenyan manufacturing sector as a case. I approach my analysis using a three-step method and pay keen attention to various methodological challenges that daunted previous empirical studies on trade reforms. In the first step, I derive a productivity measure for individual firms using the Levinsohn and Petrin (2003) econometric methodology that generates consistent and reliable estimates of the production function indices. In the second step, using the correct identification strategy, I identify the trade variables to facilitate econometric analysis. In the third stage, I analyze the impact of liberalized trade on firm-level productivity using import duties as a percentage of total imports as my measure of trade openness. If trade liberalization can stimulate productivity growth at the firm level, then we would expect firms and industries that are liberalized to grow faster than those that are not (Trefler, 2004). Aware of the criticisms on using other measures of trade reform, like trade ratios, I use a unique measure of import duties as a percentage of total imports because this measure can be viewed as the most direct indicator of trade restrictions. Countries that are more restrictive would rather restrict the import flows into the country than restrict the flow of exports outside of the country. In other words, trade restrictions are mostly imposed on imports rather than on exports. Moreover, the use of import duties is backed by theory and it captures outcomes, policy and the effect of protection on trade. With the more available firm-level data, economists are studying the impact of trade liberalization on the productivity growth of firms. More specifically, researchers keep asking whether trade liberalization generates firm productivity growth and improved export market performance in countries where economies have been liberalized. Previous studies that have attempted to account for the impact of trade liberalization on economic growth and productivity have shown conflicting results. Theoretical trade models, as well, offer conflicting predictions on the impact of trade liberalization on firm-level productivity, especially where there is imperfect competition (Pavcnik, 2002). A number of theoretical models predict that exposure of a country's economy to trade generates increases in total factor productivity (TFP) and shuffling of resources from the least productive firms to more productive ones, consequently, generating welfare gains to the country (Melitz, 2003). The Melitz (2003) model suggests that the firm's productivity is an exogenous process that is stimulated by external forces rather than the conscious efforts of the firm itself. Further, the theoretical model of Melitz (2003) assumes that firm productivity differences are derived by assigning productivity levels to firms by luck of a productivity draw. Based on their initial productivity draw, firms subsequently determine their status; whether to serve a domestic or foreign market. However, Yeaple (2005) model suggests a different channel through which firm

productivity differences could arise as a result of a firm's endogenous efforts to change its productivity path by making optimal technology and labor choices that bolster its productivity. The main results reveal that liberalizing trade enhances firm-level productivity in the traded sector with industries (textile, and food and bakery) regarded as more labor intensive, benefiting the most. These results are robust to the use of other measures of trade liberalization, like index of openness and trade freedom index. Moreover, I find that liberalizing trade increases a country's export performance and the performance of firms that export. I conclude by establishing that liberalizing trade has a positive and statistically significant impact on productivity growth and on the performance of exporting firms. Therefore, African countries that seek to generate higher productivity growth in manufacturing sectors should put in place policies that facilitate, rather than restrict, trade. To this end, reducing duties on imported goods, especially intermediate inputs would go a long way in raising firm-level productivity growth.

In chapter five (last chapter), I provide summary and concluding arguments of this thesis. Most importantly, I present the contribution of this thesis to the international trade literature and sum up with policy implications and areas for further research. This thesis contributes to our understanding of yet another salient feature present in the firm-level data, the dynamics of new export entrants. Sub-Saharan African firms who are new entrants grow faster than other exporters and a firm's market selection and growth is the outcome of distinctive productivity improvements. Moreover, this thesis shows that, although firm productivity differences can be explained by self-selection factors as one channel, firm-level investment holds the key to a possible explanation to export market entry by small firms, often with low productivity. So facilitating small firms with credit to increase firm-level investment activities increases their odds of export market entry.

Conclusively, the main message of this thesis is that exporting can be undertaken by both the large, productive and established firms, on one part, and the small and less productive ones if they implement key investments that restructure the production and marketing processes. This evidence is shown using five Sub-Saharan African countries that have sizeable manufacturing sectors. Small and young firms can circumvent any costs related to export market entry when they invest in firm-level activities that reorganize their production and marketing process, increasing the odds of initiating activities in the export market as a result. Although the standard trade model by Melitz (2003) is tractable in explaining most of the features observed in firm-level data, it omits crucial conscious efforts of firms to increase their probability of entering the export markets. These conscious efforts include firm-level investments that help firms to upgrade their technology of production and market processes, lowering their marginal costs of production and marketing as a result. Additionally, trade liberalization is an important component of international trade that can generate welfare gains for trading countries. At the policy level, policy makers should understand that exporting per se may not result into welfare gains unless it is followed by the right policies that promote rather than restrict trade, provide relevant and right information through export promotions that show the market demand and regulations in the export markets, and credit access to manufacturing industries that will facilitate these industries to expand investment activities, at firm-level, that will help revolutionize and strengthen the production and marketing processes.

1.4 Measuring productivity

A key element of this study is deriving productivity estimates for each firm crucial for the analysis. The key econometric challenge in the estimation of production functions is an endogeneity problem; when an explanatory variable or some of the explanatory variables correlate with the error term as a result of measurement error or other factors. Firms are rational agents with one objective in mind: profit-maximization. Therefore, profit-maximizing firms tend to respond to positive productivity shocks in various ways; (1) by expanding output, consequently increasing input use, (2) reorganizing production processes, and (3) expanding investment in plant and machinery, while negative productivity shocks have the opposite effect.

It is natural that there are other factors influencing production that are unobserved to the econometrician but observed by the firm, for instance, managerial inputs, may not be observed by the econometrician but known to the firm. Consider a firm that produces good x, using a Cobb-Douglas production functions in logs:

$$y_{it} = \beta_k k_{it} + \beta_l l_{it} + \omega_{it} + \varepsilon_{it} \tag{1.1}$$

y_{it} is output(in logarithms), k_{it} is the logarithm of capital input, and l_{it} is the logarithm of labor input. All these are physical inputs in the production process which are observable to analyst, but ω_{it} and ε_{it} are unobservable to the analyst. Understanding the difference between these two terms is important for the correct estimation of the production function. We can first consider the importance of ε_{it} in the analysis: this term represents shocks to the production process that are unpredictable by the firm prior to making input decisions at period t. conversely, the ω_{it} denotes shocks that are inherently expected by firms when making input choices. In this case, ω_{it} may represent variables such as; expected drought at the firm's location, expected defect rates in the production process, managerial inputs or expected surge in demand of the products. In most cases, ω_{it} has been referred to as the productivity turbulence of firm i in period t. Similarly, ε_{it} might represent issues like deviation from expected defect rates, expected machine breakdown or expected drought; or simply the observational error in the output variable. The endogeneity issue in predicting equation (1.1) occurs in the sense that the firm's superlative options for inputs k_{it} and l_{it} will be correlated with the predicted productivity shock ω_{it}, rendering OLS estimates of β's biased and unreliable. Addressing this endogeneity problem will require measurements that are associated with input choices k_{it} and l_{it} but not associated with ω_{it}. Analysts have tried to use input prices for this purpose but still this does not address the problem as input prices are suspected to pick up some variables (Ackerberg et al., 2006).

Besides endogeneity problem is the selection bias occurring as a result of correlation between productivity shocks and the probability of leaving the market. For instance, if the firm's financial gain is positive and strongly correlated with its capital stock, then the firm with the larger capital stock is likely to remain in the market regardless of the low productivity shock than the firm with the smaller capital stock, because the firm with more capital can be expected to realize higher financial gain. When capital stock and the probability of exit for a given productivity shock are uncorrelated, the estimates on the capital variable will be biased downwards if this effect is not controlled for. A novel approach is suggested by Olley and Pakes (1996) to address the

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endogeneity problem and selection bias using a structural approach to identification of production functions. Using this structural approach, the endogeneity problem is addressed using investment to proxy for an unobserved time-varying productivity shock, while the selection problem is addressed using survival probabilities. However, this approach is criticized for not being able to address collinearity issues resulting from the first stage of the respective estimation procedures (Ackerberg et al., 2006). Similarly, Levinsohn and Petrin (2003)[1] use a related approach to solve the endogeneity problem by using intermediate inputs to proxy for unobserved productivity shock. Their method uses intermediate input proxies instead of investment to estimate a production function. The advantage of using intermediate inputs as proxies is that almost all firms in our dataset report positive use of intermediate inputs, like materials. Additionally, intermediate inputs link the estimation strategy and economic theory because these inputs are not state variables. To this end, we derive our estimates of the production function using the levpet command in Stata, and obtain the estimates useful in the estimation of TFP in our data.

1.5 The data

To facilitate empirical analysis, this study uses firm-level data from five African countries, that is, Ghana, Kenya, Tanzania, Nigeria and South Africa. The data are on manufacturing sectors, focusing on a few industries, namely, textile, wood, furniture, garment, metal and machinery, and food and bakery. The data were collected under the Regional Program on Enterprise Development (RPED) organized by the World Bank, jointly by the Center for the study of African Economies (CSAE)[2] and University of Oxford, using stratified sampling strategies within each country and firm size. The dataset was drawn out of detailed questionnaires carried out with owners, and in some cases, managers and employees of sampled manufacturing firms with a view to collecting data that is relevant for firm-level analyses. The dataset is unique in having measures of productivity, investment in plant, equipment, land and buildings expenditures. Data contain replacement value of plant and machinery, the sale value of land and buildings and investment in both these types of capital. Capital stock is deflated using a weighted average of national consumer price index and nominal US dollar exchange rate[3]. Human capital stock comprises of the following worker characteristics: age, tenure in current job, education, hours worked, earnings and potential experience. Other variables contained in the dataset include real output per worker, the real value of capital per worker, real value of materials, real value of other intermediate inputs, number of employees, ownership status, firm age, export status and employee mobility. The period covered by the data is from 1991 to 2003. The original dataset downloaded from CSAE contained 10,359 observations based on more than 1000 manufacturing plants. However, after data inspection, the observations under Tanzania were double checked and cleaned for consistency with the raw data collected, retaining 9,978 observations for the whole sample. Moreover, the World Bank and World Trade Organization constituted important sources for tariff data and other export and import data including world development indicators.[4]

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[1] The detail of derivation of TFP is found in Levinsohn and Petrin, (2003) and annex
[2] I thank the Center for the study of African Economies for making the data available for download for free to researchers. I am grateful to you for this assistance without which, it would not have been possible to conduct this study.
[3] See a full description of the dataset and all the variables on www:csae.ox.ac.uk
[4] Some macroeconomic variables were drawn from the database maintained by Rose(2002), and heritage foundation.

Most of the countries in this study sample have undergone some macroeconomic challenges which greatly influenced the manufacturing sector. Furthermore, most of these countries promoted import substitution strategy to strengthen their domestic sectors prior to trade reforms that liberalized their economies. This therefore caused slow growth of the industrial output and poor development outcomes realized by these countries.

1.6 Research methodology

The study of firm-level activities and exporting involves the use of key econometric methods. To answer the research questions in this thesis, I follow: (1) a standard empirical approach using a regression framework, propensity score matching (PSM) methods together with difference-in-differences method (DID) in all the three empirical papers. Bernard and Jensen (1995 and 1999) pioneered a standard empirical approach to estimate firm dynamics and export market participation by (1) carefully assessing the pre-entry differences between future exporters and never exporters with focus on export premia and growth rates over a period of five years, that is, periods t-5, t-4, t-3, t-2 and t-1, with the main objective of assessing the productivity trajectory of future exporters; (2) examining post-entry differences between new export entrants and never entrants, with special focus on growth rates; (3) analysis of new entrants who stay in export markets, those who are intermittent (enter export markets, start exporting and stop temporarily, and re-enter again), and those who exit (exiter); (4) finally assessing the importance of size of the firm in entry and export market participation). Additionally, I use propensity score matching method introduced into the trade literature by Wagner (2002) and Girma et al. (2003, 2004). The aim is to match non-exporters and exporters at some point in time, according to their propensity to export and investigate whether the two groups differ in their propensity and firm-level productivities. The advantage of propensity score matching is that it allows for some flexibility while examining the relationships. This approach was successfully used by McGregor et al. (2014), Konings and Vandenbussche (2008), Arnold and Hussinger (2005a), Yasar and Rejesus (2005), Kostevc (2005) De Loecker (2007), Girma et al. (2004) and Wagner (2005). Additionally, I use a regression framework and difference-in-differences to evaluate the impact of trade liberalization on the performance of exporting firms and assess the direction of causality, since the expected outcomes cannot solely be attributed to the average treatment before and after the treatment as other factors contemporaneous with the treatment might be captured in the matching process.

Conclusively, research in international trade has largely evolved to include addressing intra-industry rather than inter-industry dynamics that were once impossible to address. Of great interest is the novel work of Bernard and Jensen (1995, 1999) that introduced a new direction on intra-industry research, clearly pioneering research in firm heterogeneity. Consequently, there is growing theoretical and empirical evidence as to the important role that exports play in igniting and sustaining rapid economic growth rates in most economies. Specifically, it is argued that exporting is associated with both static and dynamic gains that accrue from engaging in free trade. In the past, studies on foreign trade were conducted using the principles of comparative advantage and absolute advantage. These classical trade theories were advanced to explain the trade between two countries, in which a set of countries, export products in another a group of industries but at the same time importing goods in another group of industries, in what came to be known as the inter-industry trade. However, with the available firm-level data, it is increasing

possible to investigate the impact of international trade on various aspects of the economy to generate enriching facts about international trade. Moreover, analysts can now provide great insights on firm dynamics and export participation in a variety of settings. Therefore, this thesis makes use of the great opportunity of firm-level to study trade liberalization, firm dynamics and export participation in Sub-Saharan African countries.

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CHAPTER 2: FIRM DYNAMICS AND EXPORT MARKET PARTICIPATION IN SUB-SAHARAN AFRICAN MANUFACTURING.

2.1 Introduction

How do sunk costs of export market entry shape the firm's export market entry and participation dynamics? This question has generated controversy and a new research discourse in the international trade literature. In the past, this question would be addressed using the Heckscher-Ohlin framework (each country will export the product produced using the country's abundant factor of production) or in the comparative advantage framework (each country will export a product it produces at a relatively lower cost than its trading partners). These classical trade theories were advanced to explain trade between two countries, in which these countries export products from a group of industries and import goods from another group of industries, in what came to be known as the inter-industry trade. However, international trade literature has progressed to include intra-industry trade, where trade is increasing being carried out within firms that operate in narrowly defined industries (Melitz, 2003).

In this paper, I use firm-level data of manufacturing firms from five African countries to study firm dynamics and export market participation, with special focus on new export entrants. Firm dynamics, in this context concerns itself with the aspect of the firm that change over time. These aspects consist of firm entry, growth, size and exit, which together form the cornerstone of our understanding of firms. By export market participation, we refer to the active involvement of firms in the export markets. Exporting firms are important in the growth of economies world over. Their pivotal role is to generate export revenues, employment and drive technological developments in any country as a result of their participation in international markets (Grossman and Helpman, 1991). One of the notable features of firm-level data is the existence of much variability in the success of firms that would otherwise be similar in most respects. Empirical evidence shows that there is variability in firm-level job creation and destruction, firm growth rates and its patterns of entry and exit from the industry. The variability in firm-level data persists even when controlling for firm characteristics; like firm age, ownership status; firm location and the sector or industry it belongs. Additionally, theoretical models have been developed to test various aspects of the micro-data and provide enriching insights on how international trade affects firms, product quality, skills, productivity and other variables. For-instance, the pioneering study by Bernard and Jensen (1995; 1999) establishes how firms differ in productivity, employment growth, and other characteristics, even within narrowly defined industries. Moreover, Roberts and Tybout (1997) document how sunk costs of export market participation are important and firms must evaluate these costs before deciding their export market entry strategies.

Over the past decade and a half, theoretical and empirical literature has emphasized the systematic heterogeneity between exporters and non-exporters, with evidence from firm-level data showing that there exist large and persistent productivity differences among firms. Exporters are systematically different from non-exporter in many ways; are more productive, larger, use more skilled workers, use more capital to labor and reward their employees well than the non-exporters. Additionally, export market participation is so rare implying that firms engaged in international trade, both in export and import business, represent a small percent of

producers in most of the developed and developing world (Aw et al., 2000; Bernard and Jensen, 1995, 1999; Bernard et al., 2003; Melitz, 2003).

Further, the productivity differences between exporters and non-exporters are correlated with the firms' export status. This would imply that relatively more productive firms have high probability to export, and those that engage in international markets expand their growth rates and out-perform non-exporting ones (Bernard et al., 2007; Clerides et al., 1998; Das et al., 2007). Similarly, several empirical studies find yet another significant feature of firm-level data showing the persistence in the export behavior of exporters over time (Bernard and Jensen, 2004). Even when firms face negative productivity shocks, exporters continue to export in the following year (Timoshenko, 2015). To explain three observed features of firm-level data; variability in success of firms within narrowly defined industries, a small number of firms venturing into the international market and the export persistence, empirical studies have pointed to the existence of sunk entry costs related to exporting, where only the more efficient firms self-select or find it profitable to initiate entry into the international market because they can adequately meet the sunk entry costs. This implies that exporting involves costs that must be met before a firm engages in international markets. These costs are sunk in nature and relate to market research, paying for distribution channels, construction of production facilities, technology upgrading and other costs related to export market entry. At each point in time, potential export entrants must first pay the sunk costs S_e, which naturally can be met by large and more productive firms with small and poor performing firms locked out.

In the event that relatively more productive firms initiate export activity, it is natural to suggest that they already have prior information about sunk costs involved with exporting and are confident to pay such costs. If this is the case, then only the more productive firms join the export market. Nevertheless, recent empirical evidence has shown patterns of export market entry that are quite difficult to reconcile with the notion of sunk costs. For-instance, Eaton et al. (2008) study of Colombian exporting firms indicates that domestic firms who enter the export market every year are small and possess relatively low productivity level. This greatly contradicts with the notion that firms who venture into the international market are usually large and possess high level of productivity, because they can afford sunk costs associated with initiating selling products in the foreign markets. Moreover, Eaton et al. (2008) findings show that small firms begin by selling small quantities to a neighboring country in the hope of gaining experience to target distant markets and once they survive their first year of international experience, they thrive and expand their operations. Even though, a number of them do not live to see their first anniversary, a few who do, reap immense benefits of export market participation. Clearly, the above study presents a pattern of export market entry which is inconsistent with some theoretical underpinnings, especially the novel work of Bernard and Jensen (1999) who show exporters must be large and more productive to engage in the export market and Melitz (2003) model that argues that domestic must enter the export market with a high initial productivity draw to survive in this market.

Moreover, Roberts and Tybout (1997) document the importance of sunk costs of exporting and previous export experience in raising the chances of the firm's export decision. In their findings, Roberts and Tybout (1997) argue that firms who expect to engage in the international markets should be large and possess high level of productivity because small firms will not afford the sunk costs of export market entry because these costs are substantial an act as barrier to the

firms' export market participation. Given that sunk costs are important and that only the large and more productive firms undertake export activity because they are the only ones best suited to pay these costs, to what extent is Colombian study relevant to African exporting firms? Can the presence of sunk costs explain firm dynamics of new exporters in African exporters who are in the manufacturing sector? Providing a good understanding on how sunk costs of exporting shape a firm's export decision is important because the welfare of both the importing and exporting countries depend on the firm's export decision as exporting provides importer with a variety of goods (Broda and Weinstein, 2006). Moreover, a firm's prior experience in international markets is crucial for its decision to enter a particular market because entering new markets involves significant uncertainty (Albornoz et al., 2012). Additionally, Morales et al. (2011) observe that firms that have prior experience from export markets with some specific geographical or cultural characteristics reduce the hurdles required to enter markets with similar features.

This paper examines firm dynamics and export market participation focusing on how the presence of sunk costs shape firm dynamics and export market participation of new export entrants. To organize the analysis we rely on the methodology of Bernard and Jensen (1999) and augment our results with the approach pioneered by Wagner (2002). We trace firms for a period of five years before export market entry and after export entry to study the firm dynamics and export market participation of new exporters. By tracing new exporters over a long horizon, we are able to systematically study how sunk costs of entry into export markets affect the productivity of new exporters. We define new exporters as follows: firms that did not export for atleast one year prior to year t, export in year t, and export in atleast one year (traced to five years) are new exporters. We then try to explain how different new exporters are from those that do not. To guide the analysis, we rely on the fact that firm export behavior is largely driven by differences in productivity and the presence of sunk costs which are crucial in explaining the relationship between firm efficiency and export participation (Bernard et al., 2003; Melitz, 2003). Since exporting involves a fixed cost (which then is sunk in nature), only the most productive firms will initiate export activity while the less productive ones serve the domestic markets. These costs cannot be compensated for by contemporaneous receipts (profits) but rather by future receipts which may accrue from expansion of sales and possible adoption of new production technologies. This implies that new exporters should expect their profitability to fall for some time before export market entry and then rising with export market participation. If this is the case, the productivity dynamics of new exporters should be U-shaped as suggested by Bellone et al. (2008). On the other hand, if firms are already large and possess high productivity years before export market entry, then such firms are the only ones to enter the export market with small ones locked out.

The existence of large productivity differences between exporters and non-exporters may imply that the decision to enter the export market is determined by factors that affect the productivity of firms before entering the export market. These factors may include, the firm's decision to invest in innovations, research and development, procurement of new production technology, technology upgrading among others. Similarly, models of firm dynamics show that large and persistent productivity differences exist between exporter and non-exporter firms but do not provide systematic evidence on what generates the much observed heterogeneity. However, in dynamic industry models with heterogeneous firms (Jovanovic, 1982; Hopenhayn, 1992) and their extension to international trade (Melitz, 2003); it is assumed that initial productivity levels are assigned to firms by luck of the draw from a random distribution. Based on initial

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productivity draw, firms then sort endogenously into either exporter or non-exporter status. Those firms that joined export markets with a low productivity draw would be forced out (exit) or cut down their production for international market since they cannot change or improve their initial productivity draw (Bernard et al., 2003; Metliz,2003). However, endogenous growth theory has suggested that firms can still improve on their productivity from decisions to investment in research and development (Romer, 1990), the choice of production technology and workers to hire (Yeaple, 2005), the decision to hire workers from existing exporters (Sala and Yalcin, 2015), the decision to innovate (Caldera, 2010; Constantini and Melitz, 2008), and the decision to upgrade their skills, quality of the product and technology of production (Bustos, 2011a, 2011b; Yeaple, 2005; Iacovone and Javorcik, 2012; Verhoogen,2008;). These studies on endogenous growth have documented a positive relationship between the firm's endogenous decisions and export market entry, and participation.

Accordingly, the literature on firm heterogeneity has largely centered on proving self-selection and learning-by-exporting hypotheses; that is, whether the most productive firms export since they can afford fixed costs associated with export market entry; or whether firms that export improve their productivity when they start exporting. Additionally, there is a growing consensus in developed countries on the existence of the above two hypotheses and yet there seems to be conflicting evidence of such existence in African manufacturing firms. For example, Bigsten et al. (2006) and Foster-McGregor (2014) studies document the presence of self-selection and learning-by-exporting in African manufacturing firms. However, Söderbom and Teal (2005) show that the evidence on self-selection is very weak in the African manufacturing firms. Besides, in the context of African manufacturing firms, there is little attempt to systematically study the thesis that new exporters are already productive two, three and or five years before they join the export market but rather, the main focus has been on providing evidence on the phenomenon based on observation of the period t-1, one year before export entry- that is, Exporting at period $t+1$. The approach I use in this study, traces the exporters over a long horizon.

This study finds that African exporters are different from non-exporters and that sunk costs of exporting are significant and influence the firm's decision to enter the export market and that exporters are different from non-exporters and large firms are more productive and grow at faster rates before export market entry. In the run up to export market entry, new entrants improve their performance characteristics and their growth rates improve rapidly. Accordingly, five years to export market entry, new export entrants have labor productivity and wages growth rate is at 33.7 percent and 18.2 percent respectively. Three years to export market entry, total factor productivity growth rate is positive and statistically significant, at 9.3 percent, labor productivity growth rate is at 25.7 percent, capital intensity is 22.4 percent, wages growth rate is at 3.9 percent and employment growth rate is at 22.8 percent. Similarly, one year to export market entry, labor productivity growth increases, from 25.7 percent, three years to entry, to now 93.4 percent; an increase of 67.7 percentage points, capital intensity growth increases by 81.1 percentage points (from 22.4 percent, three years to entry, to 103.5 percent, one year to export market entry), employment growth rate has increased by 33.9 percentage points (from 22.8 percent three years to entry, to 56.7 percent one year to entry).

After entry, new entrants improve their performance further and expand their presence in the export markets by growing at faster rates than never entrants. In the year of entry, total factor

productivity for new export entrants is at 54.0 percent, dropping slightly to 31.2 percent, one year after entry. However, from the second year after entry, new entrants begin to expand their productivity, from 31.2 percent one year after entry, total factor productivity increases to 47.3 percent two years after entry. Three years after entry, total factor productivity increases, from 47.3 percent to 92.7 percent. In the fourth and fifth years, total factor productivity is at 69.0 percent and 75.1 percent respectively. Examining growth rates, we can observe that between period t and t+1, total factor productivity growth rate of new entrants is at 16.0 percent, which drops to 2.8 percent between period t+1 and t+3. However, between period t+3 and t+5, total factor productivity of new entrants, is 2.9 percent but with a negative sign. Overall, the growth rate of other measures is positive and statistically significant.

I also tested for the effect of exporting on new entrants and found that when firms engage in international trade, they improve their productivity better than firms that serve domestic markets, implying that exporting raises performance hence evidence of learn-by-exporting. Moreover, firms that enter export markets for the first time perform better than old firms and have superior growth rates; while exiting export markets is associated with low performance, and future exporters (new entrants today) possessed superior characteristics some years into export market entry showing a pattern of self-selection and the importance of sunk costs associated with exporting in the firm's decision to export. Additionally, after entry, the study finds that new entrants improve their performance further and expand their presence in the export markets by growing at faster rates than never entrants. Relatedly, this study establishes the importance of size in export market entry and participation, new export entrants who are large experience faster growth years to export market entry, than small firms, but new entrant who are small grow at faster rates after entry into the export markets, than other firms. This implies that governments that hope to maximize and expand the benefits from trade liberalization should provide incentives that ease the burden of sunk costs of export market entry, by for-instance, providing tax holidays to exporters and providing information on possible export markets and entry possibilities.

Although this paper uses the approach pioneered by Bernard and Jensen (1995; 1999), this study augments the results with the approach pioneered by Wagner (2002) and applied by Girma et al. (2003; 2004). The aim is to match non-exporters and exporters at some point in time, based on their propensity to export and investigate whether the two cohorts differ in their propensity and firm-level productivity. Another paper that is so close to this one is that by Bellone et al. (2008) who study the U-shaped productivity dynamics of French exporters, but they did not use propensity matching approach and the context is different. Besides, their study did not examine the effect of size on the performance of exporting firms. To the best of my knowledge, this paper is the first to study firm dynamics and export participation of new exporters, using an approach that traces exporters for five years, in African context.

This paper contributes to: firstly, the literature on firm dynamics focusing on new exporters in the context of Sub-Saharan Africa. As shown by Eaton et al. (2008) study, firm-level data presents unique patterns of firm entry and exit in the international trade. This study establishes empirical evidence that new export entrants in Sub-Saharan Africa display remarkable performance before and after export market entry. This finding is in line with the argument that export market entry involves incurring significant sunk entry costs, which may never be recovered in the event that the firm stops or fails to export, as was first shown by Roberts and

Tybout (1997). The findings that new exporters grow faster quickly and expand their presence in the export market when they stay in exporting activity is consistent with; firstly, the view that exporting is beneficial to exporting firms because of the learning-by-exporting mechanism; secondly, in a typical year, there are firms that enter and exit the export markets regardless of the productivity shock they face; those who exit miss out on the benefits of engaging in the international markets, while those who stay, improve their performance further and expand their presence in the export markets by growing at faster rates than never entrants as first shown by Eaton et al. (2008) and later reaffirmed by Timoshenko (2015). As in several other studies, this study contributes to our understanding of yet another salient feature present in the firm-level data, the dynamics of new export entrants; thirdly, the paper contributes to the literature on the importance of size of the firm in export market entry and participation.

The rest of the paper is organized as follows; section 2.2 presents review of the literature related to the study. Section 2.3 provides an overview of the data. Section 2.4 presents our empirical framework and econometric methods. Section 2.5 discusses the findings. Section 2.6 concludes.

2.2. Literature Review

Recent developments in international trade literature have shown new and striking information on firm heterogeneity, documenting the high and persistent level of heterogeneity across firms. An increasing body of literature on international trade documents the presence of great heterogeneity in the outcomes of firms, even within narrowly defined industries (Melitz, 2003; Bernard and Jensen, 1999; Ericson and Pakes, 1995). The much observed heterogeneity has given some firms to produce and market their output in the international markets while others produce to serve the domestic markets. Some studies find high rates of entry and exit of firms that initiate to sell products in international markets causing resource reallocation in the industry hence contributing to industry productivity (Aw et al., 2001). There is also growing evidence showing that only a small number of firms engage in international trade even in industries thought to be more likely to target the export markets (Bernard, Jensen, Redding and Schott, 2007; Tybout, 2000). Moreover, those firms who do venture into the international market continue to engage in the export market even when faced with negative demand shocks (Timoshenko, 2015; Bernard and Jensen, 2004). Empirical evidence suggests the presence of sunk costs, as an explanation for the export persistence and the barrier to export market participation (Roberts and Tybout, 1997; Sinani and Hobdari, 2010). Sunk costs of exporting are significant and limit export participation of small firms because they may find it difficult to cover these costs. Therefore, it is the more productive and large firms who engage in export activity more quickly, and enter larger markets first before engaging in small markets because they can sufficiently cover sunk costs of exporting (Sheard, 2014).

Conversely, some studies examining export dynamics using firm-level data show that entry into the export markets is gradual, where new entrants (exporters) start by selling small quantities of their products in the nearby export market to gain experience of targeting distant markets (Eaton et al., 2008). It well documented that exporting involves sunk costs which must be incurred if the firms intends to engage in international market, as such, only the more established firms (large and productive) can bear this cost and they are the only ones suited to self-select into export markets. However, Eaton et al. (2008) study of Colombian firms establishes that there exists a self-selection pattern among small and less productive firms, who otherwise could not bear these

sunk costs of export market entry and would only serve domestic markets. The question would be how to reconcile the above finding with the view that only the more productive and large firms enter export markets while the less productive and small ones sell in the domestic market. It is plausible to think that these small firms venture into export markets with the hope of gaining exporting experience, and later expand their operations and size to other markets.

However, some studies have shown the importance of the firm's investments on its decision to export. Studies have shown that firms that engage in firm-level investing activities have a high probability of entering the export market, even when they are small in nature (Rho and Rodrigue, 2016). Additionally, Research and Development (R&D) activities have been shown to induce positive firm response on the decision to export (Aw et al., 2011). Similarly, firms that engage in innovation, product or process, have a high probability of engaging in the export markets (Caldera, 2010). Consequently, the above parallel line of thought has tried to explain firm heterogeneity by positing that firms that engage in firm-level productivity enhancing activities have a high probability of initiating export market activity.

Nonetheless, theoretical papers have also shown that even when firms are homogeneous, they face critical export decisions, for-instance when to enter the export market, the choice of technology to be employed in the production of the output, whether to export and who they should employ and wages to pay (Yeaple, 2005). With the availability of firm-level data, studies can now test various channels through which productivity differences between exporting firms and non-exporting ones arise. Some studies seem to suggest that endogenous factors, that is, factors internal to the firm drive this high and persistent heterogeneity, rather than exogenous factors. These internal factors are majorly attitudinal characteristics and individual capabilities, (that is, commitment to export activity, marketing of the product, networking with other exporters among others) as discussed in and Bloom (2012), Nazar and Saleem (2009), and Sala and Yalcin (2015). The above studies have emphasized the impact of firms' internal reorganization processes on the decision to export and improve efficiency when in the export markets.

According to Bernard and Jensen (1995; 1999), there exists systematic differences between exporters and non-exporters. Their seminal work shows that only few firms engage in exporting activity, exporters are large (employ more workers), use more capital per worker, pay higher wages and are more productive than non-exporters. Moreover, exporters are already more productive years before initiating any exporting activity, suggesting the presence of sunk costs and self-selection into export markets. The evidence of sunk costs and self-selection is compelling. For-instance, Andersson et al. (2008) present robust evidence indicating that self-selection is market specific whereby small and less productive firms are restricted to markets with low productivity level. Their study further indicates that self-selection mechanisms can also be seen in a number of products traded in and markets. This implies that selection mechanisms cannot be ignored when a firm is considering its decision to trade in the international market.

According to Meinen (2015), the significance of sunk costs of exporting is derived from the degree of state dependence and export market participation is influenced by destination specific sunk costs. Firms consider what they will pay to access specific export markets before eventually deciding which market they will target. Similarly, Roberts and Tybout (1997) consider the firm's decision to export and importance of sunk costs in Colombian exporters. Their study concludes

that sunk costs could not be ruled when considering initiation of export activity, rather only firms that display significant productivity years before export market entry would export since that productivity still benefits them. Correspondingly, Isgut (2001) analyze the systematic differences between exporters and non-exporters using large data from Colombian manufacturing firms and concludes in favor of self-selection hypothesis, but also key was the observed learning-by-exporting effect. Likewise, Alvarez and Lopez (2005) study heterogeneity in firm characteristics between exporters and non-exporters among Chilean firms and document the existence of self-selection and add that the self-selection may be viewed as an active and conscious attempt by firms to improve the productivity before initiating export activity at the international scene.

Although research has sought to explain export market participation using sunk costs and self-selection mechanism, another strand of international trade literature explains export market participation using learning-by-exporting mechanism. The learning-by-exporting mechanism posits that firms improve their productivity as a result of export market participation. This implies that firms engaged in international trade interact with their customers who in turn give them technology blueprints which can be used in the technical designs of new products, consequently improving the demand of the firm's products and improving productivity in the process. For-instance, Fernandes and Isgut (2015) examine the learning-by-exporting mechanism for Colombian manufacturing plants and find significant evidence that firms that engage in exporting improve their productivity levels. However, their finding also suggests that firms who stop exporting in the previous year face drop in productivity level. Additionally, Clerides et al. (1998) assess learning-by-exporting phenomenon in exporting firms from Colombia, Morocco and Mexico and conclude that self-selection partially accounted for differences between exporters and non-exporters. Their findings suggest that self-selection was not so pronounced in their results as compared to learning-by-exporting. Similarly, Serti and Tomasi (2008) present evidence to emphasize that the observed superior efficiency level of exporters is as a result of both self-select and learning-by-exporting mechanisms in operation. Notably, Mallick and Yang (2013) examine self-selection and learning-by-exporting mechanisms among Indian firms and conclude that both mechanisms are important for productivity growth and the growth miracle in the country. Further, Fryges and Wagner (2008) study confirm the presence of productivity growth as a result of a firm's export activities. This implies that learning-by-exporting is an important channel through which firms improve their performance. Additionally, Timoshenko (2015) study of Colombian exporters finds that export persistence can also be explained by the learning-by-exporting mechanism. The above study concludes that empirical evidence of learning-by-exporting is strong and that learning-by-exporting can explain export persistence because, when learning is controlled for, the role of sunk costs in explaining export persistence is reduces.

On African manufacturing firms, Bigsten and Gebreeyesus (2009) study Ethiopian manufacturing plants, tracing the total factor productivity trajectory by export history and find conclusive evidence of self-selection and learning-by-exporting mechanisms. Their study shows how firms must first be productive before venturing into the export markets and how, in-turn, export market participation improves productivity of firms engaged in international trade. Similarly, Bigsten et al. (2004) using firm-level data from four African countries to investigate whether exporting had any effect of efficiency and whether there was evidence of self-selection in African manufacturing firms. Their findings show no evidence that African manufacturing firms display a pattern of self-selection, but rather conclude in favor of learning-by-exporting

hypothesis. Their findings seem to suggest that African manufacturing firms would venture into the export market regardless of their productivity level or pattern. Similarly, Van Biesebroeck (2005) use panel data of manufacturing firms from nine African countries examines learning-by-exporting hypothesis and confirms that there is strong evidence of self-selection and learning-by-exporting phenomena. This finding suggests that African exporters improve their performance before and after initiation of export market entry compared to non-exporters

Furthermore, Mengistae and Pattillo (2004) analyze firm-level data from three African countries and present evidence in support of self-selection hypothesis. Their findings suggest higher productivity growth for exporters relative to non-exporters. Rankin et al. (2006) use firm-level data to investigate the relative importance of self-selection and conclude that the firm's ownership status, its size and human capital are the key determinants of the decision to initiate export activity. Moreover, the size effect observed is robust and significant than any other factor in self-selection process. This finding suggests the presence of the hypothesis of self-selection through the effect of efficiency. Besides, their study shows no evidence of sector composition effects on export propensity even with more capital per workers, firms are not inclined to export. Additionally, Granér and Isaksson (2009) using data from Kenya manufacturing firms investigate the link between firm efficiency and exporting and confirm the existence of self-selection and learning-by-exporting hypotheses. However, their study covered a short time period and may not provide for any robust causal significance of both self-selection and learning-by-exporting. Likewise, Boermans (2013) studies learning-by-exporting in manufacturing firms from five African countries and finds evidence of both self-selection and learning-by-exporting. Moreover, his results suggest that there is growth in firm size, productivity, profits-to-capital ratio and labor productivity. Consequently, labor productivity, technology upgrading, employment and wages all contribute to the propensity to export.

To conclude, the study of self-selection and learning-by-exporting hypotheses in African manufacturing firms presents conflicting results and still subject to analysis and debate. Moreover, studies on African manufacturing have been conducted, sometimes using a short panel, and in most cases using small number of countries and most of them have not examined the relationship between size of the firm and its performance. Besides, the examination of self-selection is not conducted systematically bearing in mind that Bernard and Jensen (1999) suggest that firms are already having desirable characteristics years before initiating export activity. Bernard and Wagner (1997, 2004) introduce a novel way of examining self-selection and learning-by-exporting, by incorporating the aspect of lags in the period prior to entry; that is, they introduce period 3 prior to export entry, (t-3) to period two prior to export entry (t-2) and from period two prior to exporting (t-2) to period one prior to export entry (t-1) in a regression framework. This study adapts Bernard and Wagner (1997, 2004) but I differ with their work in two major ways; first I track new exporters over a long horizon-five year period and second, I introduce matching methods to augment the regression framework.

2.3 The Data

To undertake empirical analysis, this study uses firm-level data in five African countries, that is, Ghana, Kenya, Tanzania, Nigeria and South Africa. The data are on manufacturing sectors, namely, textile, wood, furniture, garment, metal and machinery, and food and bakery. The data were collected under the Regional Program on Enterprise Development (RPED) organized by the

World Bank, jointly by the Center for the study of African Economies (CSAE)[5] and University of Oxford, using stratified sampling strategies within each country and firm size. The period covered by the data is from 1991 to 2003, and has information on measures of productivity, human capital and internationalization proxies like export status, export destination, ownership status, and employment status. The original dataset downloaded from CSAE contained 10,359 observations based on more than 1000 manufacturing plants. However, after data inspection, I double-checked and cleaned the observations under Tanzania to ensure consistency with the raw data collected, retaining 9,978 observations for the whole sample.

Some of the countries (Kenya, Tanzania, Ghana and Nigeria) in this study sample have undergone some macroeconomic challenges which greatly influenced the manufacturing sector. Furthermore, most of these countries promoted import substitution strategy to strengthen their domestic sectors prior to trade reforms that liberalized their economies. This therefore caused slow growth of the industrial sector and poor development outcomes in most of these countries. The characteristics of the countries in this study are shown in table 2.1.

Table 2.1: Summary statistics for 5 Sub-Saharan countries (2010)

Country	Real GDP Growth,(%)	Real GDP p. Capita ($)	Indus. V.A share of GDP (%)	Manuf. value added (% of GDP)	Exports as a share of GDP	Adult literacy rates		Life Expectancy at birth
						Male	Female	
Ghana	6.1	360	18.6	7.02	29.4	72.8	60.4	63.8
Kenya	5.6	469	19.8	12.62	27.5	90.5	83.5	56.5
Tanzania	7.0	459	25.5	8.14	26.1	79.0	66.9	57.4
Nigeria	7.8	540	-	6.55	37.9	72.0	49.8	51.4
South Africa	2.9	3,753	30.8	14.38	27.3	-	-	52.1

Source: World Bank (2010), African Development Indicators

Most of the countries in the sample have real gross domestic product (GDP) per capita below $1,000, except for South Africa that goes way beyond that figure- to US$3,753. Further, most countries have industrial value added as a percent of GDP which is lower than 10 percent except for South Africa, that makes the highest contribution of 30.8 percent. Exporting is not the predominant activity of these economies, since exports as a share of GDP account for less than 40 percent, but surely it makes a significant contribution to GDP. All the countries in the sample have a significant exporting activity taking place, with Nigeria topping the table with 37.9 percent of total exports as a share of GDP, followed by Ghana, at 29.4percent, Kenya and South Africa having 27.5 percent and 27.3 percent respectively. Manufacturing activity in all countries is significant, with South Africa topping the sample with 14.38 percent, followed by Kenya at 12.62 percent, Tanzania at 8.14 percent, Ghana at 7.02 percent and Nigeria at 6.55 percent of manufacturing value added as a percent of GDP.

In Table 2.2, I present the summary of the firms that constitute the study. There is a total of 1,875 firms surveyed over a period of 13 years, that is, from 1991 to 2003. There is a total of 9,978 observations, with most of the firms selling their output in domestic markets. Export

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[5] I thank the Center for the study of African Economies for making the data available for download for free to researchers. I am grateful to you for this assistance without which, it would not have been possible to conduct this study.

destinations form an important component of the exporting process, with most firms exporting within Africa compared to those that exported outside Africa.

Table 2.2: Summary of manufacturing firms per country

Country	No. of firms	% of firms	No. of Obser vations	Average Exports	Average Domestic Sales	Export	Destinations
						Africa	Outside Africa
Ghana	311	34%	3564	0.17	0.83	0.50	0.07
Kenya	628	17%	3240	0.11	0.70	0.28	0.03
Tanzania	405	21%	2070	0.07	0.93	0.04	0.03
Nigeria	187	10%	700	0.09	0.91	0.07	0.05
South Africa	344	18%	404	0.67	0.33	0.59	0.40

Source: Center for the study of African Economies (CSAE) dataset

Besides manufacturing sector characteristics examined above, it is important to assess the characteristics of the sectors that these firms belong to. Table 2.3 gives the characteristics of the sectors. In Table 2.3, we see that most of the exporters are involved in the metal and machinery sector (mean value of 0.34) followed by food and bakery (mean value of 0.24), wood (mean value of 0.13), garment and furniture (sharing mean vale of 0.10) and finally textile sector (with lower value of 0.08). Similarly, non-exporters are more engaged in metal and machinery (0.29), food and bakery (0.22), garment and furniture (0.18), wood (0.07) and finally textile (0.06). We can also see that exporters more engaged in manufacturing activities in almost all the five countries.

Table 2.3: The mean characteristics of the sectors

Country	Sector	Exporters	Non-exporter	Total
Ghana	Textile	0.04	0.02	0.06
	Garment	0.19	0.13	0.32
	Wood	0.05	0.23	0.28
	Furniture	0.20	0.11	0.31
	Food and Bakery	0.24	0.27	0.51
	Metal and Machinery	0.24	0.21	0.45
Kenya	Textile	0.06	0.15	0.21
	Garment	0.20	0.08	0.28
	Wood	0.09	0.06	0.15
	Furniture	0.16	0.11	0.27
	Food and Bakery	0.24	0.28	0.52
	Metal and Machinery	0.26	0.32	0.58
Nigeria	Textile	0.12	0.27	0.39
	Garment	0.22	0.29	0.5
	Wood	0.03	0	0.03
	Furniture	0.06	0	0.06
	Food and Bakery	0.11	0.10	0.21
	Metal and Machinery	0.46	0.34	0.80
South Africa	Textile	0.05	0.05	0.10
	Food and Bakery	0.10	0.08	0.18
	Metal and Machinery	0.69	0.76	1.45
Tanzania	Textile	0.07	0.22	0.29
	Garment	0.11	0.08	0.19
	Wood	0.08	0.13	0.21
	Furniture	0.23	0.03	0.26
	Food and Bakery	0.19	0.38	0.57
All Countries				
	Textile	0.06	0.08	0.14
	Garment	0.18	0.10	0.28
	Wood	0.07	0.13	0.20
	Furniture	0.18	0.10	0.28
	Food and Bakery	0.22	0.24	0.46
	Metal and Machinery	0.29	0.34	0.63

Source: Calculations from CSAE data
Notes: The data are in means; the sector is manufacturing with six industries: textile, garment, wood, furniture, food and bakery, and metal, machinery and chemicals. South Africa no figures for textile, garment, furniture and wood.

In Table 2.4, I present the mean characteristics of non-exporters and exporters. From this table, exporters, on average, employ (216.61) more employees, have higher labor productivity (8.34), are more capital intensive(7.97), older (21.15), have more foreign ownership(0.33), pay higher wages(4.71), use more materials per worker in US$(7.56) and other inputs per worker in US$(6.77). Non-exporters, on average, employ few workers (54.85), have low labor productivity (6.24), use less capital per worker (5.60), are younger (18.76) and relatively owned by the local investors(0.16), pay low wages per employee(3.73), use less materials per worker in US$(5.62) and other inputs per worker in US$(5.61). From the above information, we can see that exporters are different from non-exporters in all characteristics.

Table 2.4: Mean characteristics of exporters and non-exporters

Country	Characteristics	Non-Exporters	Exporters	Total
Ghana	Employment	150.42	154.37	304.79
	Labor productivity	4.29	6.40	10.69
	Capital intensity	3.63	6.10	9.73
	Firm Age	18.54	19.76	38.30
	Foreign ownership	0.20	0.34	0.54
	Average monthly wage US$	3.29	3.86	7.15
	Materials per worker US$	3.84	5.65	9.49
	Other inputs per worker US$	2.78	4.92	7.70
Kenya	Employment	51.21	255.39	306.60
	Labor productivity	8.58	9.52	18.10
	Capital intensity	8.12	9.56	17.68
	Firm Age	20.24	22.77	43.01
	Foreign ownership	0.13	0.36	0.49
	Average monthly wage US$	4.14	4.67	8.81
	Materials per worker US$	6.22	7.03	13.25
	Other inputs per worker US$	7.75	9.39	17.14
Nigeria	Employment	9.20	9.65	18.85
	Labor productivity	8.21	8.95	17.16
	Capital intensity	21.88	26.92	48.80
	Firm Age	-	-	-
	Foreign ownership	0.18	0.27	0.45
	Average monthly wage US$	4.03	4.55	8.58
	Materials per worker US$	8.45	8.95	17.40
	Other inputs per worker US$	6.79	7.21	14.00
South Africa	Employment	214.01	247.18	461.19
	Labor productivity	10.29	10.73	21.02
	Capital intensity	9.60	9.64	19.24
	Firm Age	18.80	22.20	4100
	Foreign ownership	0.14	0.29	0.43
	Average monthly wage US$	6.16	6.47	12.63
	Materials per worker US$	9.50	10.01	19.51
	Other inputs per worker US$	7.56	7.75	15.31
Tanzania	Employment	44.78	270.92	315.70
	Labor productivity	7.85	8.90	16.75
	Capital intensity	7.12	8.74	15.86
	Firm Age	15.80	17.82	3362
	Foreign ownership	0.11	0.34	0.45
	Average monthly wage US$	3.54	4.11	7.65
	Materials per worker US$	7.09	8.19	15.28
	Other inputs per worker US$	5.61	6.77	12.38
All Countries [a]				
	Employment	54.85	216.61	271.46
	Output per worker	6.24	8.34	14.58
	Capital to labor ratio	5.60	7.97	13.57
	Firm Age	18.76	21.15	39.91
	Foreign ownership	0.16	0.33	0.49
	Average monthly wage US$	3.73	4.71	8.44
	Materials per worker US$	5.62	7.56	13.18
	Other inputs per worker US$	5.61	6.77	12.38

a:The complete set of variables are described in the annex.

2.4. Empirical Strategy/ Methodology

2.4.1 Theoretical model:

The question of firm dynamics and export market participation focusing on productivity trajectory has attracted much research in the literature. A number of studies that examine productivity trajectory have modeled market participation as a discrete decision, such that a firm exports in period t if the expected profits from export activity exceed the fixed costs (sunk in nature) of export market entry since international trade involves the presence of fixed (sunk) costs (Fc) and iceberg transport costs (τ). For-instance, Roberts and Tybout (1997) modeled export market participation using a binary choice model and posit that, firm i exports in period t ($Y_{it} = 1$) if its current and expected revenues ($p_{it}.q_{it}$) are greater than current period costs, denoted by, $c_{it}(X_{it}, q_{it})$ plus any possible entry costs, $f_c(1 - Y_{it-1})$ which are sunk in nature. Thus,

$$Y_{it} = \begin{cases} 1 & if \;\; p_{it}.q_{it} > c_{it}(X_{it}, q_{it}) - f_c(1 - Y_{it-1}) \\ 0 & otherwise \end{cases} \tag{2.1}$$

Conversely, firms whose current and expected revenues are lower than current period costs plus sunk entry costs will not export until this threshold is reached. The firm evaluates its decision to participate in the export market based on the profits, π, it expects to realize from the export market.

Firms are agents whose objective is to maximize profits from sales revenue and would set this where marginal revenue (MR) equal marginal cost (MC) of production ($MR_q=MC_q$). In the presence of fixed costs, only firms whose revenues exceed costs of production will be able to enter the international market, that is, $MR_q - MC_q > 0$. In this case, the firm would enter the export market when participation in the export market yields additional revenues, that is the firm considers expected net profits; today and in the future, of entering the export market.

It then follows that; a rational profit maximizing firm would export only if the following condition is met at a specific time:

$$MR_{it} - MC_{it} > 0 \qquad \text{For the foreign market}$$

$$\pi_{it} = p_{it}.q_{it} - c_{it}(X_{it}, q_{it}) - f_c(1 - Y_{it-1}) > 0 \tag{2.2}$$

Where π_{it} are the expected profits, $p_{it}.q_{it}$ is the revenue, p_{it} is the export price, q_{it} is the quantity of the product exported, c_{it} are variable costs of producing q, fc are the fixed costs(sunk) associated with exporting and Y is an indicator variable for whether a firm is exporter or non-exporter. Whether equation one reflects what happens, depends on the firm characteristics X.

However, modeling firm dynamics and export market participation as a discrete decision, presupposes that firms already possess information about the export market and sunk costs they have to pay. In this study, I assume as in Melitz (2003) that; firms possess similar characteristics when born, produce commodity g to meet market demand that will be either sold domestically (market H) or exported (market Fo). To export, firms must incur sunk costs associated with

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exporting, but they are initially uncertain of their expected export profitability. New entrant firms get to know about the extent of sunk costs when they initiate exporting activity, more importantly, a firm's export profitability, productivity and the export market are correlated over time, implying that firms improve their profitability and productivity during export market participation. This assumption is consistent with the view that exporting breeds success (learning-by-exporting hypothesis). If a firm's expected export profit is uncertain yet correlated overtime, we would observe that even the least productive firms may venture into the export market regardless of their initial productivity draw. This could plausibly explain why there are no clear self-selection patterns in firm-level data of some countries. Consequently, some studies have shown the presence of the U-productivity trajectory in some exporting firms before they initiated export activity (Bellone et al., 2008). Wagner (2007) summarizes the standard approaches used in the investigation of firm dynamics and export market participation.

In this study, I follow a standard empirical approach pioneered Bernard and Jensen (1995; 1999) in which we estimate firm dynamics and export market participation by (1) carefully assessing the pre-entry differences between future exporters and never exporters with focus on export premia and growth rates over a period of five years, that is, periods t-5, t-4, t-3, t-2 and t-1, with the main objective of assessing the productivity trajectory of future exporters; (2) examining post-entry differences between new export entrants and never entrants, with special focus on growth rates; (3) analysis of new entrants who stay in export markets, those who are intermittent (enter export markets, start exporting and stop temporarily, and re-enter again), and those who exit (exiter); (4) finally assessing the importance of size of the firm in entry and export market participation). Additionally, we augment our analysis using novel approach introduced by Wagner (2002) and Girma et al. (2004 and 2003). The aim is to match non-exporters and exporters at some point in time, based on their propensity to export and investigate whether the two cohorts differ in their propensity and firm-level productivity. The advantage of propensity score matching is that it allows for some flexibility while examining the relationships. This approach was successfully used by McGregor et al. (2014), Konings and Vandenbussche (2008), Arnold and Hussinger (2005a, 2010),Yasar and Rejesus (2005), Fernandes and Isgut (2005) Alvarez and Lopez (2005), Kostec (2005) De Loecker (2007), Girma et al. (2004) and Wagner (2005).

In conclusion, I begin the analysis by first deriving estimates of productivity which is used in examining our measure of total factor productivity (TFP) then proceed to estimate pre-entry and post-entry differences between future exporters and never exporters, on one hand, and new entrants and never exporters. After examining pre-entry and post-entry differences and growth rates, I estimate causal links between exporting and productivity, and finally assess the importance of size of the firm on the growth rates on new exporters.

2.4.2 Measuring productivity

In this section, we provide the discussion of the strategy for getting consistent estimates of the production function to be used to measure productivity. The main contributions for measuring firm-level total factor product (TFP) have been advanced by Levinsohn and Petrin (2003) and Olley and Pakes (1996). Traditionally, productivity has been looked at the deviation between observed output and the actual output predicted using Cobb-Douglas production function estimated using Ordinary Least Squares (OLS). Estimated productivity derived using OLS

approach are seen to have limitations, especially related to simultaneity- where the regressors and the error term are correlated hence biasing the OLS estimates upwards. The second limitation of OLS approach is the selection bias, which results from the relationship between productivity shocks and the probability of exit from the market. If there is a positive relationship between a firm's profitability and its capital stock, relative to small firms, firms with larger capital are more likely to stay in the market even when its productivity falls. When this is the case, then the coefficient on the capital variable will be biased downwards. To address the simultaneity and selection bias, Olley and Pakes (1996) pioneered an important approach. In the first case, they developed a consistent semi-parametric estimator which solves the simultaneity problem by using the firm's investment decision to proxy unobserved productivity shocks. In the second case, the use of survival probabilities is found to be novel. However, Olley and Pakes (1996) approach is only useful when estimating productivity of plants that report nonzero investment.

In this study, we use the alternative approach, pioneered by Levinsohn and Petrin (2003)[6] to derive productivity estimates. This approach uses intermediate input proxies instead of investment to estimate a production function. The advantage of using intermediate inputs as proxies is that almost all firms in our dataset report positive use of intermediate inputs, like materials. Additionally, intermediate inputs provide a link between the estimation strategy and economic theory because these inputs are not state variables. To this end, we derive our estimates of the production function using the levpet command in Stata, and obtain the estimates useful in the estimation of TFP in our data.

2.4.3 Export premia

There exist marked differences between exporters and non-exporters, even within narrowly defined industries. One key difference between exporting firms and non-exporting is that exporters receive export premia- export benefits, measured in-terms of productivity and profitability above what firms would receive had they not initiated international trade. Consequently, I estimate two measures of productivity between exporters and non-exporters, that is, total factor productivity and labor productivity. To achieve this we systematically estimate the equation of the following form:

$$\ln Z_{it} = \alpha + \beta \exp_{it} + \xi \text{size}_{it} + \phi \text{ownership}_{it} + \delta \text{age}_{it} + \psi_1 \text{industry}_{it} + \psi_2 \text{Country}_{it} + \psi_3 \text{year}_{it} + \mu_{it} \quad (2.3)$$

Where lnZ is the logarithm of the firm characteristics (total factor productivity-TPF, labor productivity, employment, average monthly wage, weighted average education, material usage and other input usage) being measured, i is the index of the firm, t is the index of the year, exp is a dummy variable for the current export status, equal 1 if the firm i exports in year t, 0 else). Size proxied by logarithm of employees, ownership, firm age, industry, country and year are dummies controlling for size, ownership status, age of the firm, industry, country and year effects, while μ_{it} is the error term.

The related question is whether new exporters, old exporters and exporters that stop exporting grow faster than non-exporters would also be investigated. The notion that exporters are more

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[6] See the annex for the comprehensive presentation of Levinsohn and Petrin (2003) method

productive than non-exporters also implies that exporters should grow faster than non-exporters and firms that cease to export in all firm characteristics. To compare productivity growth among exporters, non-exporters and firms that exit export market, we can estimate the following equation:

$$\Delta \ln Z_{it} = \alpha + \beta_1 S_{it} + \beta_2 B_{it} + \beta_3 St_{it} + Controls_{io} + \mu_{it} \qquad (2.4)$$

Where $\Delta \ln Z_{it}$ denote changes in firm characteristics (TPF, labor productivity, employment, average monthly wage, weighted average education, material usage and other input usage), $Control_{i0}$ is a vector of firm characteristics in year 0 and dummies for export status are defined as follows:

S_{it} =Start=1 if (Exports$_{i0}$ =0) * (Exports$_{it}$ = 1)

B_{it} =Both=1 if (Exports$_{i0}$ =1) * (Exports$_{it}$ = 1)

St_{it} =Stop=1 if (Exports$_{i0}$ =1) * (Exports$_{it}$ = 0)

In this case, non-exporting in both years becomes the reference category. The estimated coefficients, β_1, β_2 and β_3 give the estimated increase in the growth rates of new exporters, exporters in both years and firms that exit the export market relative to non-exporters in both years.

The results of equation (2.3) and equation (2.4) are shown on Table 2.5. Column 1 presents firm characteristics used to assess the differences between exporters and non-exporters, while column 2 presents estimates of exporter levels of performance. Column 3, 4 and 5 present growth rates of export starters (new entrants), continuing exporters and exporters who exit the export markets (exiters). We can observe that exporters have significant performance indicators in all measures, except for total factor productivity. Exporting firms have 4.8 percent higher labor productivity, 11.7 percent more capital intensive, pay on average 26.4 percent higher wages than non-exporters. Similarly, exporting involves working with more other intermediate inputs and intermediate materials, employing more skilled personnel and deploying more workers. Exporters use 8.3 percent more other intermediate inputs, 5.4 percent more intermediate materials and employ more skilled workers (34.4 percent) than non-exporters. Moreover, exporters employ 117.5 percent more workers than non-exporters. The above results would imply that exporting carries more advantages than participating in domestic markets.

Comparing growth rates, results show that total factor productivity of new exporters grows at 17.0 percent higher than non-exporters while older export firms grow 0.4 percent lower than non-exporters and exiting firms grow 4.3 percent. Labor productivity grows faster than old exporters, at 33.4 percent higher, while new exporters grow at 18.2 percent higher than non-exporters and export exiters have 15.0 percent lower productivity. However, capital intensity grows faster in older exporters 40.7 percent, lower in new exporters 3.0 percent and so low in export exiters, 32.6 percent; lower than non-exporters. On the other hand, wages grow 4.3 percent higher in new exporters, 1.3 percent lower in old exporters and 6.5 percent higher in exiters than in non-exporters, while real other inputs per workers grow 16.4 percent at new exporters, 23.7 percent in older exporters and 9.6 percent low in exiters than non-exporting firms. Similarly, real materials per worker grow 16.7 percent higher in new exporters, 32.7

percent higher in older exporters and 17.5 percent lower in firms that cease exporting activity. However, skills grow 51.0 percent lower in new exporters, 8.9 percent higher in older exporters, 13.4 percent higher in export exiters than non-exporting firms. Additionally, employment grows 0.7 percent in new exporters, 16.6 percent in older exporters and 13.4 percent lower in export exiters than non-exporters. The above result implies that new entrants into the export market have high productivity growth rates compared to old exporters and those that exit the export market. Firm who are old may sometimes continue to export even when they face negative growth rates in the hope that their performance may improve as exporting progresses on.

Table 2.5: Exporter premia:

Dependent variable	Levels	Growth Rates		
	Exporter	Start	Both	Stop
TFP	-0.041	0.170	-0.004	0.043
	(0.112)	(0.120)	(0.071)	(0.109)
Labor productivity	0.048	0.182	0.334*	-0.150
	(0.101)	(0.124)	(0.102)	(0.154)
Capital intensity	0.117	-0.030	0.407***	-0.326*
	(0.126)	(0.136)	(0.090)	(0.168)
Average monthly wage in US$ per worker	0.264***	0.043	-0.013	0.065
	(0.073)	(0.041)	(0.041)	(0.062)
Real other inputs per worker in US$	0.083	0.164	0.237**	-0.096
	(0.089)	(0.103)	(0.080)	(0.122)
Real materials per worker in US$	0.054	0.167	0.327**	-0.175
	(0.104)	(0.126)	(0.099)	(0.139)
Skills growth	0.340*	-0.510*	0.089	0.134*
	(0.172)	(0.203)	(0.150)	(0.095)
Employment	1.175***	0.007	0.166	-0.134*
	(0.097)	(0.044)	(0.051)	(0.059)

The regressions are in logs and include full controls; size, ownership, firm age, industry, country and year dummies. Standard errors are in parentheses. Significance levels are: * p<.05; ** p<.01; *** p<.001

2.4.4 The more productive firms go abroad

The estimates shown in table 2.5 clearly show that on average, exporters and non-exporters are quite different in all the characteristics observed. When we examine the difference in labor productivity and capital intensity between exporters and non-exporters, we see that exporters have superior characteristics compared to non-exporters. But does this mean that future exporters already possess desirable characteristics years before joining the export market? The answer obviously is no, because examining the mean differences alone may not give us clear productivity trajectory between exporters and non-exporters. It is well documented that the more productive firms go abroad and the low productive ones serve the domestic market. If good firms become future exporters, then we should expect that there are significant differences in performance measures between future export starters and future non-export starters several years before first exports occur. To address this, we test whether today's export starters were more productive than today's non-exporters several years back when all of them did not export. We track firms for a long horizon- five years before their first export activity occurred and select all

firms that did not export between year t and t-5 and compute average differences in productivity. Hence, we can write the estimation equation as:

$$\ln Z_{it-\lambda} = \alpha + \beta + \exp s_{it} + size_{it} + \psi Control_{it-\lambda} + \mu_{it}$$

(2.5)

Where $\ln Z_{it-\lambda}$ is the logarithm of the firm characteristic being measured $\exp s_{it}$ is a dummy variable (equal to 1 if firm *i* starts exporting in year t, 0 else), that is new exporters, $size_{it,}$ proxied by logarithm of employees, $Control_{it-\lambda}$ are vectors of dummy variables controlling for ownership, firm age, sector, year, country ownership, firm age, industry, country and year are dummies controlling for size, ownership status, age of the firm, industry, country and year effects, while μ_{it} is the error term.

The results reported in Table 2.6 show differences in levels between new export entrants and never export entrants. Column 1 presents the periods under review, while columns 2-8, present the estimates of TFP, labor productivity, capital intensity, wages, other inputs, materials, skills and employment. For every measure, except for total factor productivity, future exporters gain superior characteristics two years to export market entry, clearly depicting a pattern of self-selection. However, across the five years, future exporters already possess desirable characteristics in wages, skills and employment, rapidly gaining momentum two and one year to export market entry. Five years to export market entry, future exporters have 79.7 percent lower total factor productivity, 99.9 percent lower labor productivity, 27.0 percent lower capital, pay 12.8 percent higher wages, use 33.3 percent less inputs, work with 99.6 percent less materials per worker, but have 11.3 percent higher skills, and employ 24.8 percent higher workers than firms who chose not to export throughout the sample. This study suggests that the evidence on firm productivity is statistically significant but negative. However, firm size, wages and skills are positive and statistically significant. We can observe that, though the productivity coefficients on firm productivity are negative and statistically significant, other firm characteristics (firm size, wages and skills) are positive and statistically significant, suggesting a pattern of self-selection five years to export market entry.

Similarly, four years to export market entry, future exporters have 97.7 percent lower total factor productivity, 97.7 percent lower labor productivity, and use 25.7 percent lower capital, but pay 10.1 percent higher wages, use 27.8 percent less other inputs, use 96.2 percent less materials per worker, have 20.7 percent more skilled workers and employ 30.0 percent more workers than non-export starters. Just like in the fifth year, Moreover, three years to export market entry, total factor productivity of future exporters begin to improve slightly though 31.7 percent less than non-exporters, labor productivity is 45.0 percent lower, capital is 17.8 percent lower, wages are 12.9 percent higher, other inputs are 15.0 percent lower, materials per worker are 32.3 percent lower, while skills and employment are 19.3 percent and 31.1 percent respectively, higher than firms that choose not to initiate export market activity.

However, two years to joining the export market, future exporters improve their characteristics, although total factor productivity is 9.0 percent lower than non-exporters. Two years to export market entry, future exporters have 1.8 percent higher labor productivity, use 13.6 percent more capital, pay 28.0 percent more wages, use 11.8 percent more other inputs per worker, use 18.8

percent more materials per worker, employ 37.3 percent more skilled workers and employ 27.0 percent more workers than firms that decide not to export. One year to export market entry, future exporters have 7.5 percent less total factor productivity, 1.9 percent higher labor productivity, use 13.6 percent more capital, pay 27.3 percent more wages, use 21.6 percent more other inputs and materials, employ 28.2 percent more skilled worker and employ 40.2 percent more workers than non-exporters.

Table 2.6: Differences in levels between new entrants and never-entrants

Period	TFP	Y/L	K:L	Wages	Other inputs	Materials	Skills	Employ ment
Five years before entry(t-5)	-0.797** (0.264)	-0.999** (0.301)	-0.270 (0.341)	0.128 (0.195	-0.333 (0.333)	-0.996** (0.288)	0.113 (0.488)	0.248 (0.233)
Four years before entry t-4	-0.977*** (0.269)	-0.977** (0.302)	-0.257 (0.344)	0.101 (0.245)	-0.278 (0.244)	-0.962** (0.287)	0.207 (0.534)	0.300 (0.250)
Three years before entry(t-3)	-0.317 (0.214)	-0.450* (0.216)	-0.178 (0.252)	0.129 (0.162)	-0.150 (0.180)	-0.323 (0.221)	0.193 (0.291)	0.311 (0.182)
Two years before entry (t-2)	-0.090 (0.172)	0.018 (0.171)	0.136 (0.204)	0.280 (0.148)	0.118 (0.153)	0.188 (0.189)	0.373 (0.226)	0.270 (0.130)
One year to entry (t-1)	-0.075 (0.198)	0.019 (0.191)	0.136 (0.198)	0.273 (0.162)	0.216 (0.208)	0.216 (0.208)	0.282 (0.292)	0.402** (0.125)

*The measures are in logs and include full controls; size, ownership, firm age, industry, country and year dummies. Standard errors are in parentheses. Significance levels are; * p<.05; ** p<.01; *** p<.001*

Comparing the differences between future export starters and future never export starters, we evaluate whether future export starters grow faster than future never export starters in a run-up to export market entry. Thus, we investigate the pre-entry differences in growth rates between future export starters and future never export starters. If good firms initiate export activity, then there should be significant differences in performance measures between future export starters and future never export starters years before firms that initiate export activity begin to do so. To evaluate whether exporters today were more productive than never-exporters today, several years back when both of them did not export, I select all firms that did not export between periods t and t-1, t-1 and t-3 and finally between periods t-3 and t-5. I then compute the average difference in measures of interest between firms that did not export and those that exported in period t. Formally, I estimate the empirical model:

$$\Delta Z_{it} = \alpha + \beta \text{expn}_{it} + \lambda \text{size}_{it} + \delta \text{control}_{it} + \mu_{it} \qquad (2.6)$$

Where $\Delta Z_{it} \equiv Z_{it} - Z_{it-1}$, expn is an indicator variable that takes value of one if the plant exports for the first time in period, size_{it} is the log of number of employees of the firm, control is vector of industry, country and year dummies, while μ_{it} is the error term

The results reported in Table 2.7 show differences in growth rates between new export entrants and non-export entrants. Column 1 presents the periods under review, while columns 2-8, present the estimates of TFP, labor productivity, capital intensity, wages, other inputs, materials, skills and employment.

For the measure of total factor productivity, future export starters grow 7.1 percent, lower than never exporter in the period between t-3 and t-5. However, between period t-1 and t-3, growth rate rises to 9.3 percent and drops to 0.1 percent between period t and t-1 relative to never export starters. Labor productivity is the most significant measure in throughout the time horizon; in period between t-3 and t-5, it increased by 33.7 percent higher than never export starters. Similarly, between t-1 and t-3, it changed by 25.7 percent relative to never export starters, and between t and t-1, labor productivity changed by 93.4 percent. Furthermore, future export starters have 11.5 percent lower growth in the period between t-3 and t-5, but gain higher growth rates of 22.4 percent between t-1 and t-3, and 103.5 percent in the run-p to export market entry, that is, between period t and t-1. In the period t-3 and t-5, wages grew at 18.2 percent and 3.9 percent in period t-1 and t-3, higher than never export starters. However, wages dropped to 23.1percent in the run-up to export market entry, period t and t-1.

When other inputs are analyzed, future export starters, have a lower growth rate of input use. In periods t-3 and t-5, there is a recorded drop in growth of 2.7 percent, dropping again by 1.5 percent between t-3 and t-1, and dropping further by 87.6percent in the run-up to export market entry, between period t and t-1. Material use dropped by 17.3 percent in future export starters between period t-3 and t-5, but rose by 32.5 percent between period t-1 and t-3, rising further by 73.9 percent in the run-up to export market entry, that is, period t and t-1. Skill growth in future export starters recorded a growth of 53.1 percent higher than never export starters, but dropped temporarily to 5.5percent between t-1 and t-3 before rising to 5.3 percent between t and t-1. Employment grew 7.9 percent lower in future export starters relative to future never exporters between t-3 and t-5, but grew 22.8 percent faster in period between t-1 and t-3, and further by 56.7 percent faster than future never export starters between period t and t-1.

Table 2.7: Differences in growth rates between new entrants and non-entrants

Period	TFP	Va/L	K:L	Wages	Other materials	Materials	Skills growth	Employment growth
Five years before entry (t-5)	-0.071 (0.316)	0.337 (1.290)	-0.115 (0.742)	0.182 (0.300)	-0.027 (0.652)	-0.173 (0.753)	0.531 (0.754)	-0.079 (0.395)
Three years before entry (t-3)	0.093 (0.253)	0.257 (0.514)	0.224 (0.456)	0.039 (0.171)	-0.015 (0.386)	0.325 (0.475)	-0.055 (0.433)	0.228 (0.210)
One year to entry (t-1)	-0.001 (0.185)	0.934** (0.297)	1.035*** (0.271)	-0.231* (0.073)	0.876** (0.242)	0.739** (0.279)	0.053 (0.237)	0.567** (0.126)

The measures are in logs and include full controls; size, ownership, firm age, industry, country and year dummies. I exclude firm size in the estimation of employment. Standard errors are in parentheses. Significance levels are; * p<.05; ** p<.01; *** p<.001

2.4.5 Performance and growth of new exporters after entry

Theoretical and empirical evidence shows firms that engage in international trade have superior performance than those who sell in domestic markets only. Exporting is shown to have a significantly positive effect on the productivity of firms, with anecdotal evidence showing that individual firms improve their productivity as a result of export market participation- a phenomenon that is referred to as learning-by-exporting. The evidence on learning-by-exporting is not conclusive as some studies have shown the absence of learning-by-exporting (Clerides et

al., 1998; Bernard and Jensen, 1999). If we observe substantial improvements in productivity indicators in exporting firms, we may not conclude that exporting improves productivity. If exporting leads to success, relative to non-exporting, we should expect today's exporters to have superior characteristics and persistence in productivity growth, *ceteris paribus*. Correspondingly, if firms have better productivity indicators before they begin exporting, then future exporters should possess better productivity indicators and faster growth rates years before they join the export market. In effect, we should expect to see some persistence in productivity improvements and growth rates such that on average exporters would perform better in future even if they would not start to export today (self-selection bias).

The problem is that we do not observe whether these firms would really perform better because they start to export today for lack of data for the counterfactual situation. Comparatively, it is difficult to identify what would have happened to the firm if it had decided not to export in the future. To overcome this counterfactual, we construct a control group in such a way that every treated unit is matched to an untreated unit that has been as similar as possible at the time before the treatment. The calculated differences between the two matched groups based on observable measures like labor productivity, total factor productivity or employment can then be attributed to the treatment (Heckman et al., 1999). This then means that firms can be assigned into two groups: the treated group that received the treatment (firms that entered the export market at period t, and exported in periods; t+1, t+2, t+3, t+4, or t+5) and the control group that did not receive the treatment (did not export throughout the sample), such that:

$$p(x) = prob(D = 1 \mid x) = E(D \mid x) \tag{2.7}$$

Where p(x) is the probability of receiving the treatment, D is a binary variable that determines if the firm received the treatment or not, D=1 represents treated firms and D=0 are the control group. We can define our propensity score matching as a conditional (predicted) probability of receiving a treatment given pretreatment characteristics (Rosenbaum, 1983). The objective now is to evaluate the causal effect of exporting on some productivity measure ($\Delta\omega$), which in this case is the outcome we are interested in, such that:

$$\Delta\omega^1_{it+v} - \Delta\omega^0_{it+v} \tag{2.8}$$

Where $\Delta\omega^1_{it+v}$ is the outcome at period t+v, $v \geq 0$ following export market entry, $\Delta\omega^0_{it+v}$ is the outcome if the firm had not started exporting. Naturally, the critical problem of causal inference is that for each firm, we can observe only $\Delta\omega^1_{it+v}$ but not $\Delta\omega^0_{it+v}$ because each firm at a particular point in time will receive either treatment or will be in control group, but not both (Holland, 1986). In this case, estimation of causal effects can be thought of as dealing with a missing data problem where one's objective is to estimate the unobserved potential outcomes (Rubin, 1976a).Specifically, the treatment does not affect the control group, and for observational studies, the outcomes are independent of the treatment, conditional on X, that is:

$$\omega^0, \omega^1 \; D \perp x$$

Denote $\exp_{it} \in \{1, 0\}$ as dummy variable of whether firm i entered the international market for the first time at period t, we can estimate the average effect of exporting on export market entrants, such that:

$$ATT = E\left\{\Delta\omega^1_{it+v} - \Delta\omega^0_{it+v}\Big|\exp_{it} = 1\right\} = E\{\Delta\omega^1_{it+v}|\exp_{it} = 1\} - E\{\Delta\omega^0_{it+v}|\exp_{it} = 1\} \qquad (2.9)$$

Equation (9) is helpful in the estimation of the observed outcome $\left\{\Delta\omega^1_{it+v}|\exp_{it} = 1\right\}$, however our causal inference will be meaningful if proper construction of the counterfactual for the unobserved portion of equation (2.9), $E\{\Delta\omega^0_{it+v}|\exp_{it} = 0\}$, which is the average outcome entrants would have received had they not initiated export activity. To estimate $E\left\{\Delta\omega^0_{it+v}|\exp_{it} = 1\right\}$, we analyze a corresponding average value of never exporters such that:

$$E\{\Delta\omega^0_{it+v}|\exp_{it} = 0\} \qquad (2.10)$$

We can then specify a valid control group based on the observable characteristics and pre-entry level value of the outcome variable ω_{it-1}. Based on our knowledge of determinants of productivity growth, we then estimate the export probability function using a probit model. As in Rosenbaum and Rubin (1983), I use propensity score matching approach, as follows:

$$P(\exp_{it} = 1) = G(X_{it-1}, C) \qquad (2.11)$$

In this case, equation (2.11) indicates the probability that a firm initiates export activity based on function G. X_{it-1} represent the vector variables of interest and C is the full set of controls (size, firm age, ownership, sector, year, and country dummies). P ($\exp_{it}$=1), denotes the predicted probability of exporting at t for firm i, which is an ultimate exporter. I use the nearest-neighbor matching method with caliper, and then select a non-exporter firm who is "closest" to ultimate exporter in terms of its propensity score. More formally, for each new entrant firm i exporting to country f, a non-exporter firm j is selected such that:

$$\left|p^f_{it} - p^f_{jt}\right| = \min_{k \in \{\exp=0\}} \left\{p^f_{it} - p^f_{jt}\right\} \qquad (2.13)$$

This method of matching has the advantage of being easy to implement and less likely to be affected by selection bias. Moreover, the nearest neighbor matching nearly estimates the Average Treatment of the Treated (ATT) always because it matches control individuals to the treated group and discards controls that are not selected as matches. Additionally, common support condition in the matching algorithm is used and involves dropping entrants whose propensity score is higher than the maximum or less than the minimum of the control group. I then estimate equation (2.9) which gives the possible effects of exporting on performance of new export entrants. Moreover, I augment the findings using difference-in-differences approach to improve the reliability of the results. Blundell and Dias (2000) observe that the combination of matching and difference-in-differences (DID) generally improves the quality of non-experimental evaluation studies.

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The difference-in-differences method involves observation of outcomes for two groups for two time periods; the starting period and ending period-here denoted as pre and post. One group receives the treatment in the second period and not in the first period, while the second group does not receive any treatment in either period. The objective is to evaluate the impact of the treatment; thus if the same units within the group are observed in each period, then we can subtract the average change in the second (control) group from the average change in the first (treated) group. Formally, the difference-in-differences estimation can be written as:

$$\varphi_1 = (\varpi_{11} - \varpi_{10}) - (\varpi_{01} - \varpi_{00}) \tag{2.14}$$

Where φ_1 represents the impact or outcome variable, $(\varpi_{11} - \varpi_{10})$ is the outcome for the treated group and $(\varpi_{01} - \varpi_{00})$ denotes the outcome for the control group. Generally, the use of difference-in-differences removes effects of prevalent shock, presenting us with valid estimates of the treatment outcomes (De Loecker, 2007). I estimate Eq. (2.14) using difference-indifferences method and present results in table 9.

To conclude, I use a combination of matching and difference-in-differences to improve the quality of my results, since the expected outcomes cannot solely be attributed to the average treatment before and after the treatment as other factors contemporaneous with the treatment might be captured in the matching process.

The results are for Eq. (2.9) are presented in Table 2.8. The results show that new export entrants outperform non-export entrants in all the measures except for wages, in the year of entry. In the year of entry total factor productivity is 0.5percent, labor productivity is at 18.7 percent, capital intensity is at 17.6 percent, other inputs is 13.6 percent, materials is at 26.0 percent, skills is at 24.1 percent and employment is at 59.4 percent, higher than non-entrants. This finding confirms that new export entrants perform better when they start exporting.

However, this study is interested in tracking the performance of new entrants through the first five years of their exporting, if they remain in the export market. In the first year after entry, export entrants have still higher performance compared to non-export entrants, although total factor productivity and wages that are slightly lower than non-exporters. Total factor productivity is 6.8 percent while the level of wages is at 12.7 percent, lower than non-export entrants. The rest of the measures are positive and statistically significant. Thus, labor productivity is 12.8 percent higher, capital intensity is 19.9 percent higher, other inputs is 11.7 percent, materials is 12.2.4 percent higher, skills is at 46.5 percent and employment is at 51.4 percent. Similarly, in the second year after export market entry, new entrants continue to perform better than non-export entrants. Total factor productivity is now at 16.2 percent, labor productivity is at 33.7 percent, capital intensity is at 15.5 percent, other inputs is at 11.7 percent, materials is at 19.4 percent, skills is at 21.6 percent and employment is at 75.5 percent, higher than non-export entrants. In the third year after entry, performance of export entrants continues with a few variations. There is a marked drop in total factor productivity, labor productivity, other inputs usage, and material usage. Total factor productivity, labor productivity, other inputs and materials are now at 48.3 percent, 27.1 percent, 13.2 percent, and 43.3 percent lower than non-export entrants. Conversely, the rest of the measures continue to be positive and significant.

Capital intensity is at 24.6 percent, wages is at 6.6 percent, skills are at 63.4 percent, and employment is at 15.5 percent higher than non-export entrants.

In the fourth year, new export entrants expand their presence in the export market, achieving improvements in productivity and other measures. For-instance, total factor productivity, labor productivity, and capital intensity, all expanded to 104.9 percent, 110.3 percent and 2.6 percent respectively. Similarly, we observe improvement in other firm characteristics. For-instance, wages, other inputs, materials, skills and employment level rose to 17.0 percent, 103.4 percent, 84.7 percent, 151.5 percent and 51.8 percent respectively. We can suggest that new export entrants expanded their presence and performance after export market entry as a consequence of the learning mechanisms. In the fifth year, performance of new export entrants expands further, reaching impressive levels in all measures of productivity and other firm characteristics. Total factor productivity is now at 109.6 percent, labor productivity is at 198.9 percent, capital intensity is at 4.5 percent, wages is at 17.7 percent, other inputs is at 161.8 percent, materials is at 174.3 percent, skills is at 34.6 percent, and employment is at 72.3 percent; higher than non-export entrants.

Generally, the results of the propensity matching method show that new export entrants display significant performance during export market entry and continue to do so over the five-year period. This finding is indicative of the learning-by-exporting mechanism, and above all, we can observe the pattern of new export entry which is consistent with that displayed by the Colombian new entrants (Eaton et al., 2008).

Table 2.8: Matched results of new export entrants over five years

Period	TFP	Va/L	K:L	Wages	Other inputs	Material	Skills	Employ ment
	ATT	ATT	ATT	ATT	ATT	ATT	ATT	ATT
Entry year (t): C=2540;T=193	0.005 (0.616)	0.187 (0.522)	0.176 (0.497)	-0.056 (0.176)	0.136 (0.418)	0.260 (0.582)	0.241 (0.520)	0.594** (0.280)
One year after (t+1);C=2466; T=271	-0.068 (0.522)	0.128 (0.560)	0.199 (0.595)	-0.127 (0.198)	0.117 (0.448)	0.122 (0.568)	0.465 (0.509)	0.514 (0.284)
Two yrs after (t+2);C=2528; T=209	0.162 (0.554)	0.337 (0.491)	0.155 (0.512)	-0.039 (0.205)	0.117 (0.404)	0.194 (0.521)	0.216 (0.551)	0.755* (0.306)
Three yrs after (t+3); C=2607 T=130	-0.483 (0.754)	-0.271 (0.675)	0.246 (0.705)	0.066 (0.238)	-0.132 (0.519)	-0.433 (0.496)	0.634 (0.671)	0.155 (0.391)
Four yrs after (t+4); C=2654 T=83	1.049 (1.036)	1.103 (0.929)	0.026 (0.735)	0.170 (0.239)	1.034** (0.643)	0.847 (0.888)	1.515*** (0.272)	0.518 (0.376)
Five after (t+5);C=2664; T=73	1.906 (1.412)	1.989 (1.221)	0.045 (0.941)	0.177 (0.310)	1.618** (0.813)	1.743 (1.120)	0.346 (0.715)	0.723 (0.472)

*The measures are in logs and include full controls; size, ownership, firm age, industry, country and year dummies. Standard errors are in parentheses. C is the control group, T is the treated group. Significance levels are; * p<.05; ** p<.01; *** p<.001*

To improve the quality of my results, I combine matching and difference-in-differences (DID) and estimate Eq. (2.14) to remove all differences in unobserved characteristics that are constant over time which could affect the intended outcomes in a significant manner. The results are presented in Table 9. As before, column 1 is period being measured, columns 2-8 denote the firm characteristics (total factor productivity, labor productivity, capital intensity, wages, other inputs, materials, skills and employment).

We can clearly observe that the quality of the matching process has greatly improved our results. It is now clear that, in the year of export market entry, new export entrants have high total factor productivity, now at 54.2 percent. However, the rest of other measures have negative signs (except skills), but statistically significant. One year after entry, new export entrants continue to improve their productivity and perform better than non-export entrants. We can now observe that total factor productivity is at 31.2 percent, labor productivity is at 104.9 percent, capital intensity is at 81.4 percent, other inputs is at 100.0 percent, and materials is at 65.4 percent, higher than non-export entrants. It is important to note is that, new export entrants begin to improve their productivity, one year after entry.

Correspondingly, we can observe a significant increase in the level of all measures two years after export market entry. The results show that the level of total factor productivity is now at 47.3 percent, labor productivity is at 137.1 percent, capital intensity is at 102.2 percent, wages is at 4.1 percent, other inputs is at 95.3 percent, materials is at 98.6 percent, skills is at 41.4 percent and employment is at 27.7 percent, higher than non-export entrants. We observe that new export entrants are now beginning to expand their productivity level in the second year, reaching levels that are higher than those achieved in the previous years.

In the third year after entry, the performance of new export entrants is still superior to non-export entrants. Total productivity level is 92.7 percent, labor productivity is at 237.8 percent, capital intensity is at 167.8 percent, other inputs is at 167.8 percent, materials is at 186.6 percent, skills is at 12.2 percent and employment is at 31.0 percent higher than non-export entrants. However, the level of wages now is 11.7 percent lower than non-export entrants. In the third year, we can see that the productivity level of new export entrants has increased tremendously reaching levels that provide these firms with possibility of surviving in the export market longer than expected. This finding is suggestive of new exporter dynamics consistent with that displayed by the Colombian new export entrants as shown by Eaton et al. (2008). This finding may suggest that new export entrants who did not exit the export market in the first and second years, have learnt how to deal with the stiff competition in these markets. The experience they gained in the previous years of export market participation has enabled them to cut down on inefficiencies and reorganize the production process, hence creating a sustainable plan or strategy of export market survival.

In the fourth year after entry, new export entrants continue to expand their performance levels in all measures except wages and skills have now dropped to 12.7 percent and 5.9 percent respectively, lower than non-export entrants. However, total factor productivity level is at 69.0 percent, labor productivity is at 85.6 percent, capital intensity is at 32.7 percent, other inputs is at 59.2 percent, materials is at 48.8 percent and employment is 6.4percent, higher than non-export entrants. Finally, we observe that the performance of new export entrants continues to be

impressive even in the fifth year, whereby, total factor productivity level is 75.1 percent, labor productivity is 82.8 percent, capital intensity is at 18.1 percent, other inputs is 54.7 percent, materials is 36.5 percent and employment is 25.6 percent, higher than non-export entrants. This finding can be interpreted as indicative of the learning-by-exporting pattern as suggested by Eaton et al. (2008).

Table 2.9: Difference-in-differences results of new export entrants over period of five years

Period	TFP	Va/L	K:L	Wages	Other inputs	Material	Skills	Employ ment
	ATT	ATT	ATT	ATT	ATT	ATT	ATT	ATT
Entry year (t)	0.540	-0.479	-0.911	-0.272	-0.360	-0.306	0.059	-0.539
	(0.414)	(0.768)	(0.728)	(0.318)	(0.586)	(0.726)	(0.601)	(0.421)
Observations	5807	6540	6603	4716	6465	6421	4117	6937
One year after (t+1)	0.312	1.049**	0.814*	-0.672*	1.000***	0.654	-0.387	-0.296
	(0.276)	(0.483)	(0.470)	(0.239)	(0.368)	(0.457)	(0.394)	(0.266)
Observations	5807	6540	6603	4716	6465	6421	4117	6937
Two years after (t+2 Observations)	0.473*	1.371**	1.022**	0.041	0.953**	0.986**	0.414	0.277
	(0.237)	(0.416)	(0.403)	(0.196)	(0.317)	(0.394)	(0.338)	(0.230)
	5807	6540	6603	4716	6465	6421	4117	6937
Three years after (t+3)	0.927**	2.378***	1.678**	-0.117	1.678**	1.866**	0.122	0.310
	(0.303)	(0.531)	(0.516)	(0.296)	(0.404)	(0.502)	(0.434)	(0.297)
Observations	5807	6540	6603	4716	6465	6421	417	6937
Four years after(t+4)	0.690*	0.856	0.327	-0.127	0.592	0.488	-0.059	0.064
	(0.328)	(0.564)	(0.548)	(0.294)	(0.428)	(0.533)	(0.499)	(0.323)
Observations	5806	6539	6602	4715	6464	6420	4117	6936
Five years after(t+5)	0.751*	0.828	0.181	-0.154	0.547	0.365	-0.593	0.256
	(0.353)	(0.611)	(0.594)	(0.325)	(0.463)	(0.385)	(0.533)	(0.350)
Observations	5807	6540	6603	4716	6465	6421	4117	6937

The measures are in logs and include full controls; size, ownership, firm age, industry, country and year dummies.
*Standard errors are in parentheses. Significance levels are; * p<.05; ** p<.01; *** p<.001*

Overall, the study finds evidence that African manufacturing firms that initiate export activity in the international market display better productivity and performance after entry and those that survive in the market for more than one year after entry expand further their productivity and performance through to the fifth year. When we view total factor productivity and labor productivity estimates, we can confirm the advantage new export entrants have over never export entrants, a pattern that is shown by other previous studies (Eaton et al., 2008). This study is also interested in examining whether new entrants into the export markets grow at all when they initiate exporting activities. I trace new entrants for five years and match their growth rates at some intervals against never new entrants. Specifically I assess growth rate between year of

entry and a year after entry ($\frac{t+1}{t}$), between one year after and third year after ($\frac{t+3}{t+1}$), between third year and fifth year ($\frac{t+5}{t+3}$). Specifically, I estimate the following equation:

$$\%\Delta Z_{\substack{t+\Omega \\ t+\zeta}} = \frac{1}{n}(\ln Z_{it+1} - \ln Z_{it}) = \alpha + \beta_1 \text{expn} + \phi\text{size}_{it} + \Upsilon\text{Controls}_{it} + \varepsilon_{it} \qquad (2.15)$$

Where %ΔZ is the percent change in measures of interest, expn is an indicator variable equal one if firm i entered export market at time t (new export entrant), size is the logarithm of employees at time t+ζ, Controls are vectors of dummy variables controlling for ownership, firm age, sector, country and year effects respectively. Parameters Ω and ζ are important measures of growth rates, as growth rates are set in periodic intervals such that these parameters take successive values of (5;3;1) and (3;1;0). I am interested in testing whether there is a significant difference in mean growth rates between new export entrants and never export entrants. Consequently, a significant and positive sign for β_1 would indicate that new export entrants enjoy higher growth rates in percent relative to never export entrants over a long period of exporting activity.

The results of matched new entrants are presented in Table 2.10. As before, column 1 is the period while columns 2-8 denote firm measures (total factor productivity, labor productivity, capital intensity, wages, other inputs, materials, skills and employment). The estimates between year of entry and one year after show superior growth rates of new entrants relative to never entrants; total factor productivity grows at 16.0 percent, labor productivity growth rate is at 55.8 percent, capital intensity is at 45.0 percent, other intermediate inputs are at 49.4 percent, materials usage is at 51.7 percent and employment is at 18.0 percent higher than never entrants. However, the growth rates of wages and skills are lower at 10.3 percent and 30.0 percent respectively, lower than never entrants. Between the first and third years, new entrants continue to grow but a decreasing rate. Total factor productivity growth rate is at 2.8 percent, labor productivity at 5.4 percent, capital intensity and wages are at 4.4 percent, other inputs usage growth rate is at 0.8 percent, materials is at 10.8 percent and employment is at 3.2 percent higher than never entrants. However, these growth rates are lower than those in the first interval. Skills growth is still slow at 4.1 percent and lower than never entrants. Conversely, between third and fifth interval, the growth rates of new entrants worsen, except for capital intensity, wages, other intermediate inputs and employment which are still significant and positive, at 5.4 percent, 0.8 percent, 3.0 percent and 2.1 percent respectively, relative to never entrants. However, total factor productivity growth at 3.9 percent, labor productivity at 2.9 percent, materials at 2.1 percent and skills at 1.2 percent, are all significant but negative, implying that never entrants grew faster than new entrants in these measures.

Table 2.10: Growth rates of new entrants after entry into the export market

Period	TFP	Va/L	K:L	Wages	Other Inputs	Materials	Skills	Employment
$\dfrac{t+1}{t}$	0.160 (0.114)	0.558** (0.163)	0.450* (0.176)	-0.103 (0.074)	0.494* (0.136)	0.517* (0.156)	-0.300 (0.264)	0.180 (0.059)
$\dfrac{t+3}{t+1}$	0.028 (0.065)	0.054 (0.113)	0.044 (0.108)	0.044 (0.052)	0.008 (0.102)	0.108 (0.105)	-0.041 (0.169)	0.032 (0.056)
$\dfrac{t+5}{t+3}$	-0.039 (0.045)	-0.029 (0.092)	0.054 (0.085)	0.008 (0.037)	0.030 (0.074)	-0.021 (0.085)	-0.012 (0.115)	0.021 (0.039)

The measures are in logs and include controls; size, ownership, firm age, industry, country and year dummies.
*Standard errors are in parentheses. Significance levels are; * p<.05; ** p<.01; *** p<.001*

2.4.6 The growth rates of new entrants that stay, intermittent entrants and entrants who exit.

Exporting firms do not engage in international markets throughout their life time. There are seasons when exporting does not carry any advantage at all and firms may cease exporting activity temporarily or exit the export market altogether. Studies have shown patterns where new export entrants grow rapidly in the first year of exporting but this growth begins to wane thereafter. Such plants will either continue to export (stay in export market) despite the low benefits they receive from exporting, cease international market engagements temporarily (intermittent exporters/entrants) or exit the export market altogether. I am interested in understanding how new entrants performance after entry into the export market. I therefore divide my sample of new entrants into three categories; firs, entrants who stay in export markets (new entrants who stay), second, entrants who export for short while and temporarily, only to rejoin again (intermittent entrants); third, entrants who start exporting but exit the export markets shortly afterwards (exiters). I then assess the mean differences in growth rates between entrants who stay, entrants that cease exporting temporarily and rejoin later, and finally entrants that exit the export market. I trace the growth rates of these groups for two intervals, period and period and once again, estimate eq. (2.15).

The results are presented in Table 2.11. Column 1 denotes firm status; column 2 is the period, while columns 3-6 are the firm measures of our interest (total factor productivity, labor productivity, capital intensity, wages, skills and employment). These results show that new entrants that stay and continue exporting grow rapidly and continue to expand themselves in almost all measures of productivity. Tracing new entrants that stay, we find that between period t and t+1, labor productivity growth rate is positive and statistically significant, at 48.5 percent, capital intensity is at 58.6 percent and employment growth is at a rate of 23.8 percent. However, the growth rate of total factor productivity, wages and skills is significant but with a negative sign. This may imply that new entrants that stay in export markets are still learning what takes place in the export market and are yet to adjust their productivity in a much more significant manner. If this interpretation is correct, then we should expect these new export entrants to improve their productivity growth in the following period of our examination. We can now observe clearly that new entrants that stay have positive productivity growth between period t+1 and t+3. They expand their growth rates in all measures of interest during this period. Total

factor growth rate is at 4.3 percent, labor productivity growth rate is at 62.6 percent, capital intensity growth rate is at 62.8 percent, wages and skills have now grown by 1.6 percent and 5.1 percent, and employment expands further by 30.4 percent. We clearly see that, new export entrants continue to improve their growth rates when they continue to engage in the international markets.

Assessing the performance of intermittent entrants, between period t and t+1, these firms experience poor growth rates in almost all measures except wages and employment which still remain at growth rates of 10.2 percent and 11.4 percent. Total factor productivity growth rate has fallen by 11.2 percent, labor productivity dropped by 42.6 percent, capital intensity dropped by 40.0 percent and skills dropped by 6.1 percent. In the period between t+1 and t+3, intermittent firms improve their growth rates, but not to the level of entrants that stay. Labor productivity grows by 1.9 percent, capital intensity grows by 4.4 percent and wages grow by 6.0 percent. However, the growth rates of other measures are significant but with a negative. Total factor productivity growth rate dropped by 0.9 percent, skills dropped by 28.1 percent and employment dropped by 0.9 percent. Examining these growth rates, it is plausible to suggest that firms that export intermittently may be experiencing some negative productivity shocks that cause them to shut down exporting temporarily, but as the effect of such shocks fade, they restart exporting. When the effect of the shock is large, a firm that experienced this large shock may become an export exiter.

Analyzing the performance of firms that exit the export market, between period t and t+1, these firms experience significantly negative growth rates in almost all characteristics except intermediate materials and skills where the growth rates are significant and positive, at 12.3 percent and 7.4 percent respectively. Total factor productivity dropped by 14.6 percent, labor productivity dropped by 41.9percentae points, capital intensity and employment all dropped by 44.6 percent and 15.1percent. Similarly, between period t+1 and t+3, firms that exit international markets experience negative growth rates in all measures of interest. Total factor productivity dropped by 2.5 percent, labor productivity dropped by 38.0 percent, capital intensity dropped by 39.5 percent, wages dropped by 8.9 percent, skills and employment both dropped at 9.3 percent and 7.5 percent respectively.

Table 2.11: Growth rates of new entrants that stay, intermittent and exit export markets

			Growth Rates					
Firm	**Period**		**TFP**	**Va/L**	**K:L**	**Wages**	**Skills**	**Employ ment**
New entrants that stay	One year after $\dfrac{t+1}{t}$		-0.086 (0.118)	0.485* (0.217)	0.586* (0.201)	-0.076 (0.078)	-0.705** (0.284)	0.238 (0.086)
	Three years after $\dfrac{t+3}{t+1}$		0.043 (0.086)	0.626** (0.148)	0.628** (0.141)	0.016 (0.048)	0.051 (0.136)	0.304 (0.073)
Intermittent entrants	One year after $\dfrac{t+1}{t}$		-0.112 (0.158)	-0.426* (0.276)	-0.400 (0.325)	0.102 (0.143)	-0.061 (0.251)	0.114 (0.114)
	Three years after $\dfrac{t+3}{t+1}$		-0.009 (0.083)	0.019 (0.112)	0.044 (0.142)	0.060 (0.072)	-0.281 (0.148)	-0.009 (0.083)
Exiters	One year after $\dfrac{t+1}{t}$		-0.146 (0.145)	-0.419* (0.224)	-0.446* (0.224)	0123 (0.103)	0.074 (0.193)	-0.151 (0.85)
	Three years after $\dfrac{t+3}{t+1}$		-0.025 (0.080)	-0.380* (0.121)	-0.395* (0.108)	-0.089 (0.061)	-0.093 (0.101)	-0.075 (0.055)

*The measures are in logs and include controls; size, ownership, firm age, industry, country and year dummies. Standard errors are in parentheses. Significance levels are; * p<.05; ** p<.01; *** p<.001*

2.4.7 The size of the firm and growth relationship before and after export market entry

The relationship between firm size and firm growth has been a subject of much debate with studies showing contradicting results. In some developed economies, like the United States of America, firm dynamics are known to follow a particular pattern where firms enter, on average, at a relatively small-scale and with lower productivity. Many of the new entrants exit shortly after entering the export market while those who survive beyond the first year of their export debut expand further their productivity and size. Nonetheless, economic theory has long had a traditional view that the relationship between the size and growth of firms should involve the optimum size of the firm and is a negative one in the long-run (Singh and Whittington, 1975). This negative relationship occurs because large firms are assumed to be at or near their optimum size and as such must grow slowly, with a possibility of shrinking if they exceeded their optimum size. Thus, with the recent availability of firm-level data, it has been possible to evaluate the effect of size on firm export market entry. We can evaluate the fact that large and mature firms should be able to grow faster than firms of other sizes (classes). To do that, I divide my sample into four categories, (1) large sized firms, being firms who employ one hundred of more employees, (2) Medium sized firms, being those who employ fifty or more but less than one hundred employees, (3) small sized firms, being firms that employ between ten or more, but less than fifty employees and (4) micro sized firms, being firms that employ one or more, but less than ten employees. If large firms grow faster, then they should display higher productivity years before starting to export today. To understand the size effect on firm growth, I estimate the following equation:

$$\Delta Z_{it-5} = (\ln Z_{it+1} - \ln Z_{it}) = \alpha + \beta_1 \text{expn} + \lambda \text{size}_{it} + \Upsilon \text{Controls}_{it} + \mu_{it} \qquad (2.17)$$

Where $\Delta Z_{it} \equiv Z_{it} - Z_{it-5}$ is the change in measures of interest as a result of size, size_{it} denotes the logarithm of employees expn is an indicator variable equal one if firm i entered export market at time t (new export entrant), Controls are vectors of dummy variables controlling for ownership, firm age, sector, country and year effects respectively, and μ_{it} is the error term.

The results are shown in Table 2.12. Column 1 is size class, while columns 2-8 are the firm measures (total factor productivity, labor productivity, capital intensity, wages, other inputs, materials, skills and employment). For all measures of productivity, large firms grow faster than firms of other sizes. Tracing future export starters for a period of five years, their total factor productivity grows by 3.3 percent, labor productivity grows by 3.6 percent, capital intensity grows by 4.3percent higher than future never export starters. Other intermediate inputs and materials grow at 4.6 percent and 12.2 percent respectively and employment grows at 10.7percent; faster than future never export starters. However, wages grow more slowly; at 0.2 percent lower than future never export starters. Analyzing the result from medium sized firms, we observe that total factor productivity grows at 6.4 percent, labor productivity at 2.3 percent, capital intensity at 1.3 percent, while wages grow more slowly at 3.0 percent; other intermediate inputs grow at 0.1 percent, materials at 8.1 percent, while skills and employment grow slowly at 6.0 percent and 2.9 percent respectively, lower than never entrants. For the measures of interest, small firms grow slowly relative to firms of other classes. Total factor productivity at 5.9 percent low, labor productivity is 4.3 percent lower, capital intensity is 4.4 percent lower, while wages are 4.3 percent higher, other inputs, are 5.2 percent lower, materials grow at 5.5 percent lower, while skills and employment grow 2.0 percent and 1.3 percent lower than other firms of other sizes. Similarly, micro firms display lower growth rates in all measures of interest. Total factor productivity grows at 3.9 percent lower, labor productivity grows at 1.6 percent lower, capital intensity grows at 1.1 percent lower , wages grow at 1.3 percent lower, other inputs grow at 6.7 percent lower, materials grow at 0.9 percent lower, while skills and employment grow at 4.2 percent and 6.5 percent lower than firms of other sizes.

Table 2.12: The growth rate of firms by size before entry into the export market.

Size class	TFP	Va/L	K:L	Wages	Other inputs	Materials	Skills growth	Employment growth
Emp>=100	0.033	0.036	0.043	-0.002	0.064	0.046	0.122*	0.107
	(0.059)	0.024)	(0.026)	(0.037)	(0.031)	(0.028)	(0.025)	(0.039)
Emp>=50<100	0.064	0.023	0.013	-0.030	0.001	0.081	-0.060	-0.029
	(0.060)	(0.027)	(0.030)	(0.030)	(0.034)	(0.028)	(0.184)	(0.051)
Emp>=10<50	-0.059	-0.043	-0.044	0.043	-0.052	-0.055	-0.020	-0.013
	(0.063)	(0.028)	(0.028)	(0.038)	(0.038)	(0.030)	(0.204)	(0.054)
Emp<=1>10	-0.039	-0.016	-0.011	-0.013	-0.067	-0.009	-0.042	-0.065
	(0.034)	(0.018)	(0.017)	(0.024)	(0.119)	(0.021)	(0.109)	(0.030)

*The measures are in logs and include controls; ownership, firm age, industry, country and year dummies. Standard errors are in parentheses. Significance levels are: * p<.05; ** p<.01; *** p<.001*

2.4.8 The size of the firm and growth relationship after export market entry

Empirical studies in most developed economies have established that the distribution of firm size at any point in time match closely Gibrat's rule of proportional effect; that all firms grow independent of its size. This implies that, irrespective of firm size, all firms have a yearly growth rate drawn from the distribution of growth rates. Studies using firm-level data have shown contradictory results on the relationship between firm size and its growth. Sleuwaegen and Goedhuys (2002) establish that larger and older firms grow at slower rates than small and micro enterprises. Similarly, McPherson (1996) suggests that size and age are important in predicting employment growth. But there is also emerging evidence showing a significant positive relationship between firm size and growth. Pagano and Schivardi (2001) study on firm size distribution and growth indicate significant importance of large firms in driving growth. Similarly, Van Biesebroeck (2005) emphasizes that large firms grow more rapidly and improve productivity faster, while smaller firms grow slowly. I re-estimate equation (13) and test the effect of size on the growth rate of matched new entrants over a period of five years.

$$\% \Delta Z_{it+5} = \frac{1}{n}(\ln Z_{it+1} - \ln Z_{it}) = \alpha + \beta_1 \text{expn} + \Upsilon \text{Controls}_{it} + \varepsilon_{it} \qquad (2.18)$$

Where $\%\Delta Z$ is the percent change in measures of interest, expn is an indicator variable equal one if firm i entered export market at time t (new export entrant), size is the logarithm of employees at time, and Controls are vectors of dummy variables controlling for ownership, firm age, sector, country and year effects respectively.

The results are presented on Table 2.13. The columns are structured as before; column 1 is size class, while columns 2-8 are the firm measures (total factor productivity, labor productivity, capital intensity, wages, other inputs, materials, skills and employment). These results indicate that firms employing between fifty and one hundred employees, medium new exporters, grow faster and rapidly than any category of firm size. Total factor productivity growth is at 26.4 percent, labor productivity is at 98.9 percent, capital intensity is at 80.2 percent, wages grow at insignificant rates, other intermediate inputs grow at 76.9 percent, while intermediate material usage grew at 114.4 percent and employment grows at 31.9 percent. However, skills growth in medium export entrants is so poor than all the other firm sizes. Similarly, new export entrants employing one hundred and more employees, large export entrants, grew at faster rates, almost to rates of medium export entrants. Total factor productivity is at 2.5 percent, labor productivity is at 18.4 percent, capital intensity is at 28.8 percent, wages is at 2.1 percent, other intermediate inputs is at 21.4 percent, intermediate materials is at 17.6 percent and employment growth is at 4.8 percent. However, skills growth is significant but with a negative sign, at 14.4 percent. Additionally, new export market entrants employing between one and ten people, micro-firms, had significant growth rates, though not at rates of medium and large firms. Total factor productivity grow rate is at 15.3 percent, labor productivity is at 8.6 percent, capital intensity is at 4.2 percent, other inputs is at 12.9 percent, materials is at 9.4 percent and employment is at 3.2 percent. However, wages and skills are all significant but with a negative sign, at 8.0 percent and 5.6 percent respectively, implying lower growth rates than never export entrants that are micro-firms.

Conversely, firms employing between ten and fifty employees (small firms) have significant but growth rates with negative signs in almost all measures of interest except on total factor productivity where growth rate is significant and positive at 7.4 percent. The growth rates of labor productivity is at 7.4 percent, capital intensity at 19.3 percent, wages at 8.7 percent, other intermediate inputs is at 1.6 percent, skills is at 27.9 percent. All the growth rates on these latter measures are significant but with negative sign implying that their growth rates are lower than those of never export entrants of similar size.

Table 2.13: Growth rates of new entrants after entry into the export market by size.

Size class	TFP	Va/L	K:L	Wages	Other inputs	Materials	Skills growth	Employment growth
Emp>=100	0.029	0.184	0.288	0.021	0.214	0.176	-0.144	0.025
	(0.052)	(0.185)	(0.187)	(0.074)	(0.168)	(0.182)	(0.240)	(0.102)
Emp>=50<100	0.264	0.989**	0.802**	0.000	0.769**	1.144***	-0.312	0.319*
	(0.162)	(0.317)	(0.248)	(0.101)	(0.302)	(0.311)	(0.307)	(0.108)
Emp>=10<50	0.074	-0.074	-0.193	-0.087	-0.108	-0.016	-0.279	0.123
	(0.118)	(0.198)	(0.230)	(0.083)	(0.147)	(0.181)	(0.126)	(0.086)
Emp<=1>10	0.153	0.086	0.042	-0.080	0.129	0.094	-0.056	0.032
	(0.239)	(0.268)	(0.211)	(0.103)	(0.172)	(0.248)	(0.190)	(0.063)

*The measures are in logs and include controls; ownership, firm age, industry, country and year dummies. Standard errors are in parentheses. Significance levels are: * p<.05; ** p<.01; *** p<.001*

2.5. Discussion of the Results:

The results on differences between exporters and non-exporters mirror the much discussed regularities that firms that export are different from non-exporting firms in almost all characteristics as first observed by Bernard and Jensen (1995; 1997). This suggests that firms engaged in exporting activities realize some advantages; possibly due to the size of the market they serve, compared to those that serve the domestic markets. Productivity growth is higher in new exporters compared to old exporters and exporters who exit the international market. This may imply that the growth of entrants may be because they entered the export market with higher productivity while firms who are old may already be facing competition in the export market, hence reducing their productivity. Besides, one would suggest that old firms continue exporting even when they face negative growth rates in the hope that their performance may improve as exporting progresses on. We also observe that future entrants already possessed some superior performance two years to export market entry, clearly depicting a pattern of self-selection. In the run up to export entry, future entrants display significantly higher growth rates in productivity than future never entrants suggesting that firms are aware of that there are additional costs associated with exported, that cannot be recovered from the selling price hence they should be more productive to overcome the sunk costs of exporting.

After entry into the export market, entrants improve their performance and grow to expand their presence further. This superior performance advantage expands further throughout the observed sample period, that is, the five-year period. For-instance, in the third year after export market entry, we can see that the productivity level of new export entrants increases tremendously, reflecting some learning-by-exporting mechanism at work. This could be due the fact that exporting involves interacting with customers who may influence the manner in which firms

should produce the next generation of their products. Moreover, this finding is suggestive of new exporter dynamics consistent with that displayed by the Colombian new export entrants as shown by Eaton et al. (2008). The experience they gained in the previous years of export market participation has enabled them to cut down on inefficiencies and reorganize the production process, hence creating a sustainable plan of export market survival.

Overall, the study finds evidence that African exporters that initiate export activity in the international market have better performance in first few years of exporting, especially during the first and second years of exporting. However, in the subsequent years after the second year, their exporting advantage begins to wane, except on skills. New exporting firms still maintain a skills advantage over non-export entrants, even up to the fifth year. Examining whether exporting is linked to improved performance; the study establishes that firms engaged in international trade improve their performance better than those who serve domestic markets. Additionally, the new entrants into the export markets grow at faster rates than never entrants although these rates begin to worsen in the third year of exporting. Similarly, entrants that stay in the export markets will continue to improve their performance and expand further their presence in the export markets compared to intermittent and export exiters hence showing similar patterns of new entrants in other developed economies.

Finally, this study is able to establish the relationship between size and performance of firms before and after the export market entry. The finding shows that for all measures of productivity, large firms grow faster than firms of other sizes before entry. Tracing future export entrants for a period of five years, their total factor productivity grows by 3.3 percent compared to firms of other sizes, showing that larger firms self-select into export markets. Additionally, after entry, results indicate that firms employing between fifty and one hundred employees, medium new exporters, grow faster and rapidly than any category of firm size. Total factor productivity growth rate was higher than all the other sizes. Similarly, new export entrants employing one hundred and more employees, large export entrants, grew at faster rates, almost to rates of medium export entrants. Conversely, micro firms and small firms grew slowly. The results show that size matters for the growth of African export firms.

2.6. Conclusion

Recent theoretical and empirical findings have stressed the importance of sunk entry costs when firms begin exporting activities. This implies that firms breaking into the export markets must pay a first time entry sunk cost which indeed increases the stakes of exporting firms. The presence of sunk costs should then mean that only the more productive firms enter the export markets and participate in such markets. But the presence of new entrants that are small sellers is at odds with the notion of sunk costs of export market entry. In this paper, I have used firm-level data to study firm dynamics and export market participation of new exporters and trace these firms to five years before entry and five years after entry to understand their dynamics and participation in the export market. This study conducts important analyses: first I document the differences between exporters and non-exporters and trace exporters now to years when they were not exporters and test whether new exporters were already successful firms before they started exporting today. Second, I assess post-entry differences between new exporters and never exporters, tracing them to five years after their first export debut and test whether new entrants

grew at faster rates than never exporters. Thirdly, I examine the importance of size in the performance of new exporters, years before entry and after entry.

I find that African exporters are different from non-exporters and large firms are more productive and grow at faster rates before export market entry. Additionally, firms that enter export markets for the first time perform better than old firms and have superior growth rates, while exiting export markets is associated with low performance. These findings also show that future exporters (new entrants today) possessed superior characteristics some years into export market entry showing patterns of self-selection and the importance of sunk costs associated with exporting. In the run up to export market entry, new entrants improve their performance measures, while their growth rates improve rapidly as well. After entry, new entrants improve their performance further and expand their presence in the export markets by growing at faster rates than never entrants. I also tested for the effect of exporting on new entrants and found that when firms engage in international trade, they improve their performance better than firms that serve domestic markets, implying that exporting raises performance hence evidence of learn-by-exporting. Finally, this study establishes the importance of size in export market entry and participation. Future entrants who employ one hundred or more people experience faster growth years to export market entry, than firms that employ fewer workers. Similarly, new entrants who employ between fifty and one hundred workers grow at faster rates after entry into the export markets, than other firms. Additionally, firms who are considered large grow at growth rates similar to medium sized firms though other measures of productivity are not as high as in medium firms. Small and micro firms grow at worse rates after entry and their performance continued to worsen as they continued in export markets.

Conclusively, this paper establishes that African exporters in manufacturing sector are different from non-exporters and exporting firms show patterns of self-selection and learning-by-exporting. Generally, these results show that new export entrants display significant performance during export market entry and continue to do so over the five-year period, a finding indicative of the learning-by-exporting mechanism, and consistent with previous studies using firm-level data from other countries. Additionally, the paper confirms that surely size matters in exporting. At the policy level, governments should know that exporting per se may not result into welfare gains unless it is followed by better export promotion. This is because firms have to accumulate enough productivity and grow in size before selling any products in the international market. Therefore, policy makers should facilitate better export market outcomes by providing information, on market demand and regulation that helps new export entrants survive and thrive in these markets.

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CHAPTER 3: FIRM-LEVEL INVESTMENT AND EXPORT MARKET PARTICIPATION IN SUB-SAHARAN AFRICA

3.1 Introduction

Why is it that in some countries, relatively small firms enter export markets yearly, selling small quantities of their products to a nearby country? How do we reconcile this fact with the view that only the large and more productive firms engage in exporting activity? Studies show that export market entry is costly and involves incurring sunk costs besides the per-unit costs of selling the products in the export market, such that only the large and more productive firms sell products in the export markets (Melitz, 2003). In this paper, I study firm-level investment and export market participation as a possible channel that explains export market entry and participation of small firms in the international markets. I show that new investment in physical capital allows exporters to expand their productive capacity and reduce marginal costs of production thereby improving production efficiency and export market participation outcomes better than non-exporters. I use propensity score matching method and difference-in-differences approach, and find that firm-level investment increases the probability of non-exporting firms becoming exporters, and most importantly, export market participation experience as well increases the probability of the exporters who do not engage in investment activities to do so.

Expansive empirical work on exporting firms has documented how engaging in international trade generates considerable benefits through comparative advantage and intra-industry resource reallocations (Bernard, Eaton, Jensen, and Kortum, 2003; Melitz, 2003). Moreover, international trade literature has invaluably documented how crucial firm-level differences in productivity, export status, ownership structure, size and other firm characteristics are to the decision to initiating engagements in export markets. Consequently, the large and more productive firms do participate in international trade while the least productive ones sell in the home market. In this way, firm export participation is a rare activity, while firms that initiate engagements in international market and survive their first year of exporting; continue to export the subsequent years even when they face negative demand shocks (Timoshenko, 2015). Empirical evidence shows that firms who engage in international trade (both exporters and importers) constitute a small proportion of firms in many developed and developing countries. If engaging in international trade provides a firm with a larger market for its products and greater profits, then we would expect a high level of export participation. However, empirical evidence presents a different picture, low export participation of firms. What then explains the low level of export participation and entry patterns of small firm in the export markets, as documented in Eaton et al. (2008)? An expansive trade literature documents that export participation is influenced by the existence of sunk export entry costs. Firms that intend to engage in international markets must first incur costs related to researching the tastes and preferences of their customers, setting up production plants, sales and distribution channels and other costs. These costs may never be recovered even if the firm resolves not to sell its products in the international market. Thus firms export as a consequence of improved firm efficiency and productive capacity, inducing the firm to reach out to the international markets.

A number of papers have recently started to add a new feature to the study export engagements and productivity relationship: firm-level investment in activities that upgrade the productivity of

the firm. These activities include research and development (R&D) as shown by Aw, Roberts and Xu (2011), Constantini and Melitz (2008), among others. More recently though, another dimension was added to this study: firm-level investment in physical capital (Rho and Rodrigue, 2015; 2016; Wu and Miranda, 2015). The observed patterns in exporting firms have motivated economists to provide more explanations as to why exporters and non-exporters vary and what explains this variability. Empirical studies document large productivity premium exporters compared to non-exporting firms, the decision to enter export markets is influenced by factors that shape the firms' productivity prior to entering the international markets. Theoretical models of trade and firm dynamics, as presented by Jovanovic (1982) and Hopenhayn (1992), demonstrate how a firm's productivity is derived from a common distribution. Extending the novel work of Jovanovic (1982) and Hopenhayn (1992), Melitz (2003) model gives evidence to confirm that firm i's productivity in period t, can be assigned to it by luck of the draw from a common distribution. Once the firm makes a low productivity draw, it becomes difficult for it to change its future productivity. The above models of firm dynamics do not present conclusive examination of firm heterogeneity and why small, sometimes, less productive exporters venture into the export markets.

Moreover, Eaton, Eslava, Kugler and Tybout (2008) study of Colombian exporting firms confirms that domestic firms enter the export market every year and that these new exporters are small. Their findings show that new export entrants begin by vending small quantities to neighboring countries to gain experience of targeting other more distant and advanced markets. Considering that sunk costs are important and that only the large and more productive firms undertake export activity, what would explain the entry of small exporters into export markets and how can we reconcile this pattern with the self-selection hypothesis? Conversely, some studies have attempted to use endogenous growth theory to model firm productivity and link it to firm-level productivity enhancing activities like innovation, firm-level investment in physical capital, investment in research and development (R&D), technology upgrading, or investment in workers' training to give a possible explanation of their importance in export market entry (Aw, Roberts and Winston, 2007; Aw, Roberts and Xu, 2011; Bustos, 2011; Damijan, Kostevc and Polanec, 2010; Rho and Rodrigue, 2016; Wu and Miranda, 2015).

In this study, I use the models of Wu and Miranda (2015) and Rho and Rodrigue (2016), and insights from Arkolakis (2016), and Erickson and Pakes (1995) to develop an analytical framework that may account for the entry patterns of low productivity and small exporters in the international markets. The insights gained from the above works, guide my empirical work and evaluation of the research question 'whether firm-level investment in physical capital explains firm productivity dynamics.' I view firm-level investment as a productivity enhancing activity that builds a firm's capability to improve the technology of production. My definition of firm-level investment in capital involves a firm's investment expenditures in plant and equipment, which I consider productivity enhancing investments. My view is that investment in productivity enhancing activities is like upgrading a firm's technology of production that expands the firm's productivity frontier. This study is important because it provides a crucial explanation to firm heterogeneity and a possible channel that explains productivity differences between exporters and non-exporting firms. Most importantly, I focus the analysis on two Sub-Saharan African countries (Ghana and Tanzania) because of data availability. These countries have reformed their

economies and advocated for export promotion strategies, at the expense of import substitution, to strengthen export growth.

I implement my econometric analysis in a regression framework, for the first part of the research question, and using propensity score matching and difference-in-differences estimation methods, for the second part of the research question. I find evidence that a two-year lagged investment expenditure in firm-level activities increases total factor productivity by 30.6 percent, real output per worker increase by 8.8 percent and employment increase by 23.1 percent. However, I find that a two-lagged investment expenditure does not increase some firm activities. In this case, capital per worker shows a decline of 28.7 percent, real monthly wages in US$ shows a decline of 19.8 percent and skills decline by 30.7 percent. I analyze annual differences in growth rates between firms who are new exporters, old exporters and export exiters. I also find evidence to show that firm-level investment raises the annual productivity growth rates of new and old exporters to 123.8 percent and 256.5 percent respectively. However, I find evidence to suggest that exiting export markets is associated with a decline in productivity growth. Specifically, I find that exporters who cease to export and exit the export market have lower annual productivity growth rate of 12.9 percent. I view firm-level investment as a strong catalyst to improving the performance and survival of exporting firms, clearly indicating that there is investment premium that accrues to firms that engage in firm-level investment.

Furthermore, I find that non-exporting firms that engage in firm-level investment have a high probability of becoming exporters than non-exporters who do not invest in firm-level activities. A two-year lag in investment expenditure increases the probability by 3.3 percent, of a non-exporter switching its status to exporter; while a one-year lag in investment expenditure increases the probability of switching status, by 4.1 percent. Similarly, I also find that firms who engage in exporting activity have a high probability of investing in productivity enhancement. A two-year exporting experience increases the probability of a firm engaging in investment activities by 3.7 percent; while a one-year exporting experience increases the firm's odds of exporting by 9.2 percent. Additionally, I evaluate the effect of size in increasing the probability of non-exporters that engage in firm-level investment switching their export status and find that small non-exporters that engage in firm-level investment have 1.3 percent probability of switching their status when investment is lagged two years, which increases to 3.3 percent when investment is lagged by one year; from non-exporting to exporting. This establishes the fact that, although firm productivity differences can be explained by self-selection factors as one channel, firm-level investment holds the key to a possible explanation to why small firms, with low productivity, venture into the export market. This study establishes a clear indication that when firms invest in physical capital, especially plant and equipment, they gain capability to produce effectively and so more productive firms produce more output at lower unit costs as postulated in my theoretical model. Finally, I apply matching techniques and difference-in-differences approach to test whether firm-level investment stimulates better performance and participation outcomes among exporting firms. I find evidence that firms who invest in physical capital receive a positive, statistically significant premium when they engage in the international markets. These firms increase their total factor productivity by 51.0 percent, real output per worker increases by 98.2 percent, real capital per worker increases by 149.7 percent. These findings suggest that firm-level investment expenditures are associated with better export market participation outcomes. Therefore, policies aimed at promoting exports should target providing

support to firms that seek investment capital to expand the productive capacity. Firms would benefit greatly if they receive support in form of technology and capability improvements as this would stimulate the probability of export market entry hence promoting exports.

This study contributes to the literature on firm heterogeneity and industry dynamics. This is an important element of the literature on international economics and firm dynamics that continues to stimulate a lot of research and debate. Moreover, this study firm adds another dimension to the literature on firm selection and growth in new markets, first suggested by Luttmer (2007) and recently extended by Arkolakis (2016) who presents an analytical framework for studying firm and exporter growth. To the best of my knowledge, this study is the first to analyze the impact of investment in physical capital on firm dynamics and export participation in Africa.

In conclusion, I use the theoretical models of Wu and Miranda (2015), and Rho and Rodrigue (2016), and analytical frameworks of Erickson and Pakes (1995) and Arkolakis (2016), to guide the empirical analysis. This paper is similar to the insights developed in the Wu and Miranda (2015) and Rho and Rodrigue (2016) theoretical models. However, this study is carried out in a different context (African), and most importantly, the two papers of Wu and Miranda (2015) and Rho and Rodrigue (2016) are estimated using a structural approach, while mine uses an empirical approach to answer the research question. Furthermore, I use a novel approach of propensity score matching method and difference-in-differences approach to evaluate and analyze the empirical questions.

The rest of the paper is organized as follows; section 3.2 presents the review of related literature. Section 3.3 provides an overview of the data. Section 3.4 presents theoretical and empirical framework and econometric methods. Section 3.5 discusses the results. Section 3.6 concludes.

3.2 Literature Review

Recent developments in empirical work on firm dynamics and exporting behavior of firms documents various empirical regularities and shows how engaging in international trade generates considerable benefits for exporters (Melitz, 2003; Bernard et al., 2003). It is established that engaging in trade influences only the more productive firms to initiate selling their products in the international markets relegating firms with low productivity to persist serving the home market, consequently forcing the least productive exporters to cease selling their products internationally. The observed pattern among exporters has motivated economists to provide more explanations on why exporters and non-exporters differ in almost all characteristics and their contribution to the economy. Recent studies on firm differences have presented controversial findings on the observed pattern and behavior of firms: relative to non-exporters, exporting firms are large, more productive, pay higher remunerations and employ more people, hence self-select into foreign markets because of their productivity (Bernard and Jensen, 1999). Additionally, sunk costs are shown to be a major source of export-market persistence (Roberts and Tybout, 1997).

However, Eaton et al. (2008) study of Colombian exporting firms indicates that domestic firms enter the export market every year and that these new exporters are small. Their findings show how new exporters begin by selling small quantities to neighboring countries to gain experience of targeting other more distant and advanced markets. Considering that sunk costs are important

and that only the large and more productive firms undertake export engagements, we have to explain the existence of small export entrants in export markets and to reconcile this entry pattern with the self-selection hypothesis. This finding contradicts the much documented facts about exporters. Furthermore, exporting activity presents a firm with more benefits when firms engage in international trade through the opportunity to sell in a large market and learning-by-exporting mechanism. Other studies have suggested that firm heterogeneity arises from endogenous factors, that is, factors internal to the firm play a crucial role in export market entry and performance rather than exogenous factors. These internal factors are attitudinal characteristics and individual capabilities, (that is, commitment to export activity, marketing of the product, networking with other exporters among others), decisions on technology of production and other factors internal to the firm, play significant part in the internationalization of firms (Nazar and Saleem, 2009; Bloom, 2012). Additionally, theoretical papers have also shown that even when firms are homogeneous, they face critical export decisions, for-instance when to enter the export markets, the choice of technology to be employed in the production of the output, whether to export and the type of workers to employ and wages to pay (Yeaple, 2005). Conversely, Bernard and Jensen's (1995; 1999) findings suggest that while exporters tend to grow faster, exporting per se will not increase productivity.

Although consistent with observed trends in exporting firms, the evidence presented on self-selection hypothesis and considerable persistence of exporting engagement among exporter firms (Roberts and Tybout, 1997; Bernard and Jensen, 1999) does not provide a convincing explanation as to show reasons for the firms' decision to enter export markets and how export market engagement affects their productivity. It is plausible to think that there is a missing link that provides an explanation of export market entry and participation. This missing link must be firm-level productivity enhancing activities like acquiring capital to expand production, product and process innovation, research and development, capacity utilization or capacity building programs. Consequently, one may posit that some firms are initially more productive than others because of their differences in firm-level investment efforts, such as acquiring the capital crucial for production process, innovating products, processes, research and development, or upgrading of production technology-through acquisitions. In this case, there must be a connection between a firm's investment effort and its overall productivity which prompts it to initiate export activity or a link from exporting performance to increase in investment effort.

Consequently, Rho and Rodrigue (2016) study firm-level investment and export dynamics among Indonesian manufacturing firms and observe that firm-level investment in physical capital allows new exporters to grow into the export markets. Once firms make enough firm-level investment in physical capital, they expand their capacity to produce and utilize the production inputs to meet their market demands. Similarly, new firms that make enough firm-level investments in physical capital are capable of mitigating their exposure to demand disturbances across markets as they have adequate capacity to respond to these demand shocks. Consequently, new firms that have adequate investment in physical capital have higher investment rates in the year of initiating exporting activity and continue till fourth year making these new exporters gain the ability to survive longer in the export market (Rho and Rodrigue, 2015; 2016). Likewise, Ah and McQuoid (2012) study capacity constrained exporters and present micro and macro evidence to show that exporters face financial and capacity constraints, which leads to increasing marginal costs among exporters. If exporters address the issue of

financial and physical capacity constraints, they can adequately respond to market demand shocks and reduce aggregate output volatility. Additionally, Bustos (2011) finds that falling tariffs induce firms to upgrade their production technology. Her findings show that the observed firm heterogeneity cannot be completely explained by self-selection hypothesis but rather by technology upgrades as well. This suggests that trade policies that facilitate export market entry can stimulate firms to develop mechanisms of improving firm-level productivity hence stimulating international market engagements. Further, Riãno (2011) presents a dynamic model of risk-averse producers and suggests that firms face costs of export market entry and participation hence must make investments that are irreversible to reduce on volatility of their sales as a result of export market participation.

Relatedly, Aw et al. (2007) show that exporters that make effort to invest in productivity enhancement, for instance, investing in research and development or training of workers improve their future productivity level than firms who do not engage in any investment activity. Besides firms that invest or incur expenditure on training workers, benefit from these investments because of presence of a statistically significant relationship between productivity and export market entry. Similarly, Constantini and Melitz (2008) emphasize the implication of firm-level investments as possible channel for the productivity enhancing effects of trade. They conclude that when firms anticipate liberalization in the industry, firms will be stimulated to engage in productivity enhancing activities, like innovation, ahead of export market entry to maximize the benefits that might accrue from export market entry and participation. Equally, Girma, Görg and Hanley (2008) present arguments to suggest that exporting experience enhances innovation capability of firms thereby improving the performance and survival of firms. When firms innovate, they improve their productivity and chances of entering export markets as suggested by Constantini and Melitz (2008) model and as was first emphasized by Licandro, Maroto and Puch (2003). Furthermore, Doraszelski and Jaumandreu (2011) findings indicate that research and development expenditures are a key determinant of differences in firm productivity and a possible reflection of how firm-level productivity evolves over time. In the same vein, Damijan and Kostevc (2015) findings show that there is learning that exporting firms receive as the result of export market participation which enhances the firms' ability to innovate products. Their study further presents evidence of a robust, positive and statistically significant relationship between imports, exports and innovation, and that imports facilitate small firms' ability to innovate before export market entry.

Bernard, Jensen, Redding and Schott (2007) find that a firm's performance depends on its ability to create new products. However, this ability is shaped by the firm's capacity which involves the level of its physical capital and firm organization. Similarly, Yeaple (2005) models endogenously to examine the heterogeneous differences between exporters and non-exporters, and presents evidence that emphasizes the crucial role played by technology and labor force in driving these observed differences. Additionally, studies also show that investment effort in product innovation increases the propensity of firms to export (Becker and Egger, 2013; Cassiman and Golovko, 2011). Aw et al. (2011) studies electronic industry in Taiwan and estimates a structural model of research and development. Their finding does show that investments in research and development increase the firm's productivity and probability of exporting. Equally important is Damijan et al. (2010) study of the causal links between product innovation, productivity and exporting, and from exporting to process innovation to productivity.

Their study shows no causal link from either product or process innovation to productivity, but rather exporting activity that increases the firm's odds of engaging in process rather than product innovation, consequently, creating a positive impact on firm productivity and performance.

In summary, some studies have noted the effect of firm-level productivity activities like innovation, research and development, worker training programs, technology upgrading or quality upgrading on productivity from both theoretical and empirical side but little attention has been devoted to analyze the impact of firm-level investment in physical capital on the firm's probability of entry, performance and survival in the international market. This study will use investment expenditures in plant and equipment as proxy to study the distinction between firms that undertake investment and those that do not to study the impact of firm-level investment in physical capital of firm export market entry and participation.

3.3 The Data

To facilitate the empirical analysis in this study, I use firm-level data of five African countries; Ghana, Kenya, Nigeria, Tanzania and South Africa. However, because of unavailability of data on firm-level investment expenditures for Kenya, Nigeria and South Africa, I exclude these countries from the analysis and retain Ghana and Tanzania. The data are from a panel survey of firms operating in manufacturing sectors of the two countries, namely, textile, wood, furniture, garment, metal and machinery, and food and bakery. The data on Ghana manufacturing firms cover a period of twelve years collected over seven rounds, from 1992 to 2003 while for Tanzania, the data were collected over for waves between 1992 and 1999. The data were collected under the Regional Program on Enterprise Development (RPED) organized by the World Bank, jointly with the Center for the study of African Economies (CSAE)[7] and University of Oxford, using stratified sampling strategies within each country and firm size.

The dataset is drawn from detailed questionnaires carried out with owners, and in most cases, managers and workers of sampled manufacturing firms with a view to collecting data that is relevant for firm-level analyses. The dataset is unique in having measures of investment in plant, equipment, land and buildings expenditures. Data contain replacement value of plant and machinery, the sale value of land and buildings and investment in both these types of capital. Capital stock is deflated using a weighted average of national consumer price index and nominal US dollar exchange rate[8]. Human capital stock comprises of the following worker characteristics: age, tenure in current job, education, hours worked, earnings and potential experience. Other variables contained in the dataset include real output per worker, the real value of capital to labor ratio, real value materials, real value of other intermediate inputs, number of employees, ownership status, firm age, export status and employee mobility. The dataset downloaded from CSAE contains 5632 observations based on more than 1580 manufacturing firms. The countries in this study sample have undergone macroeconomic challenges which greatly influenced the manufacturing sector. Furthermore, most of these countries promoted import substitution strategy to strengthen their domestic sectors prior to trade reforms that liberalized their economies. This therefore caused slow growth of the industrial sector and poor

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[7] I thank the Center for the study of African Economies for making the data available for download for free to researchers. I are grateful to you for this assistance without which, it would not have been possible to conduct this study.
[8] See a full description of the dataset and all the variables on www:csae.ox.ac.uk

development outcomes. The characteristics of the countries in this study are shown in table 3.1. Column 1 is the country, while columns 2-7 are gross domestic products in 2011 (GDP), GDP per capita, Industrial value added as a percentage of GDP, manufacturing valued added as a percentage of GDP, exports, as a percentage of GDP, adult literacy rates (2010), and finally, life expectancy at birth in 2011.

Table 3.1: Summary statistics for two Sub-Saharan African Countries

Country	GDP Growth in2011	GDP per Capita [a]	Indus. V.A (% GDP) [b]	Manuf. value added (% of GDP) [c]	Exports (% of GDP) [d]	Adult literacy rates in 2010		Life Expectancy at birth in 2011	
						Male	Female	Male	Female
Ghana	14.3	1570.1	25.9	6.7	38.0	73.2	61.2	63.2	65.3
Tanzania	6.5	516.6	25.1	10.2	31.1	79.0	67.5	57.2	59.1

Source: World Bank (2013), African Development Indicators
a: GDP per capita (current US$) in 2011; b: Industrial value added as a percent of GDP in 2011
c: Manufacturing value added as a percent of GDP in 2011; d: Exports of goods and services as a percent of GDP in 2011

Table 3.1 presents the summary statistics of the two African countries under the study. We can clearly observe that only Ghana has a two digit gross domestic product (GDP) growth (14.3percent) while Tanzania trails with 6.5percent in 2011. Moreover, Ghana has gross domestic product per capita above 1,000 in current US$ compared to Tanzania with US$516.6. Further, the above two countries have similar pattern of industrial value added as a percent of GDP in 2011, although Ghana does poorly in manufacturing value added with 6.7 percent of GDP compared to Tanzania's 10.2 percent in 2011. On exports as a percent of GDP, the two countries display almost the same pattern with Ghana exporting the most; 38.0 percent compared to Tanzania's 31.1 percent. Adult literacy rates in 2010 for the two countries is significant compared to most countries in Sub-Saharan Africa; with Tanzania displaying better rates in both male (79.0 percent) and female (67.5 percent). Similarly, life expectancy at birth in 2011 for the two countries is above average; with Ghana displaying higher rates for both male (63.2 percent) and female (65.3 percent) compared to Tanzania's male (57.2 percent) and female (59.1 percent).

Next, I present an over view of manufacturing firms in each individual country under the study. Column 1 is the country, columns 2-6 are number of firms, percentage of firms, number of observations, average exports, average domestic sales, and export destinations (categorized into destinations to African countries and, destinations outside of Africa).

Table 3.2: Summary of manufacturing firms per country

Country	No. of firms	% of firms	No. of Obser-vations	Average Exports	Average Domestic Sales	Export Destinations	
						Africa	Outside Africa
Ghana	311	43.44%	3564	0.17	0.83	0.50	0.07
Tanzania	405	56.56%	2068	0.07	0.93	0.04	0.03

Source: Calculations using Center for the study of African Economies (CSAE) dataset

Table 3.2 above gives the summary of the firms that constitute the study. There is a total of 716 firms surveyed over a period of 12 years, that is, from 1991 to 2002. There is a total of 5,632 observations, with most of the firms selling their output in domestic markets. Export destinations form an important component of the exporting process, with most firms exporting within Africa compared to those that export outside of Africa.

Besides manufacturing sector characteristics examined above, it is important to assess the characteristics of the sectors that these firms belong to. Table 3.3 gives the mean shares of the sectors. Column 1 is country, column 2 is sector, and columns 3 and 4 are export status, while column 5 is the sum of the shares.

Table 3.3: Mean shares of the sectors

Country	Sector	Exporters	Non-exporter	Total
Ghana	Textile	0.04	0.02	0.06
	Garment	0.19	0.13	0.32
	Wood	0.05	0.23	0.28
	Furniture	0.20	0.11	0.31
	Food and Bakery	0.24	0.27	0.51
	Metal , Machinery & Chemicals	0.24	0.21	0.45
Tanzania	Textile	0.07	0.22	0.29
	Garment	0.11	0.08	0.19
	Wood	0.08	0.13	0.21
	Furniture	0.23	0.03	0.26
	Food and Bakery	0.19	0.38	0.57
	Metal , Machinery & Chemicals	0.33	0.17	0.50
All Countries				
	Textile	0.06	0.08	0.14
	Garment	0.18	0.10	0.28
	Wood	0.07	0.13	0.20
	Furniture	0.18	0.10	0.28
	Food and Bakery	0.22	0.24	0.46
	Metal , Machinery & Chemicals	0.29	0.34	0.63

Source: Calculations from CSAE data
Notes: The estimates presented are in mean shares of individual sectors; the sector is manufacturing with six industries: textile, garment, wood, furniture, food and bakery, and metal, machinery and chemicals.

Table 3.3 above presents the manufacturing sectors of the countries under the study. Most exporters are involved in the metal and machinery sector (mean value of 0.29) followed by food and bakery (mean value of 0.22), garment and furniture (sharing mean vale of 0.18), wood (mean value of 0.07), and finally textile sector (with lower value of 0.06). Similarly, non-exporters are more engaged in metal and machinery (0.34), food and bakery (0.24), wood (0.13), garment and furniture (0.10), and finally textile (0.08). We can also observe that exporters more engaged in manufacturing activities in almost all the two countries, showing how important the sector is in boosting economic growth and development in these countries.

The export data in this study has also measures crucial for the study. Below in table 4.4, I present summary of the firm characteristics, clearly displaying the mean estimates of the measures.

Table 3.4: Mean shares of investment by exporting and non-exporting firms:

Country	Firm measures	Exporting Firms		Non-Exporting Firms	
		Investment	*No Investment*	*Investment*	*No investment*
Ghana	Real Output per worker [a]	8.61	4.49	8.05	3.16
	Capital per worker [b]	8.28	4.21	6.93	2.64
	Real monthly earnings [c]	3.74	3.94	3.34	3.27
	Investment expenditure [d]	5.54	-	4.28	-
	Education [e]	10.95	10.15	10.14	9.63
	Employment [f]	206.16	77.92	71.65	35.62
Tanzania	Real Output per worker	8.97	8.88	7.92	7.84
	Capital per worker	8.49	8.74	7.39	7.09
	Real monthly earnings	4.27	4.09	3.57	3.54
	Investment expenditure	5.14	-	5.01	-
	Education	8.57	8.24	7.54	7.31
	Employment	599.67	241.22	76.88	41.33
All Countries	Real Output per worker	8.62	5.71	8.03	4.42
	Capital per worker	8.29	5.48	6.98	3.83
	Real monthly earnings	3.78	3.99	3.39	3.38
	Investment expenditure	5.53	-	4.38	-
	Education	10.84	9.40	9.81	8.41
	Employment	222.55	144.28	72.34	38.47

a: log of real output per worker in US$
b: log of real US$ Capital per worker
c: log of real monthly wages in US$
d: log of Investment expenditure in plant and equipment per employee
e: weighted firm average of education of employees
f: Number of workers currently employed by firm

Table 4.4 above presents the mean shares of non-exporters and exporters with their firm-level investment. From this table, exporter firms that invest in physical capital, on average, have higher real output per worker (8.62) than exporters that make no effort to invest (5.71). Similarly, non-exporting firms that invest in physical capital, on average, are more productive (8.03), than those who do not invest (4.42). This would be consistent with the view that exporting firms are more productive than non-exporting firms (Bernard and Jensen, 1999).

Exporting firms who invest in physical capital, on average, operate with more capital (8.29) per worker than exporters who have not invested (5.48). Similarly, non-exporters that invest in physical capital, on average, operate with more capital (6.98) than non-investing firms who are non-exporters (3.83). Because exporting firms face export market entry costs which are fixed and variable in nature, the firms who commit to initiate export market activity should have accumulated enough capital to address the demands that come with export market entry. On real monthly earnings, we can observe that the four groups have average earnings within the same comparable ranges and on average; exporters have higher investment expenditure (5.53) than non-exporters (4.38).

Moreover, exporting firms that invest, on average, employ workers with higher skills (10.84) than non-investing firms that are exporters (9.40). Similarly, non-exporters that invest in physical capital employ workers with higher skills (9.81) than those that do not invest (8.41). The

employment of more skilled workers by exporters is compatible with the view that these exporters use advanced technologies of production which requires high skills to facilitate the utilization of the technology (Romer, 1990). Moreover, exporters face stiff competition in the international markets which would then require them to upgrade the match between the technology they use and the skills. Additionally, exporting firms that invest, on average, employ more workers (222.55) than non-investing exporters (144.28). However, non-exporter firms employ fewer workers; those that have made investment employ more workers (72.34) compared with their counterparts who, on average, employ fewer workers (38.47). We can observe that firms that incur investment expenditures expand their capacity to, not only, produce but also employ large number of workers as a result of their capacity. I can therefore conclude that firm-level investment provides leverage for firms that seek to improve their productivity and enter export markets, and that exporters that invest perform better than firms that do not participate in investment to raise productivity.

To summarize, I also present firms by their exporting and investment status as a percent of the overall sample in the study. Table 5 below provides information on the investment behavior of non-exporting and exporting firms.

Table 3.5: Summary of firms by their exporting and investment status:

Firms	Non-exporting Firms (%)	Exporting Firms (%)	All Firms (%)
Do not engage in firm-level investment (%)	72.79	8.04	80.83
Engage in firm-level investment (%)	13.87	5.30	19.17
All firms (%)	86.66	13.34	100.00

Source: Calculations from the data

Table 3.5 indicates that 72.79 percent of non-exporting firms do not engage in any form of firm-level investment, while 13.86 percent of them engage in firm-level investment. Conversely, 8.05 percent of exporting firms do not engage in firm-level investment activity whereas 5.30 percent of them have incurred investment expenditure. I can suggest that firm-level investment is a costly venture that mostly can be undertaken by established firms as can be seen from the number of firms that engage in it.

3.4. Theoretical model and Empirical Strategy

3.4.1 Theoretical Framework

To guide my econometric analysis, I rely on the theoretical and empirical model on firm's profit maximizing behavior in a dynamic framework as in Erickson and Pakes (1995). In this dynamic framework, the firm faces a business environment characterized by harsh competition coming from within and outside of the industry. To succeed, the firm has to take risks and invest to increase its chances of growth and survival, otherwise realize a fall in its profitability and eventual shut down. In this setting, the goal of the firm is to maximize profits given expectations about industry competition. In each period, a firm decides on its business status; either to serve the domestic market as a domestic supplier or to engage in the export market as an exporter. As in Wu and Miranda (2015), a firm i starts each period t_0 either as an exporting firm $i = 1$ or non-exporting firm $i = 0$ with a predetermined investment in capital stock k≥0. In this set up, the firm

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operates in a competitive market environment and takes exporter price P_1 and non-exporter price P_0 as given. In this set up, firm i that has intentions to enter export market will then choose to increase its investment in capital stock with the aim of increasing firm efficiency, decrease marginal costs and consequently initiate export activity. I can also express the firm's capital stock in the following period as given by:

$$k_{it} = (1-\eta)k_{it-1} + \psi_{it-1} \tag{3.1}$$

Where k_{it} is the current capital stock holding, $\eta \in$ (0, 1) is the per-period rate of capital depreciation, ψ_{it-1} is the firm's total investment in physical capital in period t-1. Each year a firm is faced with some decisions; whether to invest and serve the domestic market or to invest and serve the export market. Each of these decisions involves incurring some costs. If the firm decides to invest in order to engage in the export market, it has to decide how much investment will lead to the production of optimum output for the export market, in this case, $\psi \geq 0$. Similarly, in each period, a firm producing good x, that is non-exporter choosing to become an exporter incurs a switching cost $s_x > 0$ which is sunk in nature and irrecoverable should the firm decide to exit the export market (Aw et al., 2008; Melitz, 2003).

The switching costs can then be expressed as

$$\varphi_{it} = \begin{cases} s_{x,} & if \quad i=0, \ m=1 \\ 0, & Otherwise \end{cases}$$

Where φ_{it} are the total fixed capital and all other costs associated with export market entry and conditional on the firm selecting export status m in the current period, when it starts with export status i. As in Wu and Miranda (2015), we also assume the firm pays quadratic variable costs of production and marketing. We express the quadratic cost function as,

$$D(s) = d_1 s_x + 0.5 d_2 s_x^2 \tag{3.2}$$

And the firm also incurs a quadratic variable cost of investment which will depend on the export status k of the firm, so that:

$$C_m(x) = \lambda_m C(x) \tag{3.3}$$

where

$$C(x) = c_1 x + 0.5 c_2 x^2 \tag{3.4}$$

So that $\varphi_0 = 1$ and $\varphi_1 = \varphi \leq 1$ so that exporters face lower costs of investment. If the firm faces increasing marginal costs of production and investment, then we would expect that
$c_1 \geq 0, \ c_2 \geq 0, d_1 \geq 0, and \ d_2 \geq 0$ as shown by Rho and Rodrigue (2016)

In monopolistically competitive markets, firms behave as economic agents whose objective is to maximize profits from sales revenue and would set this where marginal revenue (MR) equal marginal cost (MC) of production ($MR_q = MC_q$). In the presence of fixed costs, only firms whose revenues exceed costs of production will be able to enter the international market, that is, $MR_q - MC_q > 0$. In this case, the firm would initiate export market engagement when participation in

the international market yields additional revenues, that is to say, the firm assesses its current and expected future net profits, before entering the export market.

The firm's dynamic choice problem can be expressed by a Bellman equation in which the value function denotes the maximum present value of the current and expected future profits attainable by the firm given its export status j and m at the beginning of the period.

Let V_{it} denote the value of firm i in year t, given its capital stock, k, it the follows:

$$V_{it}(k) = \max_{\substack{m=0,1 \\ \psi \geq 0}} \{P_m k - \lambda_m C(x) - D(s_x) - \varphi_{im} + \delta V_m((1-\eta)k + \psi)\} \qquad (3.5)$$

Where i=1 if the firm starts period t as an exporter and i=0, otherwise; $k \geq 0$ is predetermined capital; $m=1$ denotes switching of status from non-exporter to exporter and $m=0$ if the firm does not change its status, $\psi \geq 0$ the choice of the firm's investment level, $\delta \in (0 \ 1)$ denotes per-period discount factor. In each year t, a firm is faced with two important decisions, that is, whether to initiate export activity or to remain serving the domestic market, thus:

$$E_t V_{it+1}(k_{it+1}) = \int_{\omega'} V_{it+1}(k') dF(\omega' \mid \omega_{it}) \qquad (3.6)$$

Equation (3.6) implies that a firm benefits if it chooses to take investment decisions to increase its capital stock in the following period, $t+1$. If the firm does not invest in the current period t, the firm's capital stock is likely to fall and its marginal costs of production, given the same quantity of output, will rise in the following period. However, a firm that makes optimal investments will raise the level of its capital stock in period $t+1$; as a result, its marginal costs will fall. This argument is line with the recent strand of trade literature that documents that a number of firms are constrained by their capacity (Ahn and McQuoid, 2012; Blum et al., 2011; Nguyen and Schaur, 2012).

3.4.2 Empirical Strategy:

Our empirical analysis follows the insight developed and discussed in the theoretical model. As in Wu and Miranda (2015) and Rho and Rodrigue (2016), in each period, non-exporters that change their status to exporters must incur a switching cost $S_x > 0$ which is sunk. When the firm i, producing good x assumes the exporter status $i=1$, it incurs a one-time sunk cost and marginal costs of exporting each unit of good x, and the firm incurs rising marginal costs of production and investment. These costs may become export constraints to small and young firms with constrained production capacity unless these firms possess higher productivity to minimize the cost constraint. However, relative to firms with smaller capital stocks, firms that have made new investments in physical capital and have built larger capital stocks grow faster into export markets, survive longer and face lower marginal costs (Rho and Rodrigue, 2016). Once firms make enough firm-level investment in physical capital, they expand their capability to produce and utilize the production inputs to meet their market demands.

Relatedly, new firms that made enough firm-level investments in physical capital are capable of mitigating their exposure to demand shocks across markets as they have adequate capacity to respond to these demand shocks. Consequently, if identical firms that are equally productive operate in the same industry and face similar production and marginal costs, the firms with larger capital stock will produce efficiently and at lower marginal costs, and subsequently initiate

export activity faster than those firms will smaller capital stock, because of enhanced production capacity. If this is the case, I would expect firms that have made investments in physical capital displaying higher productivity before export market entry, in the year of entry and after entry. Additionally, I would also expect the firms' export market participation creating productivity advantages for firms that have made investments than those that made no effort to invest, implying that a firm's export status is important for additional investments. This could plausibly explain the existence of small firms in the export market, and possibly another channel that explains firm productivity differences and why there are no clear self-selection patterns in firm-level data of some countries.

To fix ideas, I use a novel approach introduced to the trade literature introduced by Wagner (2002) and Girma, Greenaway and Kneller (2004), to match exporters to non-exporters at a point in time, based on their propensity to export and study the distinctions between the two cohorts. My main purpose, firstly, is to analyze the effect of firm-level investment on the propensity to export and, secondly, to evaluate the causal effect of export status of the firm on the propensity to invest.

$$p(x) = prob(D = 1 \mid x) = E(D \mid x) \tag{3.7}$$

Where p(x) denotes the probability of receiving the treatment, D is a binary variable that determines if the firm received the treatment or not, D=1 represents treated firms and D=0 are the control group. I can define this propensity score matching approach as a contingent on the probability of getting a treatment considering pretreatment characteristics (Rosenbaum, 1983). Using propensity score matching, I want to analyze effect of the treatment (firm-level investment) on the outcome variable ($\Delta\omega$); where $\Delta\omega$ represents the change in either employment, real earnings, total factor productivity or labor productivity. Denote the export status of firm i by $Exp_{it} \in \{0,1\}$ the dummy variable equals one if firm i entered the international market in time t, and zero otherwise. Therefore, the aim is to evaluate the causal effect of firm-level investment on propensity to export on some productivity measure $\Delta\omega$, the outcome variable, and causal effect of exporting on firm-level investment such that:

$$\Delta\omega_{it} = \omega^1_{it+v} - \omega^0_{it+v} \tag{3.8}$$

Where $\Delta\omega^1_{it+v}$ is the outcome at period $t+v$, $v \geq 0$ following export market entry, $\Delta\omega^0_{it+v}$ is the outcome if the firm had not invested and started exporting. Naturally, the critical challenge of causal inference is the fact that, for each firm, I can see only $\Delta\omega^1_{it+v}$ but not $\Delta\omega^0_{it+v}$ because each firm in a certain point in time gets either treatment or will be in control group, but not both (Holland, 1986). Conversely, it is difficult to identify what would have happened to the firm if it had decided not to invest and export in the future. To overcome this counterfactual, I create a control group in such a way that every treated unit is matched to an untreated unit with same characteristics at the time before the treatment. The calculated differences between the two matched groups based on observable measures like labor productivity, total factor productivity or employment can then be assigned to the effect of the treatment (Heckman et al., 1999). This then means that firms can be assigned into two groups: the treated group that received the treatment (firms that made firm-level investments in physical assets and entered the export market at period t, and exported in periods; $t+1, t+2, t+3, t+4,$ or $t+5$) and the control group that did not get the treatment (in our case, did not invest and export throughout the sample).

Specifically, the treatment does not affect the control group, and for observational studies, the outcomes are unconnected to the treatment, subject to X, that is:

$$\omega^0, \omega^1 \ D \perp x$$

Denote $\exp_{it} \in \{1, 0\}$ as indicator variable showing whether firm i entered the international market for the first time at period t, I can estimate the average treatment effect of exporting on export market entrants, such that:

$$ATT = E\left\{\Delta\omega^1_{it+v} - \Delta\omega^0_{it+v} \middle| \text{invest}_{it} = 1\right\} = E\{\Delta\omega^1_{it+v} | \text{invest}_{it} = 1\} - E\{\Delta\omega^0_{it+v} | \text{invest}_{it} = 0\} \quad (3.9)$$

And,

$$ATT = E\left\{\Delta\omega^1_{it+v} - \Delta\omega^0_{it+v} \middle| \exp_{it} = 1\right\} = E\{\Delta\omega^1_{it+v} | \exp_{it} = 1\} - E\{\Delta\omega^0_{it+v} | \exp_{it} = 1\} \quad (3.10)$$

Equations (3.9) and (3.10) are helpful in the estimation of the observed outcome $E\{\Delta\omega^1_{it+v} | \text{invest}_{it} = 1\}$ and $\{\Delta\omega^1_{it+v} | \exp_{it} = 1\}$, however my causal inference will be meaningful if proper construction of the counterfactual for the unobserved portion of equations (3.9) and (3.10); $E\{\Delta\omega^0_{it+v} | \text{invest}_{it} = 1\}$ and $E\{\Delta\omega^0_{it+v} | \exp_{it} = 1\}$, which are the average outcomes entrants would have received had they not invested and initiated export activity. To estimate $E\left\{\Delta\omega^0_{it+v} | \exp_{it} = 1\right\}$, I analyze a corresponding average value of never exporters such that:

$$E\{\Delta\omega^0_{it+v} | \text{invest}_{it} = 0\} \quad (3.11)$$

And;

$$E\{\Delta\omega^0_{it+v} | \exp_{it} = 0\} \quad (3.12)$$

I can then specify a valid control group based on the observable characteristics and pre-entry level value of the outcome variable ω_{it-1}. Based on our knowledge of determinants of productivity growth, I then estimate the export probability function using a probit model. As in Rosenbaum and Rubin (1983), I use propensity score matching approach, as follows:

$$P(\text{invest}_{it} = 1) = G(\text{invest}_{it-1}, X_{it}) \quad (3.13)$$

Where $\text{invest}_{it,}$ denotes the lagged firm-level innovation status, while $X_{it,}$ is the outcome variables of interest, including the control variables (size, firm age, ownership status, sector, year and country). Based on the propensity score, I match firms that invested against those that did not in period *t-1* and examine the effects of lagged firm-level investment on the current exporting status in period *t.* Similarly, I match exporters and non-exporter firms hinging on their probability to export and test whether the two cohorts are different in their innovative ability. Formally, I specify the firm's probability of being an exporter as:

$$P(Exp_{it} = 1) = G(Exp_{it-1}, X_{it})$$ (3.14)

Where Exp_{it-1}, represents the lagged firm-level exporting status, while X_{it} is the outcome variables of interest, including the control variables (size, firm age, ownership status, sector, year and country).

Consequently, equations (3.13) and (3.14) indicate the probability that a firm invests or initiates export activity based on function G (invest$_{it}$=1 or Exp$_{it}$=1), denotes the predicted probability of investing or exporting at t for firm i, who then is an ultimate exporter. I then use the psmatch2 suite of Leuven and Sianesi (2003) nearest-neighbor matching method with common support, and then select a non-exporter firm that is "closest" to ultimate exporter in terms of its propensity score. More formally though, for individual new entrant firm i, exporting to country f, a non-exporter firm j can be selected such that:

$$\left| p_{it}^{f} - p_{jt}^{f} \right| = \min_{k \in \{exp=0\}} \left\{ p_{it}^{f} - p_{jt}^{f} \right\}$$ (3.15)

This method of matching has the advantage of being easy to implement and less likely to be affected by selection bias. Moreover, the nearest neighbor matching nearly estimates the Average Treatment of the Treated (ATT) always because it matches control individuals to the treated group and discards controls that are not selected as matches. Additionally, common support condition in the matching algorithm is used and requires discarding entrants whose propensity score is not stable in the control group. I then estimate equations (3.9) and (3.10) which give the possible effects of firm-level investment on exporting, on one hand, and effect of exporting on firm-level investment. Additionally, I augment our findings using difference-in-differences method to enhance the reliability of our outcomes. Blundell and Dias (2000) observe that integrating matching and difference-in-differences (DID) substantially improve the quality of non-experimental evaluation studies. The difference-in-differences method involves observation of outcomes for two groups for two time periods; the starting period and ending period-here denoted as pre and post. One group receives the treatment in the following period and not in the previous period, while the second group does not receive any treatment in either period. The objective is to evaluate the impact of the treatment; thus if the same units within the group are observed in each period, then we can subtract the average change in the second (control) group from the average change in the first (treated) group. Formally, the difference-in-differences estimation can be written as:

$$\Delta\omega_{1} = (\omega_{11} - \omega_{10}) - (\omega_{01} - \omega_{00})$$ (3.16)

Where $\Delta\omega_{1}$ represents the impact or outcome variable, $(\omega_{11} - \omega_{10})$ is the outcome for the treated group and $(\omega_{01} - \omega_{00})$ denotes the outcome for the control group.

Therefore, I can write down our difference-in-differences equations for investment and exporting based on the sample of matched firms as

$$\Delta\omega_{it} = \alpha\omega_{it-1} + \beta X_{it-1} + \sum_{v=-1}^{2} \lambda_{v} invest_{it-v} + D_{jkt} + \varepsilon_{it}$$ (3.17)

And,

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$$\Delta\omega_{it} = \alpha\omega_{it-1} + \beta X_{it-1} + \sum_{v=-1}^{2} \lambda_v Exp_{it-v} + D_{jkt} + \varepsilon_{it} \qquad (3.18)$$

Where $\Delta\omega$ denotes the change in the outcome variables (total factor productivity, labor productivity, employment or wages), i,t,j and k index firms, time periods, sectors/industries and countries respectively, while D denotes the full set of industry, regions and time dummies. X is a vector of control variables, and $invest_{it}$ and Exp_{it} are dummy variables set to 1 if firm i made firm level investments or switches to exporting, at point $t,$ and zero otherwise. To evaluate the impact of investment on exporting and exporting on investment, I also use an indicator to predate investment *(invest$_{it+2}$)* and exporting *(Exp$_{it+2}$)* to further control for any relationships in pre-periods not captured by matching process.

To conclude, I integrate matching and difference-in-differences to enhance the quality of our outcomes, since the expected outcomes cannot solely be attributed to the average treatment before and after the treatment as other factors contemporaneous with the treatment might be captured in the matching process.

3.4.3 Estimating Total factor productivity (TFP)

Deriving productivity estimates for each firm is important for this study. In this section, I present the approach that allows for derivation of reliable estimates of the production function because such estimates are helpful in facilitating the examination of the firm's export and investment decisions. The key estimation challenge in the estimation of production functions is an endogeneity problem; when an explanatory variable or some of the explanatory variables are correlated with the error term following a measurement error or other factors. It is natural that there are factors influencing production that are not predicted by the econometrician but can be predicted by the firm, for instance, managerial inputs, may not be observed by the econometrician but known to the firm. Consider a firm that produces good, x, using a cobb-Douglas production functions in logs:

$$y_{it} = \beta_k k_{it} + \beta_l l_{it} + \omega_{it} + \varepsilon_{it} \qquad (3.19)$$

y_{it} is the log of output, k_{it} is the log of capital input, and l_{it} is the log of labor input. All these are physical inputs in the production process which are observable to analyst, but ω_{it} and ε_{it} are not observable to the analyst. Understanding the distinction between these two terms holds the key to the correct prediction of the production function. I first consider the importance of term ε_{it} in the analysis: this term is expected to represent shocks to the production process that are unpredictable by the firm prior to making input choices in the current period t. conversely, the ω_{it} represent shocks that can be predicted by firms when making input choices. By intuition, ω_{it} can represent variables such as the expected drought at the firm's location, expected defect rates in the production process, managerial inputs or expected surge in demand of the products. In most cases, ω_{it} has been referred to as the productivity shock that firm i confronts in period t. Similarly, ε_{it} might represent issues like deviation from expected defect rates, expected machine breakdown or expected drought; it might also represent the measurement error in the output variable. The endogeneity problem in estimating equation (3.19) arises because of the firm's rational decision on inputs k_{it} and l_{it} will be correlated with the predicted productivity shock ω_{it},

rendering OLS estimates of β's biased and inconsistent. Addressing this endogeneity problem will require instruments that are correlated with input selections k_{it} and l_{it} but uncorrelated with ω_{it}. Analysts have tried to use input prices for this purpose but still this does not address the problem as input prices are suspected to pick up some variables (Ackerberg et al., 2006).

Besides endogeneity problem is the selection bias arising from the correlation between productivity shocks and the probability of exiting the market. For-instance, if a firm's profitability is positively correlated with its stock of capital, then the firm with a substantial stock of capital is more likely to remain selling in the market despite a low productivity shock compared to the firm with a smaller capital stock, because the firm with more capital will expect to produce greater future profits (Levinsohn and Petrin, 2003). The observed negative relationship between the stock of capital and probability of exiting for a given productivity shock will drive the coefficient on the capital variable to be biased downwards unless this effect is controlled for. A more reliable approach to address the endogeneity problem and selection bias using a more structural approach to identification of production functions is presented by Olley and Pakes (1996). The endogeneity problem is addressed using investment as a proxy for an unobserved time-varying productivity shock, while the selection problem is addressed using survival probabilities. However, this approach is criticized for not being able to address collinearity issues arising in the first step of the estimation procedures (Ackerberg et al., 2006). Similarly, Levinsohn and Petrin (2003) use a related approach to addressing the endogeneity challenge by using intermediate inputs to proxy for unobserved productivity shock. As in Olley and Pakes (1996) approach, this method is criticized for generating inconsistent estimates and failing to address collinearity issues. An alternative approach that avoids collinearity problems and generates consistent estimates is suggested by Ackerberg et al. (2006). This approach draws on aspect s of both Olley and Pakes (1996) and Levinsohn and Petrin (2003), and is able to generate consistent estimates, as no coefficients are estimated in the first stage of estimation but in the second stage of estimation. In this study, Ackerberg et al. (2006) approach is used to derive a measure of firm-level productivity.

3.5 Results and Discussion:

3.5.1 Export and investment premium

The mean estimates presented and discussed in table 3.4 in section three shows that firms that engage in firm-level investment are different from those that do not engage in any form of investment activity because they display higher mean estimates. Consequently, it is plausible to suggest that firm-level investment provides unique advantages to firms, whether exporting or non-exporting. Rho and Rodrigue (2016) findings suggest that new investment in capital stock facilitates faster entry and survival in the export market as investment expenditures provide significant returns for the investing firms. However, how different are exporters that invest in physical capital from exporters who do not invest but engage in international markets? To fix my ideas, I am interested in understanding the performance of exporting that have invested and those that exporters that did not engage in investment for the rest of the sample. To proceed, I divide the sample of exporters into two; exporters that engage in investment and those that do not, and systematically estimate an equation of the form:

$$\ln y_{it} = \alpha + \beta_1 \exp_{it} \big| \delta iv_{it-1 \ OR \ it-2} + \xi size_{it} + \sum_{i=1}^{n} Controls_{it} + \varepsilon_{it} \tag{3.20}$$

Where $\ln y_{it}$ is the logarithm of the firm's characteristic being measured, i is the index of the firm, t is the index of the year, exp. $|\delta$ iv is a dummy variable for the current export status of the firm and or a two- or one-year lagged investment status of the firm, equal 1 if the firm i exports and invests in year t, 0 , otherwise). Size proxied by logarithm of employees, ownership, firm age, industry, country and year are dummies controlling for size, ownership status, age of the firm, industry, country and year effects, while μ_{it} is the error term.

Besides, I also attempt to answer a related question; whether new exporters, old exporters and exporters that stop exporting have annual growth rates that are faster than exporters that do not engage in any investment in physical capital. The notion that exporters are more productive than non-exporters also implies that exporters should grow faster than non-exporters and firms that cease to export in all firm characteristics. To compare productivity growth among exporters that invest in physical capital and exporters who do not, especially focusing on growth rates of new, old and those that exit the export market, I estimate the following equation:

$$\Delta y_{it} = \frac{1}{y_{it-1}}(y_{it} - y_{it-1}) = \alpha + \beta_1 S_{it} + \beta_2 B_{it} + \beta_3 St_{it} + Controls_{io} + \varepsilon_{it} \tag{3.21}$$

Where $\Delta \ln y_{it}$ denote annual changes in firm characteristics, $Control_{io}$ is a vector of firm characteristics in year 0 and dummies for export status are defined as follows:

S_{it} =Start=1 if ($Exports_{io}$ =0) * ($Exports_{it}$ = 1) and engage in investment activities

B_{it} =Both=1 if ($Exports_{io}$ =1) * ($Exports_{it}$ = 1) and engage in investment activities

St_{it} =Stop=1 if ($Exports_{io}$ =1) * ($Exports_{it}$ = 0) and engage in investment activities

I use exporters who have not engaged in any firm-level investment throughout the sample as the reference category. The estimated coefficients, β_1, β_2 and β_3 give the estimated increase in the annual growth rates of new exporters, exporters in both years and firms that exit the export market relative to exporters who do not engage in firm-level investment.

The results of equations (3.20) and (3.21) are presented in Table 3.6. Column1 are firm characteristics (total factor productivity, labor productivity, capital intensity, real monthly wages, skills-proxied by weighted average education, and employment-log of number of employees). Column 2 gives the estimates of levels of differences between exporters who invest and those who do not, while columns 3-4 estimates of new export entrants, continuing exporters and exporters who exit the market. We can clearly observe that two-year lagged investment expenditure has a significant contribution to exporting firms that incur firm-level investment in physical capital than exporters who do not engage in any form of firm-level investment activity. Exporters who have made firm-level investment receive a premium from their investment in-terms of productivity improvements. Exporting firms that engage in firm-level investment in capital stock increase: total factor productivity (TFP) by 30.6 percent, real output per worker by 8.8percent and employment is up at 23.1 percent; higher than exporters who do not engage in

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any form of firm-level investment. However, capital per worker is lower at 28.7 percent, real monthly wages is lower at 19.8 percent, and skill accumulation is lower at 30.7 percent; lower than exporters who do not engage in any form of firm-level investment.

We can observe that there is a productivity premium that firms that engagement in investment activities get when they engage in exporting. This finding is in agreement with the opinion that firm-level investment improves the firms' production efficiency as firms now have enough capability to respond to any form of demand shock. Firm-level investment, especially in plant and equipment gives the firm an opportunity to upgrade its production technology which enhances productivity (Bustos, 2011). Additionally, better technology of production enables the firm to reduce marginal costs of production leading to firm-level efficiency (Rho and Rodrigue, Wu and Miranda, 2015), consequently leading to firm productivity heterogeneity. This could be one possible channel that explains large productivity differences between exporting and non-exporting firm, and now the differences between exporters who are involved in investment activities and those exporters who do not.

Analyzing annual growth rates of exporters who engage in firm-level investment activity, I find evidence that old exporters who engage in investment activities have 256.5 percent annual growth rates in total factor productivity, 0.2 percent annual growth rates in real output per worker, 1.4 percent growth rates in real monthly wages, 14.9 percent growth rates in skills and 3.0 percent growth rates in employment. This evidence is in agreement with the notion that old exporters perform better than other exporters as they already have better firm characteristics and as a consequence of their experience in export markets. However, I do not find evidence of growth rates of capital per worker, as this is at (1.9 percent) lower than firms who do not engage in firm-level investment. Most importantly, the evidence on new export entrants who engage in firm-level investment activity is interesting. New export entrants improve their productivity upon export market entry; they have annual growth rates of 123.8 percent in total factor productivity higher than non-export entrants. Additionally, they have 4.2 percent growth rates in real output per worker, 18.9 percent annual growth rate in real wages in US$, 10.7 percent annual growth in skills and 105.8 percent annual growth in employment. This finding is in agreement with previous empirical studies that show that new exporters grow faster in their first years of export entry (Bernard et al., 2007; Das et al., 2007; Aw et al., 2000; Bernard and Jensen, 1999; and Clerides et al., 1998). However, capital per worker still grows slowing at 14.7 percent.

The negative growth in capital per worker could be explained by the view that entry and participation in the export market involves prior investments in capital and exporters will not need to accumulate it further. Conversely, when I examine exporters who invest, start exporting and stop exporting activity, I find evidence that stopping to export among exporters who engage in firm-level investment leads to a fall in annual growth rates: total factor productivity falls by 12.9 percent and employment falls by 3.5 percent. However, real output per worker, capital per worker, real monthly wages and skills have a significant growth of 0.4 percent, 0.8 percent, 12.2 percent and 7.6 percent respectively. This finding is consistent with previous studies that show that firms who exit export markets have negative productivity growth (Bernard and Wagner, 2001).

To conclude, firm-level investment in capital stock by firms is the key to improving performance and productivity of exporters because of the fact that it expands the production capacity and

efficiency. Consequently, I find evidence of productivity increases among exporters who engage in firm-level investments leading us to believe that there is a premium that firms get when they investment in improving production capacity.

Table 3.6: Investment premium:

Firm Characteristics	Levels Exporter	Annual growth Rates Exporter Investment=1		
	Investment=1	Start	Both	Stop
Total Factor Productivity	0.306	1.238	2.565.	-0.129
	(0.240)	(1.726)	(2.405)	(0.394)
Real Output per worker	0.088	0.042	0.002	0.004
	(0.176)	(0.044)	(0.014)	(0.017)
Capital per worker	-0.287	-0.147	-0.019	0.008
	(0.208)	(0.129)	(0.013)	(0.017)
Real monthly wage in US$	-0.198	0.189	0.014	0.122
	(0.242)	(0.198)	(0.082)	(0.255)
Skills	-0.307	0.107	0.149	0.076
	(0.450)	(0.085)	(0.157)	(0.027)
Employment	0.231	1.058**	0.030	-0.035
	(0.175)	(0.588)	(0.014)	(0.021)

*The regressions are in logs and include full controls; size, ownership, firm age, industry, country and year dummies. Standard errors are in parentheses and significant levels are; * p<.05; ** p<.01; *** p<.001.*

3.5.2 Does firm-level investment stimulate export market entry?

It has been argued that prior firm-level investments may stimulate entry to the export market and past export experience stimulates further firm-level investments. To examine this argument, I use equation (3.13) to match non-exporting firms that engage in firm-level investment with non-exporting firms that do not in period *t-2* to estimate average treatment effect of the treated. Specifically, I want to know whether previously non-exporting firms that engage in firm-level investment are more likely to become exporters in period t than non-exporters who do not engage. Analogously, I estimate equation (3.14) by matching exporters and non-exporters in period t-2 and evaluate whether previous exporters that do not engage in firm-level investment activities with are more likely, than non-exporters who do not engage, to engage n firm-level investment.

Using propensity matching approach, our two cohorts are matched using the nearest neighbor and the results are shown in Table 3.7. Correspondingly, I find evidence that a two-year lag in investment increases the firm's probability by 3.3percent of becoming an exporter, while a one-year lag in firm-level investment increases probability by 4.2 percent. My evidence is in line with other findings that show that firms who engage in any productivity enhancing activities like innovation, Research and Development or technology upgrading at the firm-level receive a stream of benefits thus raising productivity and performance of firms (Jorgenson, 2011; Damijan et al., 2010; Aw et al., 2007; Bustos,2011; Caldera, 2010).

Similarly, I also find evidence that lagged exporting status of the firm has a statistically significant impact on the probability that a firm will engage in firm-level investment. A two-year

firm experience in exporting increases the probability of a firm engaging in firm-level investment by 3.7 percent, while a one year exporting experience increasing it by 9.2 percent. The evidence presented here is compatible with the notion that exporting experience raises the firm's ability of learning-by-exporting thus improving its survival chances in the export market (Aw et al., 2011).

Table 3.7: Pooled Average treatment Effects of lagged investment (lagged Export status) on change in Export (investment) status:

Period	ATT [a]	SE [b]	Observations [c]
Invest(t-2)	0.033	0.027	786(1957)
Invest(t-1)	0.042	0.027	835(2356)
Exports(t-2)	0.037	0.041	433(2309)
Exports(t-1)	0.092	0.036	501(2689)

a:Common support imposed; none of the estimates are statistically significant; b:Standard Errors
c: Number of treatment observation, number of the control group in parentheses.

3.5.3 How firm size and firm-level investment stimulate export market entry?

Eaton et al. (2008) study of Colombian exporting firms establishes an empirical regularity that small domestic firms enter the export market every year is quite difficult to reconcile with the self-selection hypothesis. Considering that sunk costs are important, I would expect that only the large and more productive firms undertake export activity. I evaluate the effect of size on the probability of firms changing their status from non-exporting to exporting and the probability of exporters engaging in investment activities. I divide the sample into four categories: the large-sized firms (having one hundred or more employees), medium-sized firms (having fifty or more employees but less than one hundred), small-sized firms (having ten or more employees but less than fifty employees) and the micro-firms (having one or more employees but less than ten employees. I then re-estimate equations (3.13) and (3.14) to evaluate the influence of size.

The results are presented in Table 3.8. Column 1 is size class, column 2 is average treatment effects of the treated (ATT), column 3 is standard errors and column 4 is the observations. I find evidence indicating that size indeed matters in determining whether a firm that engages in investment activities enters the export market. I first analyze the effect of firm-level investment on the possibility of small-sized firms switching their status to exporting firm. The findings presented in table 3.8 show that a two-year firm-level expenditure increases the probability of a small-sized non-exporter becoming an exporter by 1.3 percent, while a one-year lag in firm-level investment increases the probability by 3.3 percent. Similarly, a two year exporting experience increases the probability of a small-sized firm engaging in firm-level investment activity by 6.9 percent, while a one-year exporting experience increases it by 4.3 percent. Turning to large-sized firms, I find evidence to indicate that a two-year lagged firm-level investment increases the probability of a large-sized firms switching status from non-exporter to exporter, by 1.2 percent, while a one-year lagged expenditure raises its probability by 4.8 percent.

Additionally, a two-year exporting experience increases the probability of a large exporting firm engaging in firm-level investment by 5.2 percent, while a one-year experience raises it by 9.1 percent. Observing the matched results of a medium-sized firm, I note that a two year investment

increases the probability of a non-exporter that is medium-sized to switch status to exporter by 5.3 percent, while a one-year raises it by 3.6 percent. However, I find no evidence that medium-sized exporters have a probability of engaging in firm-level investment activities. In the same way, I also do not find evidence of a two-year exporting experience increasing the probability that micro-firms will engage in firm-level investment activities. Notwithstanding, I find evidence to affirm that micro firms that are non-exporters and engaged in firm-level investment activities two years ago increase their probability of switching status to exporters by 4.3 percent, while a one-year investment increases their probability by 7.4 percent. In the same vein, a one-year exporting experience increases the probability of a micro firm to participate in firm-level investment by 2.3 percent.

The evidence presented in table 3.8 shows that firm productivity differences can be explained by self-selection factors as one channel, but I also confirm that firm-level investment holds the key to a possible explanation as to why small firms, with low productivity venture into the export market. In this study I establish a clear indication that when firms engage in physical capital investment, especially plant and equipment, they gain capacity to produce at cost effectively and so more productive firms produce more output at lower unit costs as postulated in our theoretical model. Therefore, it is possible to argue that new investments provide small firms with a great opportunity to grow into the export markets faster than their expected export entry and perhaps survive[9] longer in the export markets.

Table 3.8: Size Average treatment Effects of lagged investment (lagged Export status) on change in Export (investment) status:

Size class	ATT [a]	SE [b]	Observations [c]
Emp>=100			
Invest(t-2)	0.012*	0.083	241(719)
Invest(t-1)	0.048	0.092	243(886)
Exports(t-2)	0.052	0.063	192(767)
Exports(t-1)	0.091	0.059	220(908)
Emp>=50<100			
Invest(t-2)	0.053*	0.076	102(153)
Invest(t-1)	0.036	0.078	110(175)
Exports(t-2)	-0.093	0.104	54(201)
Exports(t-1)	-0.129	0.090	70(215)
Emp>=10<50			
Invest(t-2)	0.013	0.042	299(572)
Invest(t-1)	0.033	0.038	333(669)
Exports(t-2)	0.069	0.064	144(727)
Exports(t-1)	0.043	0.061	163(839)
Emp>=1<10			
Invest(t-2)	0.042	0.038	144(513)
Invest(t-1)	0.074	0.031	149(626)
Exports(t-2)	-0.143	0.114	35(614)
Exports(t-1)	0.023	0.100	43(727)

a:Common support imposed; none of the estimates are statistically significant; b:Standard Errors
c: Number of treatment observation, number of the control group in parentheses.
*: included caliper (0.0001)

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[9] I do not estimate effect of firm-level investment on the survival of new entrants. This would be beyond the scope of this paper.

3.5.4 The effect of lagged investment on export market participation

Next I consider the view that firm-level investment has a strong impetus to the firm's increased performance in the export market. I view the investment expenditure incurred by the firm as a catalyst that expands its production capacity thus improving production efficiency. If the firm cuts down on its marginal costs of production, it will sell in the international markets at a reduced cost compared to firms whose marginal costs of production are still high. If this is the case, I should be able to see a firm increase its performance once it begins to sell in the export market thus increasing its productivity levels. I estimate equation (3.13) and match exporting firms that engage in firm-level investment with non-exporters who do not, to evaluate their productivity differences. I also augment the results by estimating equation (3.17), which gives us the results of difference-in-differences. I use Quantile difference-in-differences algorithm, with covariates and without covariates to estimate equation (3.17).

The matched results are presented in Table 3.9 and confirm the view that firm-level investment is another channel that explains the large productivity differences between exporters and non-exporters. I find evidence that exporters who engage in firm-level investment activities increase: total factor productivity by 17.0 percent, labor productivity by 22.8 percent, real monthly wages by 11.8 percent, skills by 18.9 percent and employment by 4.2 percent.

Table 3.9: The effect of lagged investment on export market participation

Firm Characteristics	ATT	SE	Observation
Total Factor Productivity (TFP)	0.170	0.092	753(1157)
Real output per worker	0.228	0.153	758(1176)
Real capital per worker	0.404*	0.184	761(1172)
Real monthly wages	0.118	0.111	412(636)
Education	0.189	0.197	702(1036)
Employment	0.042	0.109	777(1234)

a:Common support imposed; Significance levels are; *** p<0.01; ** p<0.05; * p<0.1
b:Standard Errors; c: Number of treatment observation, number of the control group in parentheses

Similarly, the results of difference-in-differences estimation are presented in Table 3.10. Column 1 is the firm measures (total factor productivity, real output per worker, real capital per worker, Real monthly wages in US$, Weighted average of education, and employment), column 2 is the estimates with covariates, and column 3 is the estimates without covariates). As anticipated, I find evidence that firm-level investment has a positive statistically significant effect on the performance of the exporting firms. Firm-level investment raises: total factor productivity by 51.0 percent, real output per worker by 98.2 percent, real capital per worker by 149.7 percent, real monthly wages by 34.1 percent. However, there is a significant drop in skills and employment, by 203.0 percent and 226.5 percent.

The evidence presented in this study is consistent with the notion that firm-level investment is crucial channel for productivity enhancing effects of trade, implying that firms that incur investment expenditures strengthen their ability to improve their productivity and performance in export markets (Constanstini and Melitz, 2008). Furthermore, my findings are in agreement with evidence presented by Yeaple (2005) emphasizing the view that heterogeneous differences between exporters and non-exports arise because of differences in production technology. Firms

that endogenously improve production technology of producing good *x* improve their efficiency and reduce the marginal costs of producing additional units of that good. Firm-level investment in capital stock is analogous with improving the firm's technology and productive capacity, thus increasing firm production efficiency.

Table 3.10: The Difference-in-Differences effect of lagged investment on export market participation.

	With Covariates			Without Covariates		
Firm Measures	ATT [a]	SE [b]	Observ. [c]	ATT [a]	SE [b]	Observ.[c]
Total Factor Productivity (TFP)	0.510	1.243	762(1470)	-2.360	2.049	806(1901)
Real output per worker	0.982	1.085	763(1498)	-1.316	3.285	866(2597)
Real capital per worker	1.497	1.467	765(1493)	-3.280	4.088	867(2593)
Real monthly wages	0.341	0.887	417(947)	-0.133	0.788	459(1445)
Education	-2.030	1.685	706(1383)	-3.196***	0.943	728(1473)
Employment	-2.265	1.196	786(1958)	-2.996	2.022	835(2437)

a:Average treatment effects of the treated; Significance levels are; *** $p<0.01$; ** $p<0.05$; * $p<0.1$;
b:Bootstrapped standard Errors(50 replications)
c: Number of treatment observation, number of the control group in parentheses

3.6. Conclusion

In this study, I analyzed the effect of firm-level investment in capital stock on export market participation. Firstly, I evaluate the view that exporting firms that engage in firm-level investment activities perform better than the exporters who do not engage in firm-level investment activities. I find evidence that, for exporters who engage in firm-level investments, a two year lag in investment expenditure is associated with a high level total factor productivity (30.6 percent), real output per worker(8.8 percent) and employment level (23.1 percent). However, there is a significant drop in the level of real capital per worker (28.7percent), real monthly wages in US$ (19.8 percent) and skill (30.7 percent). I view firm-level investment as a strong catalyst to stimulate export market entry and improving the performance of exporting firms, clearly indicating that there are investment premiums that accrue to firms that engage in firm-level investment. Secondly, I analyze the difference in annual growth rates between new, old and exporters who exit the export market, who engage in investment activities. I find that, new and old exporters have large annual productivity growth rates, larger than exporters who exit the export market.

Thirdly, I evaluate the probability of non-exporting firms that made prior firm-level investment, becoming exporters (the probability of export market entry); and the probability of exporting firms engaging in firm-level investment activities. I find that non-exporting firms that engage in firm-level investment have a high probability of becoming exporters than non-exporters who do not invest in firm-level activities. Similarly, I also find that firms that engage in exporting activity have a high probability of engaging in investment activities. Additionally, I evaluate the effect of size in increasing the probability of non-exporters that engage in firm-level investment switching their export status and find that small non-exporters that engage in firm-level investment have a high probability of switching their status; from non-exporting to exporting. This establishes the fact that although firm productivity differences can be explained by self-

selection factors as one channel, firm-level investment holds the key to a possible explanation as to why small firms, with low productivity, venture into the export market. This study establishes a clear indication that when firms invest in physical capital, especially plant and equipment, they gain capacity to produce effectively and so more productive firms produce more output at lower unit costs as postulated in my theoretical model.

Finally, I evaluate whether firms that invest in productivity enhancing activities perform better when they initiate exporting activities. I apply matching together with difference-in-differences methods to test whether firm-level investment stimulates better performance among exporting firms. I find evidence that firms that invest in physical capital receive a positive, statistically significant premium when they engage in the international markets. My findings suggest that firm-level investment expenditures are associated with better export market participation outcomes. Therefore, policies aimed at promoting exports should target providing support to firms that seek to expand their productive capacity. Firms would benefit greatly if they receive support in form of technology and capacity improvements as this would stimulate the probability of export market entry hence promoting exports.

To conclude, this paper observes that African exporters in manufacturing sector that engage in firm-level investment activities can expand their productive capability through firm-level investments thus reducing marginal costs of production and improving their export market performance in the process.

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CHAPTER 4: TRADE LIBERALIZATION, PRODUCTIVITY GROWTH AND EXPORT MARKET PERFORMANCE: FIRM-LEVEL EVIDENCE FROM KENYA

4.1 Introduction.

Does trade liberalization generate firm productivity growth and improved export market performance? This is a much debated question with theoretical frameworks predicting that trade liberalization leads to increase in aggregate productivity and welfare gains. However, empirical frameworks have presented contradicting findings of the impact of trade liberalization. The traditional trade theory observes that trade can induce welfare gains due to specialization hinging on comparative advantage; compared to the new trade theory that attributes the welfare gains to a combination of product variety and economies of scale. Proponents of trade liberalization have argued that trade liberalization has the advantage of introducing variety of products and economies of scale in production (Krugman, 1979; 1980). Additionally, various studies have also shown that trade liberalization and export-oriented development strategy is important for developing countries if they are to reap the benefits of international trade. This implies that developing countries would benefit more from exporting because of wider market and contact with international customers and producers (Bernard and Jensen, 1995). In the same vein, empirical evidence on the impact of trade liberalization shows another additional source of welfare gain associated with trade liberalization- the reallocation of resources from the low productivity firms to the high productivity firms (Pavcnik, 2002).

In this paper, using firm-level data from Kenya, I study the impact of trade liberalization on firm-level productivity in the Kenyan manufacturing sector. Kenya is chosen from the five Sub-Saharan African countries because of data availability. First, this paper makes the use of import duties as a percentage of total imports, as a measure of trade liberalization. This measure is available for Kenya; with the rest of the countries having missing or incomplete data. Second, Kenya has carried out a number of structural and macroeconomic reforms aimed at addressing the bottlenecks to trade and economic growth since independence (Odhiambo and Otieno, 2005), which is why it forms an appropriate case study. However, most of the trade reforms in the country were carried out in two waves; wave one included the period 1980 to 1987. During this period, the country committed itself to Structural Adjustment programs (SAPs) that were designed to improve production and resource allocation more efficient (Odhiambo and Otieno, 2005). The major objective of the Structural Adjustment Program (SAP) was to move the economy away from a highly protected import-substitution policy to one of export promotion. The SAPs also introduced other policies aimed at reforming the public sector and encouraging the participation of the private sector in the economy. Despite the need to adopt SAPs, the implementation process was not quite successful due to some macroeconomic challenges that the economy faced which created fear and panic in the management of the economy. Consequently, the government of Kenya halted some of the reforms it had initiated during that period (Odhiambo and Otieno, 2005). Conversely, wave two of the reforms was initiated in 1988 and was considered to have the most successful package of reforms. Between 1989 and 1995, Kenya's development plan hinged on export promotion strategy anchored on the premise of reduction and restructuring of tariffs, abolition of export duties, improvement in foreign

exchange regulation and reform of trade institutions. It is believed that by 1995, the government of Kenya had completed carrying out important trade reforms that were thought to provide the country with key trade liberalization benefits. Therefore Kenya offers a good example of an African country that successfully implemented trade reform, and would be ideal for studying the impact of trade liberalization on firm productivity growth and export market performance.

Theoretical trade models offer conflicting predictions on the impact of trade liberalization on firm-level productivity, especially where there is imperfect completion (Pavcnik, 2002). A number of theoretical models predict that exposure of a country's economy to trade generates increases in total factor productivity (TFP) and shuffling of resources from the least productive firms to more productive ones, consequently, generating welfare gains to the country (Melitz, 2003). The Melitz (2003) model suggests that the firm's productivity is an exogenous process that is stimulated by external forces rather than the conscious efforts of the firm itself. Further, the theoretical model of Melitz (2003) assumes that firm productivity differences are derived by assigning productivity levels to firms by luck of a productivity draw. Based on their initial productivity draw, firms subsequently determine their status; whether to serve a domestic or foreign market. However, Yeaple (2005) model suggests a different channel through which firm productivity differences could arise as a result of a firm's endogenous efforts to change its productivity path by making optimal technology and labor choices that bolster its productivity. Relatedly, Melitz and Ottaviano (2008) model indicates how trade liberalization increases product variety, as a result of competition, which lowers prices for consumers hence generating increased benefits from a combination of improved productivity, lower prices and increased product variety. This clearly shows that liberalizing trade benefits both trading partners by improving the productivity of firms and providing a variety of tradable goods to consumers of a given country. Similarly, trade liberalization may induce reshuffling of production within a firm in response to a reduction in tariffs. Plants may rationalize their production processes and resources by reorganizing their plants in order to produce a limited variety of products (Trefler, 2004). In the same vein, Bernard, Redding and Schott (2010) present a model of international trade featuring self-selection and show that trade liberalization induces within firm and between firms reshuffling of resources to strengthen firm productivity. The model also emphasizes the fact that reallocation of resources occurs not only within and between firms, but may extend to between products and export destinations. Similarly, theoretical models also show that trade liberalization provides trading firms with technology advantage which would otherwise be lacking if firms remained serving the domestic market. Firms that serve foreign markets receive productivity gains resulting from access to better inputs and technology of production that raises technical efficiency (Grossman and Helpman, 1991; and Rivera-Batiz and Romer, 1991). This is shown to be important for developing countries that may still be using outdated technology and poor inputs.

On the empirical side, various studies analyze the effect of trade liberalization on firm productivity. However, the impact of liberalized trade on productivity growth in manufacturing sectors in developing economies still continues to generate debate, for and against reforming trade. Studies have pointed to that fact that trade liberalization leads to significant gains in productivity. This view continues to point to the advantages that accrue from increased product variety and quality as the reasons why liberalized trade generates productivity and welfare gains. However, this view is challenged by new growth theories of endogenous growth that have shown

that the evidence for trade liberalization generates contradictory results. The available empirical evidence on the impact of trade liberalization on productivity growth remains controversial. For instance, Rodrik (1995) using firm and industry level data finds a positive relationship between trade policy and productivity growth. None the less, trade liberalization is argued to create large productivity gains, with real value added per worker growing to almost 15 percent (Trefler, 2004).

Analysts use the experience of 1989 Canada and United States (U.S) Free Trade Agreement as a good case scenario where trade liberalization generated large productivity growth following a drop in tariffs. Additionally, trade liberalization exposes domestic industries to stiff competition coming from foreign imports which reduces market power of the domestic producers hence causing firm-level reorganization in the production process. Consequently, the reorganization process might force domestic firms to expand their output, cut down marginal costs of production hence facilitating them to benefit from economies of scale (Pavcnik, 2002). Additionally, trade liberalization facilitates the adoption and transfer of new technology especially through import of intermediate products and capital crucial in the production process (Damijan, de Sousa and Lamotte, 2009; Grossman and Helpman, 1991). Similarly, international trade facilitates the firms' learning process (learning-by-exporting) especially when firms export their goods to advanced economies (Clerides, Lach and Tybout, 1998). This is because entry into export markets in advanced economies may require high quality products, high levels of safety and other standard requirements. Moreover, international trade facilitates external knowledge spillovers, usually coming in the form of foreign ownership and technical assistance. Studies has shown that firms that have foreign ownership are likely to be better managed and can easily access updated technology, on one hand, and establish external links with the parent firms, generating improvements in productivity and performance.

In this study, I examine the impact of trade liberalization on firm-level productivity using the Kenyan manufacturing sector as a case study. I approach my analysis using a three-step method and pay keen attention to various methodological challenges that daunted previous empirical studies on trade reforms. In the first step, I derive a productivity measure for individual firm using the Levinsohn and Petrin (2003) econometric methodology that generates consistent and reliable estimates of the production function indices. Further, using the correct identification strategy, I identify the trade variables to facilitate econometric analysis. In the second step, I analyze the impact of liberalized trade on firm-level productivity using import duties as a percentage of total imports as my measure of trade openness. Aware of the criticisms on using other measures of trade reform, like trade ratios, I use a unique measure of import duties as a percentage of total imports because this measure can be viewed as the most direct indicator of trade restrictions. Countries that are more restrictive would rather restrict the import flows into the country than restrict the flow of exports outside of the country. In other words, trade restrictions are mostly imposed on imports rather than on exports. Moreover, the use of import duties is backed by theory and it captures outcomes, policy and the effect of protection on trade.[10] Additionally, I estimate annual productivity growth rates and evaluate how trade liberalization has impacted on productivity growth in each industry under the study. To guide my analysis, I consider years 1992-1995 as pre-liberalization years (years when actual reforms

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[10] This classification is from Wacziarg (1998) broad categorization of measures of trade openness.

started or carried out) and call these years as period1. Then I take years 1996-1999 as post-liberalization years (years when there were no more reforms) and call these years period2.

First, evaluating the impact of trade liberalization on firm productivity, I find evidence to support the view that liberalizing trade enhances firm-level productivity in the traded sector. Specifically, using recovered productivity indices, I show that increase in the exposure of Kenya's manufacturing sector to trade generated large firm-level productivity of 33.7 percent. The biggest beneficiaries of trade liberalization are the textile industry which made a productivity improvement of 147.2 percent and the food and bakery industry which recorded productivity improvement of 89.8 percent. This paper shows how liberalizing trade can facilitate firm-level productivity improvements in the manufacturing sector of a developing economy. Additionally, the relationship between trade liberalization and productivity is robust to other measures of trade openness, like index of openness and trade freedom index. Secondly, I find evidence which points to the fact that, liberalized trade in the manufacturing sector leads to aggregate productivity growth rates of 14.6 percent. During the pre-liberalization period, productivity declined by 296.2 percent, and this drop was driven by the textile industry which recorded a drop of 9806.6 percent. Conversely, the textile industry recorded a large productivity growth rate of 326.5 percent in the prost-liberalization period. This implies that trade liberalization eased some input pressures faced by the textile industry before trade reforms. The second largest beneficiary of trade liberalization is the metal, machinery and chemical industry which recorded productivity growth rates of 56.9 percent. Thirdly, my findings show that liberalization of trade is associated with aggregate productivity growth of 33.0 percent in the post-liberalization period.

The observed productivity growth is driven by the textile industry which recorded a productivity growth of 1177.7 percent in the post-liberalization period. The second largest beneficiary of productivity growth is the food and bakery industry which recorded a productivity growth of 198.2 percent in the post liberalization period. In the pre-liberalization period, productivity growth is at 1.4percent, which is quite low compared with the post-liberalization period that recorded large productivity growth. Lastly, I evaluate whether liberalizing trade leads to better export performance outcomes. I select the pre-liberalization and post-liberalization samples and analyze the performance of exporting firms in the pre-liberalization period and compare it with the post-liberalization period. In the pre-liberalization period, total factor productivity level is at 18.3 percent, whereas in the post-liberalization period, it rises to 86.1 percent. We can observe that there is a general increase in total factor productivity of about 370.49 percent from the pre-liberalization and post-liberalization periods. This possibly indicates that production inefficiency could have been eliminated as a result of trade liberalization. Further, this could also mean that there has been some industry rationalization that is occasioned by trade liberalization. To conclude, this paper notes that liberalizing trade has a positive and statistically significant impact on productivity growth and on the performance of exporting firms. Therefore, African countries that seek to generate higher productivity growth in manufacturing sectors should put in place policies that facilitate, rather than restrict, trade. To this end, reducing duties on imported goods, especially intermediate inputs would go a long way in raising firm-level productivity growth.

This paper makes a contribution to the literature on impact of trade on aggregate productivity growth as first discussed in the Melitz (2003) model. This line of literature examines the role of international trade in stimulating productivity growth and within firm and industry re-allocation

of resources. The Melitz (2003) model emphasizes how exposure to trade induces only the more productive firms to initiate entry into the export markets while the less productive remain serving the home market or are forced out of the market altogether. Furthermore, this paper addresses the methodological issues that plagued previous studies examining the impact of trade policy on productivity growth. Previous research that examined the impact of trade liberalization on total factor productivity growth, suggested that causality was attributed simply by association whereby, if there is observed increase in total factor productivity in the post-liberalization period, then such increased should have been caused by trade liberalization (Chand and Sen, 2002). I address this methodological by using a generally accepted measure of tariff protection- import duties as percent of total imports, as a measure of trade protection to analyze how changes in trade policy impact productivity growth. Earlier studies that used other measures of trade protection, like openness index, black market premium, import penetration ratios, dollar indexes and other measures were criticized as not backed by economic theory and their failure to capture the impact of policy changes on trade.

My paper is similar to Pavcnik (2002) who studies trade liberalization, exit and productivity improvements in Chilean plants, and Njikam and Cockburn (2011) who study trade liberalization and productivity growth in Cameroon. The major difference between this paper and that of Pavcnik (2002) is that we study different contexts in which trade liberalization was carried out. Besides, Pavcnik (2002) considers exiting firms, which I omit in the analysis; and moreover I incorporate the impact of trade liberalization on the performance of exporting firms, which is quite different from Pavcnik (2002) study. Njikam and Cockburn (2011) use Pavcnik (2002) framework to study the impact of trade liberalization on productivity growth. Just like Pavcnik (2002), they too do not incorporate the impact of trade liberalization on the export market performance.

In conclusion, I use the theoretical framework of Erickson and Pakes (1995) to guide the empirical analysis. The empirical framework of Erickson and Pakes (1995) provides a guide on how to analyze the dynamic behavior of a profit maximizing entrepreneur or a firm. I implement the econometric analysis using a regression framework and difference-in-differences method. Furthermore, I use a novel approach of difference-in-differences to evaluate and analyze the impact of trade liberalization on the export market performance. The rest of the paper is organized as follows; section 4.2 presents review of related literature. Section 4.3 provides an overview of the data. Section 4.4 presents theoretical and empirical framework and econometric methods. Section 4.5 discusses the results. Section 5.6 concludes.

4.2 Literature Review

The effects of trade liberalization on productivity of firms have widely been studied, both using theoretical models and empirical analysis. In this line, a number of theoretical models on the effect of trade liberalization predict that exposure of a country's economy to trade generates increases in total productivity and shuffling of resources from the least productive firms to more productive ones, consequently, generating welfare gains for the country (Melitz, 2003). The Melitz (2003) model suggests that the firm's productivity is an exogenous process that is induced by external forces other than the conscious efforts of the firm itself. Further, the theoretical model of Melitz (2003) assumes that firm productivity differences are derived by assigning

productivity levels to firms by luck of a productivity draw. Based on their initial productivity draw, firms subsequently determine their export status; whether to serve domestic or foreign markets. The Melitz (2003) model assumes that it is not possible for the firm to change the future of its productivity once it has entered the market with a low productivity draw. However, Yeaple (2005) model suggests a different channel through which firm productivity differences could arise as a result of a firm's endogenous efforts to change its productivity path by making optimal technology and labor choices that bolster its productivity.

Relatedly, Melitz and Ottaviano (2008) model indicates how trade liberalization increases product variety, as a result of competition, which lowers prices for consumers hence generating increased benefits from a combination of improved productivity, lower prices and increased product variety. This clearly shows that liberalizing trade has benefits for both trading partners by improving the productivity of firms and providing a variety of tradable goods to consumers of a given country. Similarly, trade liberalization may induce reshuffling of production within a firm in response to a reduction in tariffs. Plants may rationalize their production processes and resources by reorganizing their plants in order to produce a limited variety of products (Trefler, 2004). In the same vein, Bernard, Redding and Schott (2011) present a model of international trade featuring self-selection and show that trade liberalization induces within firm and between firm reshuffling of resources to strengthen firm productivity. Their model also emphasizes the fact that reallocation of resources occurs not only within and between firms, but may extend to between products and export destinations. Similarly, theoretical models also show that trade liberalization provides trading firms with technology advantage which would otherwise be lacking if firms remained serving the domestic market. Firms that serve foreign markets receive productivity benefits as a consequence of access to better inputs and technology of production that raises technical efficiency (Ethier, 1982; Grossman and Helpman, 1991; Rivera-Batiz and Romer, 1991). This is shown to be important for developing countries that may still be using outdated technology and poor inputs.

However, there are theoretical models of trade that do not project productivity improvements or trade liberalization advantages. Some theoretical studies have shown that for countries to fully maximize trade liberalization there should be complementary policies to accompany trade reform effort. Consequently, trade will not stimulate growth in economies having business bottlenecks (Bolaky and Freund, 2004; Hoekman and Javorcik, 2004).

On the empirical side, various studies examine the effect of trade liberalization on firm productivity. Pavcnik (2002) studies effect of liberalized trade on plant productivity and finds evidence of plant productivity improvements as a result of trade liberalization. Her findings establish that the overall productivity improvements are derived from the reshuffling of resources from the least to the most productive firms. Additionally, international trade reform stimulates competition, making plants to respond by trimming off their production process leading to within plant productivity improvements. Besides, Pavcnik (2002) study incorporates exit of firms into her analysis, and shows that exit of firms generally contributes to productivity gains and reshuffling of resources between and within firms in the economy. Pavcnik (2002) study clearly demonstrates how trade reform may cause firms to reorganize their production processes and rationalize input use so as to maximize output and aggregate benefits from trade reform. Additionally, Gustafsson and Segerstrom (2010) study firm-level productivity differences and

Research and Development led growth and find evidence that trade liberalization causes a reallocation of resources, from low productivity to high productivity firms. Moreover, trade liberalization increases overall productivity when the least productive firms are forced out of the industry and productivity adjustment mechanisms that raise productivity draw (Palangkaraya and Yong, 2011; Ha and Kiyota, 2014).

Relatedly, Amiti and Konings (2007) study the effect of tariff reduction on intermediate inputs and final goods, and present evidence showing that reducing input tariffs significantly increases productivity of firms operating in the industry. Similarly, lowering of output tariffs has the effect of increasing productivity by stimulating tougher import competition. Furthermore, Lileeva (2008) examines the effect of United States of America (USA) and Canadian tariff cuts on productivity dynamics of firms and finds evidence that tariff cuts increased exit rates among low productivity firms and resource reallocation from low productivity firms to high productivity firms. Most importantly, new export entrants received greater productivity improvement as a consequence of the reduction in tariffs.

Accordingly, Trefler (2004) studies the effect of free trade agreement between Canada and the United States of America and finds evidence in productivity improvements in Canadian exporting plants, compared to the non-exporting firms. Additionally, Liveela and Trefler (2010) study the impact of Canada-U.S. Free Trade Agreement (FTA) and find evidence of within-plant labor productivity in Canadian manufacturing and reshuffling of resources from low productivity firms to high productivity firms. Moreover, firms who have better access to international markets show promising signs of engaging simultaneously in export and investment, raising their productivity further as a consequence. Their study also establishes how the lowering of tariffs stimulates export market entry, product innovation and improved adoption of advanced technologies.

Relatedly, Topalova and Khandelwal (2011) study of trade liberalization and firm productivity in India presents evidence showing that trade reform increased productivity among Indian firms and provided firms with access to quality production inputs and production technology. This implies that lowering of barriers, in turn my lower the cost of production hence providing producers with a cost minimization advantage. Accordingly, Hu and Liu (2014) study the impact of tariff reduction on productivity and find evidence that trade liberalization increases total factor productivity for Chinese manufacturing firms. Equally, Dovis and Milgram-Baleix (2009) examine the effect of tariff and foreign competition on total factor productivity of Spanish manufacturing firms and find evidence to indicate that trade liberalization increases total factor productivity which is explained by intra-industry. Accordingly, Chand and Sen (2002) study the impact of trade reforms in Indian manufacturing sector and present evidence of positive impact. Trade liberalization effected the growth of total factor productivity among manufacturing firms in India.

In the same vein, some empirical studies explored the relationship between trade and productivity and found a causal effect of trade on productivity across countries and that more open countries show evidence of faster productivity growth than less open ones hence open economies reap more benefits that come with free trade like capital inflows, technology, and accelerated growth, among others (Alcala and Ciccone, 2004; Dowrick and Golley, 2004; Dollar

and Kraay, 2004). Additionally, using a comparative data set of 93 countries Edwards (1998) finds a positive connection between openness and total factor productivity (TPF). Correspondingly, Frankel and Romer (1999) find a positive and statistically significant relationship between growth and different measures of openness. On the African economies, studies have documented how important trade liberalization is to productivity growth. Njikam and Cockburn (2011) examine trade liberalization and productivity growth in Cameroon and report evidence of total factor productivity growth following the trade liberalization episode. Similarly, Gries and Redlin (2012) study the effect of liberalization on growth and show evidence of short-run and long-run relationship between trade liberalization and growth.

However, some studies show a negative impact of trade liberalization on productivity. For instance, de Loecker (2011) finds lower gains following trade liberalization though the study recognized the fact that overall average productivity of an industry can still increase due to the elimination of inefficient producers. Similarly, Majeed, Ahmed and Butt (2010) study trade liberalization and total factor productivity in Large Scale Manufacturing (LSM) sector of Pakistan and find no evidence that trade reform increased total factor productivity.

To conclude therefore, various studies have been conducted on trade liberalization and firm productivity across most economies, excluding Africa, but such studies on African economies are scarce, which is why this study will help enhance our knowledge of the effect of trade liberalization on firm productivity and export participation in the context of African economies.

4.3 The Data

This empirical analysis is based on strongly balanced panel data from Kenya. The data are from a panel survey of firms operating in the manufacturing sector of the country and include, the textile industry, wood industry, furniture industry, garment industry, metal, machinery and chemical industry, and food and bakery industry. The data cover a period of seven years collected over seven rounds, from 1992 to 1999 collected over four waves between 1992 and 2000. The data were collected under the Regional Program on Enterprise Development (RPED) organized by the World Bank, jointly by the Center for the study of African Economies (CSAE)[11] and University of Oxford, using stratified sampling strategies within each firm size. The dataset was drawn from comprehensive questionnaires carried out with owners or managers and workers of sampled manufacturing firms with a view to collecting data that is relevant for firm-level analyses. The dataset is unique in having measures of productivity, investment in plant, equipment, land and buildings expenditures.

Data contain replacement value of plant and machinery, the sale value of land and buildings and investment in both these types of capital. Capital stock is deflated using a weighted average of national consumer price index and nominal US dollar exchange rate[12]. Human capital stock comprises of the following worker characteristics: age, tenure in current job, education, hours worked, earnings and potential experience. Other variables contained in the dataset include real output per worker, the real value of capital per worker, real value of materials, real value of other

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[11] We thank the Center for the study of African Economies for making the data available for download for free to researchers. We are grateful to you for this assistance without which, it would not have been possible to conduct this study.

[12] See a full description of the dataset and all the variables on www:csae.ox.ac.uk

intermediate inputs, number of employees, ownership status, firm age, export status and employee mobility. This dataset was downloaded from CSAE and contains 3240 observations based on more than 628 manufacturing firms. Moreover, the World Bank and World Trade Organization constituted important sources for tariff data and other export and import data including world development indicators.[13]

Kenya is chosen for the study because it offers a good example of an African country that successfully implemented trade reforms, and would be ideal for studying the impact of trade liberalization on firm productivity growth and export market performance. Besides, Kenya government initially operated a strong import substitution strategy which nearly stifled the manufacturing sector, causing slow growth of the industrial sector and poor development outcomes. This study provides the descriptive statistics highlighting the key features of the data in table 4.1.

TABLE 4.1: Mean contributions of firms to the manufacturing sector

Country	Sector	Exporters	Non-exporter	Total
Kenya	Textile	0.15	0.06	0.21
	Garment	0.20	0.08	0.27
	Wood	0.09	0.06	0.15
	Furniture	0.16	0.11	0.27
	Food and Bakery	0.24	0.28	1.04
	Metal, Machinery, Chemical	0.26	0.32	0.58

Source: Calculations from CSAE data.
Notes: Estimates are in means.

Table 4.1 above presents the manufacturing industries under the study. Most exporters (26 percent) are involved in the metal, machinery and Chemical industry, followed by food and bakery (24 percent), garment (20 percent), furniture (16 percent), textile (15 percent) and finally wood sector has the lowest contribution (9 percent). Similarly, non-exporters are more engaged in metal, machinery and chemical industry (32 percent), food and bakery (28 percent), furniture (11 percent), garment (8 percent) and finally textile and wood (6 percent) respectively. We can observe that both exporters and non-exporters engage in manufacturing activities. This clearly shows how important the sector is in boosting economic growth and development in Kenya.

TABLE 4.2: Mean shares of exporters and non-exporters

Country	Characteristics	Non-Exporters	Exporters	Total
Kenya	Employment	51.21	255.39	306.60
	Value added per worker	8.58	9.52	18.10
	Capital per worker	8.12	9.56	17.68
	Firm Age	20.24	22.77	43.01
	Foreign ownership	0.13	0.36	0.49
	Average monthly wage US$	4.14	4.67	8.81
	Materials per worker in US$	7.84	8.85	16.69
	Other inputs per worker US$	6.22	7.03	13.25
	Weighted Average education(skills)	7.75	9.39	17.14

Source: Calculations from CSAE data

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[13] Some macroeconomic variables were drawn from the database maintained by Rose (2002), and heritage foundation.

Table 4.2 above presents the mean characteristics of non-exporters and exporters for the Kenyan manufacturing sector. From this table, exporters, on average, employ more employees (255.39) have higher value added per worker (9.52), use more capital per worker (9.56), are older (22.77), have more foreign ownership (0.36), pay higher wages (4.67), use more materials per worker in US$ (8.85) and other inputs per worker in US$ (7.03) and hire more skilled workers (9.39) than non-exporters. Non-exporters, on average, employ few workers (51.21), have low value added per worker (8.58), use less capital per worker (8.12), are a bit more younger (20.24) and relatively owned by the local investors (0.13), pay less wages per employee (4.14), use less materials per worker in US$ (7.84) and other inputs per worker in US$ (6.22), and employ low-skilled workers (7.75). From the above information, we see that exporters are different from non-exporters in all characteristics. This would be consistent with the view that exporters possess superior characteristics and are more productive than non-exporting firms (Bernard and Jensen, 1999).

4.4 Theoretical and Empirical Model:

4.4.1 Theory

Various theoretical models have been advanced to explain the impact of trade liberalization on the economy. Moving forward with the empirical analysis, I rely on the theoretical work of Erickson and Pakes (1995) that explains the dynamic behavior of a profit maximizing entrepreneur or firm. The firm faces a business environment that is characterized by harsh competition coming from within and outside of the industry. To succeed, the firm has to take risks and invest to increase its chances of growth and survival, otherwise realize a fall in its profitability and eventual shut down. Surrounded by competitive business pressures, the goal of the firm is to maximize profits given expectations about industry competition. In each period, a firm decides on its business status; either to serve the domestic market as a domestic supplier or to serve the international market as an exporter.

A firm continues to sustain production after evaluating its expected future net cash flows given the current level of investment or production. Conditional on the expected future value, the firm will continue to operate only if its expected future marginal revenue (MR) exceeds expected future marginal costs (MC); that is, MR>MC. Conditional on the firm's market outcomes, it then selects input mixes that enhance realization of its business goal of profit maximization. Therefore, a firm's choices of shut down and input decision depends on its observable characteristics such as capital, labor and investment, and continues to operate only when it is fairly certain of the expected future gains that accrue. Because the business environment is surrounded by competition and uncertainty, firms consider the actions of other firms in the industry before taking their decisions on capital and investment. As in Pavcnik (2002), the profits, π_{it}, of firm i at time t, are dependent on its capital, k_{it}, labor input, l_{it}, and productivity, ω_{it}, (unobserved) so that:

$$\pi_{it} = f(k_{it}, l_{it}, \omega_{it}) \tag{4.1}$$

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It's only reasonable to suggest that firms can easily adjust their materials and other inputs in the production process, but may find it difficult to adjust capital and labor[14] stocks within the shortest time. In this manner, I then describe the firm's problem by a value function, thus:

$$V_t(\omega_t, l_t, k_t) = \max\left\{S_t, \pi_t(\omega_t, l_t, k_t) - z(i_t) + dE(V_{t+1}(\omega_{t+1}, l_{t+1}, k_{t+1})|\Theta_{it}\right\} \qquad (4.2)$$

Where capital stock accumulation can then be written as:

$$k_{t+1} = (1-\eta)k_t + i_t \qquad (4.3)$$

Where V is the expected future value, S is the scrap value from the firm if it chooses to shut down its production, z() denotes the cost related to the undertaking, d denotes the discount factor, Θ, is the valuable information in period t, while η is the depreciation rate of capital stock. In pursuance of a tractable model, I take productivity as evolving as a discreet first-order Markov Process, where the firm's current state variables depend on the historical (previous) value of state variables. Conditional upon its productivity and market outcomes, a firm persists to produce if its productivity surpasses a particular set value, ϖ, which is a function of its labor and capital:

$$M_t = \begin{cases} 1, if\, \omega_t \geq \varpi_t(l_t, k_t) \\ 0, Otherwise \end{cases}$$

Where M_t equals one, if the firm continues to operate in the market in period t and M_t equals zero, when the firm shuts down all its operations and exits the market. The firm is faced with a dynamic decision: how much to invest in order to realize the expected market outcomes? It invests after evaluating its future productivity and profitability, which in this case will depend on the stock of capital, labor and productivity, thus:

$$i_t = f(\omega_t, l_t, k_t) \qquad (4.4)$$

When firms engage in export markets, this exposes them to international competition which causes firms to respond in a variety of ways, and follow different productivity paths. In this way, firms realize the need for rational use of their resources and reorganize the production processes to remain competitive amidst competitive pressures from the industry, hence causing productivity improvements induced by trade policy changes.

4.4.2: Empirical strategy

Our empirical strategy is to examine productivity growth resulting from changes in trade reforms. Regulatory changes are not only accompanied by a great deal of firm entry and exit, but improvements in firm performance usually determined by a firm's productivity draw or level. Given that firms' productivity levels are unobservable directly I need to implement a strategy that estimates productivity and recovers production function parameters that are consistent and reliable.

In this section, I provide the discussion of the strategy for getting consistent estimates of the production function for measuring productivity. The main contributions for measuring firm-level total factor product (TFP) have been advanced by Wooldridge (2009), Ackerberg, Caves and Frazer (ACF, 2006), Levinsohn and Petrin (LP, 2003) and Olley and Pakes (OP, 1996). Traditionally, productivity is considered as a deviation between observed output and the actual

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[14] I treat labor stock as less variable than materials; as it takes time to recruit new workers, train them and orient them to new tasks. This is line with Ackerberg, Caves and Frazer(2006)

output predicted using Cobb-Douglas production function from Ordinary Least Squares (OLS). However, deriving productivity estimates using OLS approach is sometimes criticized because of the simultaneity bias- where the regressors and the error term are correlated hence biasing the OLS estimates upwards. Besides, there is the selection bias –leading to endogeneity problem, as a consequence of the relationship between productivity shocks and the probability of exiting the market. When there is a positive relationship between a firm's profitability and its capital stock, relative to small firms, firms with larger capital are likely to stay in the market even when their productivity falls. When this is the case, then the estimate on the capital variable will be biased downwards. Then there is econometric issue of endogeneity; when an explanatory variable or some of the explanatory variables is (are) correlated with the error term as a result of measurement error or other factors. It is natural that there are factors influencing production that are unobserved to the econometrician but observed by the firm, for instance, managerial inputs, may not be observed by the econometrician but known to the firm. Consider a firm that produces good, x, using a Cobb-Douglas production function in logs:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_o o_{it} + \beta_m m_{it} + \omega_{it} + \varepsilon_{it} \tag{4.5}$$

Where, y_{it} is the log of output, k_{it} is the log of capital input, and l_{it} is the log of labor input, o_{it} is other materials, m_{it} is materials. All these are physical inputs in the production process which are observable to analyst, but ω_{it} and ε_{it} are unobservable to the analyst. Understanding the difference between these two terms is important for correct estimation of the production function. I first consider the importance of ε_{it} in the analysis: this term is expected to represent shocks to the production process that are unpredictable by the firm before making input decisions at period t. Conversely, the ω_{it}, represents shocks that can be predicted by the firms when making input decisions and may denote variables such as the managerial ability of the firm, or expected surge in demand of the products. I can take ω_{it} to be a productivity shock of firm i in period t. Similarly, ε_{it} might represent factors that cause deviations from expected plan of the firm. These can be expected defect rates, or expected machine breakdown and might also denote the measurement error in the output variable. The endogeneity problem in estimating equation (4.5) arises in that the firm's optimal choice of inputs k_{it}, l_{it} and m_{it} will be correlated with the predicted productivity shock ω_{it}, rendering OLS estimates of β's biased and inconsistent. Addressing this endogeneity problem will require instruments that are correlated with input choices k_{it} and l_{it} but uncorrelated with ω_{it}.

A novel method is suggested by Olley and Pakes (1996) to address the endogeneity problem and selection bias using a structural method to identification of production functions. The endogeneity issue, in their specification, is addressed using investment to proxy for an unobserved time-varying productivity shock, while the selection problem is addressed using survival probabilities. However, this approach is criticized for not being able to address collinearity issues resulting from the first stage of the estimation process (Ackerberg et al., 2006). Similarly, Levinsohn and Petrin (2003) use a similar method for solving the endogeneity issue by using intermediate inputs to proxy for unobserved productivity shock. In this study, with

the help of a Stata code (levpet), I use LP[15] approach to derive a measure of firm-level productivity.

Consider a firm with a Cobb-Douglas production function;

$$Y_{it} = A_{it}(\Upsilon)L_{it}^{\beta_l}K_{it}^{\beta_k}O_{it}^{\beta_o}M_{it}^{\beta_m} + \varepsilon_{it} \qquad (4.6)$$

Where Y_{it} denotes output of firm i at time t which is a function of labor, L_{it}, capital, K_{it}, other intermediate inputs, O_{it}, and materials, M_{it}. Υ, denotes trade policy stance, ε_{it} represents two components: the observable and unobservable components. Our interest is to examine whether productivity of firm i is a function of trade policy, and provide explanation whether firms that operate in export market before and after the trade liberalization are different. I follow a three-step estimation approach to estimating the effect of trade policy on firm productivity and performance. In the first step, I estimate total factor productivity, and subsequently examine how this total factor productivity (TFP) is affected by trade policy in the second step. In the third step, I use a difference-in-differences method applied in the trade literature by Wagner (2002), which involves observation of outcomes for two groups for two time periods; the starting period and ending period-here denoted as pre and post. One group receives the treatment in the second period and not in the first period, while the second group does not receive any treatment in either period. The objective is to evaluate the impact of the treatment; thus if the same units within the group are observed in each period, then I can subtract the average change in the second (control) group from the average change in the first (treated) group.

In the first step, I can take the natural logarithms of eq.(4.6) above, and denote using small letters, so that I can write the production function as:

$$y_{it} = \beta_0 + \beta_1 l_{it} + \beta_2 k_{it} + \beta_3 o_{it} + \beta_4 m_{it} + \varepsilon_{it} \qquad (4.7)$$

Let ε_{it} compose of two components:

$$\varepsilon_{it} = \omega_{it} + \psi_{it}$$

Where ω_{it} denote the predictable component- in this case, firm i's productivity in time t, while ψ_{it} represent the unpredictable component, for instance, demand changes.

The Levinsohn and Petrin[16] approach proposes a three step estimator to address two concerns; selection and endogeneity problems. In the first step, I estimate the coefficients of variables inputs (labor and materials), while in the second step, the use of moment conditions is imposed to estimate capital coefficients, and thirdly, predicting residuals. Following LP, I recover the predicted firm-level productivity estimates and build an index of the firm's total factor productivity (TFP), thus I can then write our estimates as:

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[15] You can check LP, 2003 and annex A1.2, for details of their estimation procedure. Thanks to Levinsohn and Petrin for providing us with the Stata code.

[16] LP method is discussed in "estimating production functions using inputs to control for unobservable (2003).

$$\overline{\omega}_{it} = TFP_{it} = y_{it} - \overline{\beta}_1 l_{it} - \overline{\beta}_2 k_{it} - \overline{\beta}_3 o_{it} - \overline{\beta}_4 m_{it} \qquad (4.8)$$

Where the bar denotes the recovered productivity estimates from each variable of interest (labor, capital, other inputs and materials.

In the second step, I follow standard estimation method common in the trade liberalization literature[17] and modify it to our analysis. I seek to understand and explain how trade policy impacts on firm productivity across trade regimes. Specifically, I conduct my econometric analysis in a regression framework, where I regress the recovered firm productivity measures on various trade liberalization, business environment, and firm and industry characteristics. In my baseline specification, I posit that the effects of trade reform depends on a number of factors: import penetration rates, the size of the firm (proxied by number of employees), the age of the firm, the ownership structure (whether foreign owned or local or state owned), the sector or industry it belongs, other macroeconomic factors like inflation, bank and currency crises. I use a tariff measure of import duties as a percentage of total imports[18] as a measure of trade policy stance prevailing in the country. Tariff measures are considered the most visible form of trade restriction and are considered as a more direct indicator of trade restriction. The tariff measures have the advantage that they capture both trade policy and its effects, compared to other measures of openness that neither captures trade policy nor its effects (David, 2007). I base my specification on insights drawn from Pavcnik (2002), Njikam and Cockburn (2011), Topalova and Khandelwal (2011), Dovis and Milgram-Baleix (2009) and Fernandes (2003), where I consider the impact of a one-period lagged value of trade policy measure on firm productivity in period *t*. It is plausible to suggest that trade reform implemented in the previous period will have its impact felt in the current period hence the importance of lagging the trade policy measure. In my specification, I capture intensity of import competition in individual sectors using import penetration rates *(mpr)*, I then use a one-period lagged values of import duties as a percentage of total imports as our trade policy stance, denoted by trade. This is a unique innovation in my work, since few studies have used this measure. I control for other macroeconomic disturbances usual to all firms in the industry, like bank crisis[19], denoted by *bcriss*, inflation[20], denoted by *inf*, currency crash or crisis[21], denoted by *curr*. Moreover, I use Herfindah-Hirschman index,(HHI), to capture the degree of competition in the industry, denoted by *dcom*. The impact of trade policy on productivity may also be influenced by the size of the firm (proxied by logarithm of number of workers), denoted by *lnsize*. I also control for firm age, ownership, time and year effects, indexed by vector X. There is evidence to suggest that firm productivity increases with age, its size and ownership structure, giving me a reason to suggest that it is important to control for these factors. Thus, the base line specification for assessing the impact of trade liberalization on productivity can be specified as:

$$\omega_{it} = \beta_0 + \beta_1 \ln mpr_{it-1} + \beta_2 trade_{it-1} + \beta_3 bcriss + \beta_4 dcom + \beta_5 \ln size_{it} + \beta_6 \inf_{it} + \beta_5 curr_{it} + \sum_{i=1}^{n} X_{it} \quad (4.9)$$

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[17] See Pavcnick(2002), Schor(2004), Topalova (2004), Amiti and Konings(2007) Fernandes(2007) for details

[18] Available in the site maintained by Rose(2002)

[19] The data on bank crises is taken from database in Rose(2002). If country experienced bank crises in period, it is coded 1 and zero otherwise.

[20] Same as in note 18 above

[21] Same as in note 18 above.

Where ω_{it} is productivity, mpr_{it-1} is a one-period lagged import penetration rates, $trade_{it-1}$ is a one-period lagged trade policy, $bcriss$ is banking crisis, $dcom$ is degree of competition in the economy, $size_{it}$ is logarithm of workers, $\inf_{it}$ is inflation, $curr_{it}$ is currency crash and $\sum_{i=1}^{n} X_{it}$ denotes a vector of dummy variables(firm age, ownership, year and industry effects).

Next, I evaluate how productivity annual growth rates evolved over the pre- and post-liberalization periods. I divide the data into two periods; period 1, takes periods 1992 to 1995 as the pre-liberalization period and period 2, considers periods 1996 to 1999 as post-liberalization period. To assess the impact of trade liberalization on productivity growth rates, I specify my estimation equation as:

$$\Delta\omega_{it} = \beta_0 + \beta_1 \ln mpr_{it-1} + \beta_2 trade_{it-1} + \beta_3 bcriss + \beta_4 dcom + \beta_5 \ln size_{it} + \beta_6 \inf_{it} + \beta_5 curr_{it} + \sum_{i=1}^{n} X_{it} \qquad (4.10)$$

Where $\Delta\omega_{it} = \dfrac{1}{\omega_{it-1}}(\omega_{it} - \omega_{it-1})$

Next I analyze the impact of trade liberalization on productivity growth before trade liberalization took place and after trade liberalization. I am interested in assessing whether Kenya's trade reforms have benefited the manufacturing sector and whether I can find evidence to support the notion that trade liberalization leads to firm-level productivity growth. In this vein, I modify equation (10) and re-estimate it.

$$\Delta\omega_{it} = \beta_0 + \beta_1 \ln mpr_{it-1} + \beta_2 trade_{it-1} + \beta_3 bcriss + \beta_4 dcom + \beta_5 \ln size_{it} + \beta_6 \inf_{it} + \beta_5 curr_{it} + \sum_{i=1}^{n} X_{it} \qquad (4.11)$$

Where, $\Delta\omega_{it} = (\omega_{it} - \omega_{it-1})$.

Lastly I consider whether trade liberalization has helped exporting firms to perform better than non-exporting ones. I use difference-in-differences (DID) method to examine this argument. The DID involves observing outcomes of two groups in two time periods; the starting period and ending period-here denoted as pre and post. One group receives the treatment in the second period and not in the first period, while the second group does not receive any treatment in either period. The objective is to evaluate the impact of the treatment; thus if the same units within the group are observed in each period, then I can subtract the average change in the second (control) group from the average change in the first (treated) group. Formally, the difference-in-differences estimation can be written as:

$$\Delta\omega_1 = (\omega_{11} - \omega_{10}) - (\omega_{01} - \omega_{00}) \qquad (4.12)$$

Where $\Delta\omega_1$ represents the impact or outcome variable, $(\omega_{11} - \omega_{10})$ is the outcome for the treated group and $(\omega_{01} - \omega_{00})$ denotes the outcome for the control group.

Therefore, I can write down the difference-in-differences equations for trade liberalization and exporting based on the sample of matched firms as:

$$\Delta\omega_{it} = \omega_{it} - \omega_{it-1} = \alpha_{it} + \beta X_{it} + \sum_{v=-1}^{2} \lambda_v trade_{it-v} + \exp_{it} + D_t + \varepsilon_{it} \qquad (4.13)$$

Where $\Delta\omega$ denotes the change in the outcome variables (total factor productivity, labor productivity, employment or wages), *i, t,* and *k* index firms, time periods, and sectors/industries respectively, while D denotes the full set of four-digit industry, regions and time dummies. *X* is a vector of control variables, and exp_{it} is dummy variables set to 1 if firm *i,* is exporting at point *t.* To evaluate the impact of trade policy on exporting, I test eq. (4.13) on both the pre and post liberalization period.

To conclude, I use difference-in-differences to evaluate the impact of trade liberalization on the performance of exporting firms and assess the direction of causality, since the expected outcomes cannot solely be attributed to the average treatment before and after the treatment as other factors contemporaneous with the treatment might be captured in the matching process.

4.5 Results and Discussion:

4.5.1 Coefficients estimates for the production function.

This study requires a correct estimation of firm productivity estimates, and building on the work of Levinsohn and Petrin (2003), I present coefficients for the production function from the study sample. To organize my work properly, I divide the sample into two periods, period1 and period 2: period 1 contains estimates for period 1992-1995, and period 2 contains estimates for period 1996-1999. I pool the estimates of the two periods and call estimates for period1, the pre-liberalization estimates while period2 estimates are referred to as post-liberalization estimates. I present the estimates using two methods: the Ordinary Least Squares (OLS) method and the semi-parametric estimation or Levinsohn and Petrin (LP) method. My interest is in the LP estimates while OLS estimates are only presented for comparison purpose.

In Table 4.3, I show estimates of input coefficients derived from the production function specified in eq. (8). The production function is estimated on four digit ISIC industry classification for each manufacturing industry. I estimate the production function on textile industry (ISIC 3219), wearing apparel-garment (ISIC 3220), wood (ISIC 3319), furniture and fixtures (ISIC 3320), food and bakery (ISIC 3121/3117), and metal, machinery and chemical industry (ISIC 3819/3829/3529). The estimates for labor, capital and materials are presented for pre- and post-liberalization periods. The first six columns present the pre-liberalization period while the last six present the post- liberalization period; we can observe that there is a significant difference between the OLS and the semi-parametric estimates. The OLS coefficients on labor and materials are biased upwards for both the pre- and post-liberalization periods, hence confirming the much observed theoretical evidence that the OLS estimates tend to be biased upwards. Conversely, the coefficients on labor, capital and materials derived from semi-parametric estimation move in the direction that indicates successful elimination of simultaneity bias. Of particular interest are the estimated coefficients on capital that indicate a higher movement in the direction of successful elimination of simultaneity bias in both the pre- and post-liberalization periods.

In all industries under the study, we can observe that estimated coefficients on capital adjust downwards or decline, implying that the selection bias may be less important than the simultaneity bias. Accordingly, we can observe that semi-parametric estimates on the

coefficients on capital in the textile industry move from OLS estimates of -0.435 to LP estimates of -0.372 in the pre-liberalization period which reflects an efficient adjustment on the coefficient estimates. Similarly, we can observe that the estimated coefficients on capital in the same industry move from OLS estimates of -0.895 to LP estimates of -0.812 in the post-liberalization period. In the garment industry, the estimated coefficients on capital from OLS estimates move from -0.607 to LP estimates of -0.549 in the pre-liberalization period, and from OLS estimates of -0.849 to LP estimates of -0.754 in the post-liberalization period. Similarly, in the wood industry, the estimated coefficients on capital from OLS estimates move from -0.595 to LP estimates of -0.500 in the pre-liberalization period and from -0.732 to LP estimates of -0.636 in the post-liberalization period. Similarly, the estimated coefficients on capital in the furniture industry from OLS move from -0.669 to LP estimates of -0.597 in the pre-liberalization period, and from OLS estimate of -0.0.550 to LP estimate of -0.470 in the pot liberalization period. In the food and bakery industry, estimated coefficients on capital display the same pattern; OLS estimates move from -0.779 to LP estimates of -0.703 in the pre-liberalization period, and from OLS estimates of -0.876 to LP estimates of -0.777 in the post liberalization period. Finally, we can observe that metal, machinery and chemical industry manifest similar trend when estimated coefficients on capital inputs from OLS estimates move from -0.518 to LP estimates of -0.452 in the pre-liberalization period, and from OLS estimate of -0.687 to LP estimates of -0.606 in the post liberalization period.

We can observe that Kenya's manufacturing sector has firms producing a variety of products within a four digit ISIC industry classification. These firms are endowed with various inputs to facilitate the production process hence they use the same input proportions that are imperfect substitutes. This notion fits into the existing literature on intra-industry trade, Melitz (2003), where products are produced using the same factor proportions but play different functions in the country's trade. This implies that, when firms have inputs that are imperfect substitutes in the production process, they can be impacted differently by exposure to international trade. Because of this fact, firms will also respond differently in the event that trade is liberalized. How firms respond to, for-instance, the lowering of trade barriers or tariffs will signal the different trade orientations prevalent within a given industry.

I now present the estimated coefficients for both the pre- and post-liberalization periods on Table 4.3.

Table 4.3: Coefficient of the Production Function:

Industry	Pre-liberalization period(1992-1995)						Post-liberalization (1996-1999)					
	Labor		Capital		Materials		Labor		Capital		Materials	
	OLS	LP	OLS	LP	OLS	LP	OLS	LP	OLS	LP	OLS	LP
Textile	-0.115	-0.145	-0.435**	-0.372*	0.268	0.266	-0.578*	-0.581*	-0.895**	-0.812***	2.166***	2.024***
	(0.110)	(0.104)	(0.119)	(0.119	(0.102)	(0.098)	(0.347)	(0.211)	(0.034)	(0.033)	(0.866)	(0.779)
Garment	-0.177	-0.200*	-0.607**	-0.549**	0.481**	0.495**	-0.205	-0.244	-0.849	-0.754**	0.584	0.587
	(0.079)	(0.076)	(0.082)	(0.082)	(0.083)	(0.079)	(0.297)	(0.265)	(0.033)	(0.033)	(0.407)	(0.363)
Wood	0.180	0.121	-0.595**	-0.500**	0.359*	0.385*	0.518	0.489	-0.732**	-0.636**	0.296	0.327
	(0.113)	(0.105)	(0.084)	(0.082)	(0.141)	(0.127)	(0.726)	(0.645)	(0.089)	(0.087)	(0.318)	(0.282)
Furn.	-0.028	-0.049	-0.669**	-0.597**	0.703**	0.683**	-0.715**	-0.615*	-0.550**	-0.470**	-0.394	-0.296
	(0.092)	(0.086)	(0.066)	(0.064)	(108)	(0.100)	(0.272)	(0.242)	(0.057)	(0.056)	(0.246)	(0.219)
F&B	-0.468*	-0.453*	-0.779**	-0.703**	0.554	0.571**	0.320	0.248	-0.876**	-0.777**	0.937*	0.908**
	(0.114)	(0.106)	(0.046)	(0.045)	(0.121)	(0.112)	(0.284)	(0.256)	(0.046)	(0.045)	(0.309)	(0.274)
M/M &C	-0.221*	-0.218*	-0.519**	-0.452**	0.092	0.127*	-0.548*	-0.504*	-0.687**	-0.606**	-0.097	-0.030
	(0.066)	(0.061)	(0.039)	(0.038)	(0.094)	(0.087)	(0.188)	(0.168)	(0.043)	(0.042)	(0.209)	(0.190)

*Notes: Textil represents textile industry, Garm is garment industry, Wood is wood industry, Furn. is furniture, F&B, is the food and Bakery industry, M/M &C, is metal and metal or chemical industry. Standard errors are in parentheses and Significance levels are. * p<.05; ** p<.01; *** p<.001*

4.5.2 The impact of trade liberalization on firm productivity.

Pavcnik (2002 presents evidence showing how plants belonging to sectors having different trade orientations respond differently to trade liberalization policy. It is only natural to suggest that trade policy impacts trading firms in various ways. Some firms see trade liberalization episodes as an opportunity to reorganize their operations while others see it as a chance to initiate export activity. I investigate the theoretical argument that trade liberalization facilitates firm-level productivity improvements, and that exposure of an economy to trade induces the most efficient firms to thrive and grow faster than the less productive. To answer this puzzle, I estimate eq. (4.9) on a number of variables as explained earlier on, and estimate productivity on each sector or industry using the productivity indices retrieved from the estimation of the production function. I pool the sample for pre-liberalization and post-liberalization periods and proceed with the estimation process.

The results are shown in Table 4.4, with pre-liberalization estimates presented on the left panel and post-liberalization estimates on the right panel. The OLS estimates are presented for comparison purpose only, because my interest is on the semi-parametric estimates. Table 4.4 shows that the textile and metal/machinery and chemicals industry, made productivity improvements of 4.0 percent and 0.6 percent respectively, and are the only industries that have improved productivity before the trade liberalization episode. The rest of the industries have worsening trends in their productivity levels. Garment and wood industries have a decline in productivity of 5.0 percent and 6.4 percent respectively. Similarly, furniture and food and Bakery industries recorded a decline of 4.3 and 5.4 percent during the pre-liberalization period. We can observe that the Kenyan manufacturing sector recorded a general productivity decline of 1.8 percent during the pre-liberalization period. Conversely, relative to the pre-liberalization period, there is a significant improvement in the productivity levels in all the industries following trade

liberalization episode, with the textile industry benefiting the most from the liberalized trade. The textile industry has made productivity improvement of 166.9 percent, garment has made productivity improvement of 12.3 percent, wood have made productivity improvement of 34.7 percent and furniture has made productivity improvement of 14.6 percent. Similarly, food and bakery, and metal, machinery and chemical industries made productivity improvements of 84.3 percent, 27.8 percent respectively.

Though the impact of trade liberalization on productivity improvement at firm-level in the manufacturing industry is a disputed issue, I find evidence to show that there is aggregate productivity improvement of 33.7 percent in Kenyan manufacturing industry after the trade liberalization episode. To be quantitative in my conclusion, the overall result in table 4.4 indicate that a one standard deviation reduction in tariff duties as a percent of total imports increases firm productivity in the manufacturing industry by 33.7 percent after a trade liberalization episode. This finding is in line with the conventional wisdom suggesting that trade liberalization can lead to significant gains in productivity and is beneficial for developing countries. When economies transition from autarky to trade, my finding suggests that there is an increase in aggregate productivity level that may generate welfare gains in the economy in line with the dynamic industry model of Melitz (2003).

Table 4.4: The impact of trade liberalization on firm productivity

Industry	Pre-liberalization (1992-95)		Post-liberalization (1996-99)	
	OLS	Levinsohn & Petrin	OLS	Levinsohn & Petrin
Textile	0.047	0.040	1.669	1.472
	(0.073)	(0.075)	(1.736)	(1.537)
Garment	-0.029	-0.050	0.112	0.123
	(0.125)	(0.121)	(0.928)	(0.835)
Wood	0.058	-0.064	0.402	0.347
	(0.187)	(0.181)	(0.388)	(0.346)
Furniture	-0.036	-0.043	0.057	0.146
	(0.158)	(0.156)	(0.372)	(0.322)
Food & Bakery	-0.063	-0.054	0.933	0.843
	(0.157)	(0.154)	(1.004)	(0.898)
Metal& Machinery or Chemical	-0.004	0.006	0.356	0.278
	(0.098)	(0.095)	(0.569)	(0.501)
Aggregate manufacturing sector	-0.015	-0.018	0.378	0.337
	(0.057)	(0.056)	(0.392)	(0.351)

*Notes: The dependent variable is TFP, Standard errors are in parentheses. The estimates are not significant at * $p<.05$; ** $p<.01$; *** $p<.001$*

4.5.3 The impact of trade liberalization on productivity growth (annual growth rates)

Next I attempt to answer the question of whether liberalizing trade induces productivity growth rates that are higher than in the pre-liberalization period. To evaluate this question, I estimate equation (4.10) to derive the firm-level productivity growth rates. The results are presented in Table 4.5. In the pre-liberalization period, the growth rate in the garment industry is at 56.8 percent, food and bakery industry has a growth rate of 172.5 percent and metal, machinery and

chemical have productivity growth rates of 41.4 percent. Conversely, textile industry records a decline in productivity growth rates of 9806.6 percent, implying that it is the most volatile industry in a developing country like Kenya. The textile industry relies heavily on cheap labor and other inputs like electricity. When there is a negative shock on these inputs, it is probable that the textile industry will be more affected than any other industry. Besides, studies show that this sector faced stiff competition from more established international firm, with the more wealthy sections of the population preferring imported textile.

Similarly, wood and furniture recorded a decline in productivity growth rates of 1.6 percent and 17.9 percent respectively. Overall, productivity growth rates in the manufacturing industry in Kenya recorded a decline of 296.6 percent during the pre-liberalization period, with the textile industry being the most affected and contributor to this decline. This finding is consistent with the suggestion that trade restrictions reduce the firms' ability to acquire the much needed intermediate inputs necessary in the production process. In the post- liberalization period, we observe that the garment industry still recorded declining productivity growth rates of 38.6 percent. This might be another signal of the population's continued preference of imported apparel and wearing garments.

Conversely, the textile industry, on average, saw productivity growth rates of 326.5 percent faster than any industry in the post-liberalization period. We can observe that trade liberalization benefits the textile industry more than any other industry. Perhaps this may signal the fact that trade liberalization could have eased the input pressures that were faced by the textile industry, implying that it is now easy to access the input necessary for the production process. The wood industry recorded a productivity growth rate of 18.2 percent, furniture had productivity growth rate of 6.8 percent, food and bakery, metal, machinery and chemical had productivity growth rates of 25.6 percent, and 56.9 percent. Consequently, the productivity growth rates in the manufacturing industry in the post-liberalization period went up by 14.6 percent. This implies that a one standard deviation reduction in the import duties as a percentage of total imports increases firm-level productivity growth rates by 14.6 percent in the post-liberalization period.

Furthermore, productivity growth rates are responsive to changes in import duties. It is therefore plausible to suggest that the reduction in import duties enhances the firms' ability to acquire the much needed technology and intermediate inputs that facilitate output growth hence total productivity growth as suggested by Olper, Curzi and Raimondi (2017). This finding establishes the importance of trade reform for developing countries, especially those in Africa where manufacturing constitutes a small percent to Gross Domestic Products.

Table 4.5: The impact of trade liberalization on productivity annual growth rates across industries.

Industry	Pre-liberalization (1992-95)		Post-liberalization (1996-99)	
	OLS	Levinsohn & Petrin	OLS	Levinsohn & Petrin
Textile	-14.880	-98.066	0.965***	3.265***
	(16.561)	(99.145)	(0.049)	(0.041)
Garment	-0.006	0.568	-0.805	-0.386**
	(0.379)	(0.620)	(0.624)	(0.081)
Wood	0.976	-0.016	0.251	0.182
	(1.500)	(0.471)	(0.616)	(0.178)
Furniture	0.920*	-0.179	-0.699***	0.068
	(0.407)	(0.170)	(0.000)	(0.000)
Food & Bakery	0.285	1.725	0.679	0.256
	(2.535)	(1.910)	(1.103)	(0.162)
Metal& Machinery or Chemical	-0.123	0.414	-1.530	0.569*
	(0.425)	(0.334)	(1.139)	(0.342)
Aggregate manufacturing sector	-0.265	-2.962	-0.324	0.146
	(0.803)	(3.481)	(0.438)	(0.097)

*Notes: The dependent variable is ΔTFP, Standard errors are in parentheses and significant levels are. * p<.05; ** p<.01; *** p<.001*

4.5.4 The impact of trade liberalization on firm-level productivity growth.

The next most logical question is whether trade liberalization leads to firm-level productivity growth. It is only natural to ask whether an increase in the exposure of a country's economy to trade stimulates firm-level productivity growth. My major goal here is to test whether liberalizing trade induces firm productivity growth than when firms operate in more restricted economy. It is difficult to imagine that there are countries in the world that do not trade with others, but I want to evaluate the impact of trade liberalization on firm-level productivity growth. To guide the estimation process, I estimate equation (4.11) using semi-parametric productivity indices recovered from the estimation of the production function. If trade liberalization stimulates firm-level productivity growth, we should see productivity growth in most of the industries.

The results from the estimation of equation (4.11) are presented in Table 4.6. In the pre-liberalization period, there is a significant growth in most industries; the textile industry grows by 16.9 percent, furniture industry growth by 8.8 percent, food and bakery industry grows by 10.7 percent, and metal, machinery and chemical grows by 13.8 percent. However, the garment and wood industries recorded a decline in productivity growth of 22.8 percent and 25.6 percent respectively. Overall, the manufacturing sector recorded productivity growth of 1.4percent in the pre-liberalization period. Conversely, in the post-liberalization period, we see most firms improve their productivity, with textile industry benefiting the most. Accordingly, the textile industry grows by 1177.7 percent, wood grows by 10.1 percent, furniture grows by 13.0 percent, food and bakery grows by 198.2 percent, metal, machinery grows by 18.1 percent. However, trade liberalization did not benefit the garment industry as productivity growth declined by 85.6 percent.

Generally, trade liberalization increased productivity growth in the manufacturing sector by 33.0 percent. This finding establishes that fact that liberalizing trade for the manufacturing sector stimulates productivity growth of 33.0 percent. Although trade theory offers few guidelines on how firms, especially exporting firms, respond when trade is liberalized, it's plausible to suggest that the most productive ones increase their output in the export market. Similarly, we would expect imports to make inroads into the country as a result of the lowering of trade barriers. If this is true, then using import duties as a measure of trade restrictiveness captures the true effect of trade liberalization.

Further, the identification of the impact of trade liberalization on firm productivity could be affected by other macroeconomic factors like bank and currency crises, but I control for these and still find that the results are unchanged and remain significant. Besides, I control for inflation crisis, which often a common occurrence in most African economies, but the results remain the same and robust. This is an important point because most firms depend on imported intermediate inputs to facilitate the production process. So when import duties are reduced significantly, firm productivity growth increases.

Table 4.6: The impact of trade liberalization on firm-level productivity growth.

Industry	Pre-liberalization (1992-95)		Post-liberalization (1996-99)	
	OLS	**Levinsohn & Petrin**	**OLS**	**Levinsohn & Petrin**
Textile	0.189	0.169	13.052***	11.777***
	(0.203)	(0.215)	(0.281)	(0.249)
Garment	-0.195	-0.228	-0.889	-0.856
	(0.217)	(0.219)	(0.773)	(0.688)
Wood	-0.276	-0.256	0.201*	0.101
	(0.344)	(0.336)	(0.039)	(0.085)
Furniture	0.091	0.088	0.132***	0.130
	(0.277)	(0.274)	(0.000)	(0.000)
Food & Bakery	0.110	0.107	2.200*	1.982
	(0.178)	(0.176	(1.231)	(1.074)
Metal& Machinery or Chemical	0.142	0.138	0.194	0.181
	(0.187)	(0.183)	(0.558)	(0.559)
Aggregate manufacturing sector	0.022	0.014	0.387	0.330
	(0.096)	(0.095)	(0.295)	(0.270)

*Notes: The dependent variable is ΔTFP, Standard errors are in parentheses and significant levels are; * p<.05; ** p<.01; *** p<.001*

4.5.5 The impact of trade liberalization on export performance

Next I consider the view that trade liberalization improves the performance of exporting firms. Pavcnik (2002) finds evidence to suggest that producers of exportable products in Chile did not experience any productivity growth that would directly be linked to the effect of trade liberalization. She attributes this fact to the view that exporters probably already possessed the required productivity. However, studies have also shown that exporters who engage in the export market improve their productivity as a result of the learning-by-exporting hypothesis. To evaluate the impact of trade liberalization on export market performance, I estimate equation (4.13), using a difference-in-differences approach.

Using difference-in-differences has the advantage of improving the quality of evaluation results, since the expected outcomes cannot solely be attributed to the average treatment before and after the treatment as other factors contemporaneous with the treatment might be captured in the matching process. The results are presented in Table 4.7. The left panel is the pre-liberalization period while the right panel is the post-liberalization period. The results show that exporters' performance in the pre-liberalization period is quite significant as all the firm characteristics are positive and statistically significant. Total factor productivity level, real output per worker and real capital per worker are high at 18.3 percent, 41.3 percent, and 509.5 percent respectively. Similarly, real monthly wages, skills and employment are equally high at 14.6 percent, 78.2 percent and 17.8 percent. It is important to observe that real capital per worker is high, probably because exporters operate with large real capital per worker.

Previous research has shown that exporters operate with large capital compared with non-exporters (Bernard and Jensen, 1999; 1995). Besides, exporting involves some fixed entry costs which are sunk (unrecoverable) and it's natural to expect only the large and more productive firms venturing into the export market. Therefore, it is not unusual to find that exporting firms have superior firm characteristics even before trade is liberalized. Similarly, in the post-liberalization period, we observe that trade liberalization facilitates exporting firms to improve their productivity further. Total factor productivity has increased further from 18.3 percent in the pre-liberalization period to 86.1 percent in the post-liberalization period, an increase of about 370.49 percent. This possibly indicates that production inefficiency has been eliminated as a result of trade liberalization. Further, this could also mean that there has been some industry rationalization that is occasioned by trade liberalization.

Similarly, there is a significant improvement in real output per worker, from 41.3 percent in the pre-liberalization period to 51.4 percent in the post-liberalization period; an increase of 24.46 percent. Additionally, real capital per worker increased from 509.5 percent in the pre-liberalization period to 556.3 percent in the post-liberalization period, an increase of 46.8 percent. Moreover, the estimates on real monthly wages increased from 14.6 percent, in the pre-liberalization period to 25.2 percent, in the post-liberalization period, an increase of 72.60 percent. Conversely, there is a decline in skills accumulation, from 78.2 percent in the pre-liberalization period to 11.6 percent in the post-liberalization period, a decrease of 85.17 percent. This could be attributed to the fact that exporters already have the skilled personnel and employing additional workers raises marginal costs significantly. Similarly, we observe a drop in level of employment, from 17.8 percent, in the pre-liberalization period, to negative 44.6 percent in the post-liberalization period, a drop of 350.56 percent.

These finding establishes the fact that trade liberalization has a positive and statistically significant impact on exporting firms. This implies that when import duties are reduced, it stimulates a large productivity growth among exporters as barriers to trade are lowered. It is documented that imports of intermediate inputs are crucial components of the production process, especially in developing countries (Topalova and Khandelwal, 2011; Njikam and Cockburn, 2011; Dovis and Milgram-Baleix, 2009). My findings are in line with the view that trade liberalization of intermediate goods sectors has a large impact on total productivity growth

than that in the final-goods sectors, which is in line with Chand and Sen (2002) Hu and Liu (2014).

Table 4.7: The effect of trade reform on export performance

Firm Characteristics	Pre-liberalization (1992-95)			Post-liberalization (1996-99)		
	ATT [a]	SE [b]	Observation [c]	ATT [a]	SE [b]	Observation[c]
Total Factor Productivity	0.183	0.366	63(152)	0.861**	0.238	89(92)
Real output per worker	0.413	0.226	53(152)	0.514**	0.172	94(92)
Real capital per worker	5.095***	0.419	222(155)	5.563***	0.284	704(107)
Real monthly wages	0.146	0.175	50(151)	0.252	0.128	86(92)
Skills	0.782*	0.401	46(155)	0.116	0.422	57(49)
Employment	0.178	0.223	94(155)	-0.446**	0.190	144(103)

*a:Significance levels are ; *** p<0.01; ** p<0.05; * p<0.1; b:Bootstrapped standard Errors(50 replications)*
c: Number of Observations, number of the treated group in parentheses

4.6 Conclusion

In this paper, using firm-level data from Kenya, I examine the impact of trade liberalization on the evolution of firm-level productivity in the Kenyan manufacturing sector. I approach my analysis using a three-step method and pay keen attention to various methodological challenges that daunted previous empirical studies on trade reforms. In the first step, I derive a productivity measure for each firm using the Levinsohn and Petrin (2003) econometric methodology that generates consistent and reliable estimates of the production function indices. Further, using the correct identification strategy, I identify the trade variables to facilitate econometric analysis. In the second step, I analyze the impact of liberalized trade on firm-level productivity using import duties as a percentage of total imports as my measure of trade openness.

Aware of the criticisms on using other measures of trade reform, like trade ratios, I use a unique measure of import duties as a percentage of total imports because this measure can be viewed as the most direct indicator of trade restrictions. Countries that are more restrictive would rather restrict the import flows into the country than restrict the flow of exports outside of the country. In other words, trade restrictions are mostly imposed on imports rather than on exports. Moreover, the use of import duties is backed by theory and it captures outcomes, policy and the effect of protection on trade. Additionally, I estimate annual productivity growth rates and how trade liberalization has impacted productivity growth in each industry under the study. To facilitate my analysis, I consider years 1992-1995 as pre-liberalization years (years when actual reforms started or carried out) and call these years as period1. Then I take years 1996-1999 as post-liberalization years (years when there were no more reforms) and call these years, period 2.

First, evaluating the impact of trade liberalization on firm productivity, I find evidence to support the view that liberalizing trade enhances firm-level productivity in the traded sector. Specifically, using recovered productivity indices, I show that increase in the exposure of Kenya's manufacturing sector trade generated large firm-level productivity of 33.7 percent. The biggest beneficiaries of trade liberalization are the textile industry which made a productivity improvement of 147.2 percent and the food and bakery industry which recorded productivity improvement of 89.8 percent. This paper shows how liberalizing trade can facilitate firm-level productivity improvements in the manufacturing sector of a developing economy. Additionally, the relationship between trade liberalization and productivity is robust to the use of other

measures of trade openness like index of openness and trade freedom index. Further, my results may suggest that when firms are exposed to trade, they experience intense competition from imports, so that only the more productive firms continue operating in the market while the less productive shut down their operations and exit the market. The findings suggest that firms respond to intense competition by reorganization and re-engineering their production processes.

Secondly, I evaluate the impact of trade liberalization on annual productivity growth rates in each of the industries under the study. I find evidence that liberalized trade in the manufacturing sector leads to aggregate productivity growth rates of 14.6 percent. During the pre-liberalization period, productivity declined by 296.2 percent, and this drop was driven by the textile industry which recorded a drop of 9806.6 percent. Conversely, the textile industry recorded a large productivity growth rate of 326.5 percent in the prost-liberalization period. This implies that trade liberalization eased some input pressures faced by the textile industry before trade reforms. The second largest beneficiary of trade liberalization is the metal, machinery and chemical industry which recorded productivity growth rates of 56.9 percent.

Thirdly, I analyze the impact of trade liberalization on productivity growth in the Kenyan manufacturing sector. I establish that liberalization of trade is associated with aggregate productivity growth of 33.0percent percent in the post-liberalization period. The observed productivity growth is driven by the textile industry which recorded a productivity growth of 1177.7percent in the post-liberalization period. The second largest beneficiary of productivity growth is the food and bakery industry which recorded a productivity growth of 198.2 percent in the post liberalization period. In the pre-liberalization period, productivity growth is at 1.4percent, which is quite low compared with the post-liberalization period that recorded large productivity growth.

Lastly, I evaluate whether liberalizing trade leads to better export performance outcomes. I select the pre-liberalization and post-liberalization samples and analyze the performance of exporting firms in the pre-liberalization period and compare it with the post-liberalization period. In the pre-liberalization period, total factor productivity level is at 18.3percent, whereas in the post-liberalization period, it rises to 86.1percent. We can observe that there is a general increase in total factor productivity of about 370.49percent from the pre-liberalization and post-liberalization periods. This possibly indicates that production inefficiency could have been eliminated as a result of trade liberalization. Further, this could also mean that there has been some industry rationalization that is occasioned by trade liberalization.

To conclude, this paper notes that liberalizing trade has a positive and statistically significant impact on productivity growth and on the performance of exporting firms. My findings establish the fact that reducing import duties stimulates a large aggregate productivity growth among firms, which rises further when firms participate in trade and when firms switch their status from non-exporters to exporters. Therefore, African countries that seek to generate higher productivity growth in manufacturing sectors should put in place policies that facilitate, rather than restrict, trade. To this end, reducing duties on imported goods, especially intermediate inputs would go a long way in raising firm-level productivity growth.

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CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 General summary

Sub-Saharan African economies have seen periods of trade reform after years of trade protection and stagnant growth. Most countries in Sub-Saharan Africa committed to reform their trade policies so to benefit from trade and expand their growth prospects. Since the mid-1980s, there have been drastic measures taken to reduce trade barriers, especially, tariffs and relaxing some other measures like financial restrictions, in addition to introducing export promotion zones and identifying export opportunities. By mid-1990s, most of these countries had implemented trade liberalization with the expectation of jump-starting their stagnant economies. Indeed, these countries seemed to be growing and enjoying their fastest growth episodes in years, growing rapidly in the mid-1990s by an annual average of approximately 6 percent, for nearly a decade and half. This impressive growth was attributed to trade reforms embraced during that period, better microeconomic policies, more prudent macroeconomic management, institutional and political reforms, flow of development aid and high export prices (Commission on Growth and Development, 2008). Consequently, investment rates in countries like Uganda, Tanzania, Mozambique, and Ghana nearly reached 20 percent of GDP, helping these countries to lift their savings rate while diversifying their exports at the same time. Despite the observed impressive economic growth, economic activity in most Sub-Saharan African countries seems to have waned in the recent past due to a host of challenges including drops in export prices, limited economic diversification, poor governance and quality of institutions and a growing unemployment rate especially among youth.

Consequently, trade liberalization is still considered important to the growth of most Sub-Saharan African countries taking into account the role it plays in supporting firms to grow into the export markets, in addition to introducing a variety of products and expanding scale of production. Given the role trade liberalization plays, it is only natural that countries trapped in underdevelopment must implement a package of economic, financial, and institutional reforms to reap the benefits from trade. Moreover, trade liberalization affects firms differently and stimulates varying responses among firms. Empirical evidence shows that trade liberalization induces productivity growth among exporting firms, and reallocation effect in the industry. Additionally, firms participating in international trade grow faster than those serving the home market, and most importantly, perform better in almost all the firm characteristics. Correspondingly, empirical findings have confirmed the peculiarity of exporting firms. Exporting firms are superior compared to non-exporting firms, especially as exporting firms have shown improved productivity, capital intensity, larger size and pay high wages compared to non-exporting firms. Therefore, many Sub-Saharan African countries have pursued economic growth by encouraging growth and development strategies that emphasize export promotion, at the expense of import substitution industries, with the view that when export capacity of the economy is strengthened, firms will improve their productivity to participate in the export markets.

In the same vein, the growing literature on trade documents invaluably the heterogeneity of firms that trade, focusing on the relationship between productivity and exporting while confirming the available empirical evidence which shows that the more productive firms self-

select into the international markets. But most importantly, firms also learn-by-exporting. Although it is natural to expect firms to either improve their productivity prior to export market entry or improve productivity while participating in the export markets, recent empirical findings on how trade liberalization impacts firms, and how firms respond to trade liberalization episode find it more difficult to provide conclusive evidence on either self-selection into export markets or learning- by-exporting, and productivity improvements. Additionally, Eaton et al. (2008) confirm the nature of new export entrants: they are small, enter export markets on a yearly basis, start by selling small quantities to neighboring countries to gain experience of exporting to distant and advanced markets. The evidence presented in the above study contradicts the much established fact that sunk costs related to export market entry are significant so that only the large and more productive firms venture into the export markets. If sunk costs of exporting are indicative of export entry barrier, so that only the large and more productive firms initiate international trade, what would explain the entry of small exporters into export markets and how can we reconcile this pattern with the self-selection hypothesis?

Correspondingly, trade liberalization is considered essential in stimulating export market entry and participation. However, theoretical trade models offer conflicting predictions on the impact of trade liberalization on firm-level productivity, especially where there is imperfect competition (Pavcnik, 2002). A number of theoretical models predict that exposure of a country's economy to trade generates increases in total factor productivity (TFP) and shuffling of resources from the least productive firms to more productive ones, consequently, generating welfare gains to the country (Melitz, 2003). The Melitz (2003) model suggests that the firm's productivity is an exogenous process that is stimulated by external forces rather than the conscious efforts of the firm itself. On the empirical side, various studies examine the effect of trade liberalization on firm productivity. The impact of liberalized trade on productivity growth in manufacturing sectors in developing economies still continues to generate debate, for and against reforming trade. Some studies have pointed to that fact that trade liberalization results into significant benefits in productivity. However, this suggestion is contested by new growth theories of endogenous growth that have shown that the evidence for trade liberalization generates contradictory results (Rodrik, 1995). If trade liberalization can stimulate productivity growth, then we would expect firms and industries that are liberalized growing faster than those that are not. Similarly, we should see trade liberalization induce a reshuffling of production within a firm in response to a reduction in tariffs or any other form of trade reform. However, firm-level data in both the developed and developing countries has shown compelling evidence to suggest that firm export participation is a rare activity, and firms that participate in the export markets (both exporters and importers) constitute a small fraction (Bernard et al., 2007). If engaging in international trade provides a firm with benefits of a larger market for its products and greater profits, then trade liberalization would stimulate ease of entry into the international market, productivity growth (since only the more productive firms venture into the export market) and productivity improvements. Nonetheless, the impact of liberalized trade on productivity growth in manufacturing sectors in developing economies still continues to generate debate.

5.2 Major findings, conclusions and policy implications

This thesis is composed of three papers, analyzing the different aspects of international trade literature that have generated much debate over the years. To organize this work, each paper is

presented in chapter form that anchors on a specific research question that has spawned empirical debate in the international trade literature. Henceforth, I present summaries of the findings in individual chapters based on the research questions.

In chapter two, I assessed the main implication of the Melitz (2003) model on firm-level productivity and the firm's internationalization process, anchoring on firm-level entry and participation dynamics. More specifically, I examine how the presence of sunk costs shape firm dynamics and export market participation among new exporters (new entrants). I trace new entrants for five years and assess the productivity patterns and growth rates. Using firm-level data from five African countries, namely; Ghana, Kenya, Tanzania, Nigeria and South Africa, I study firm dynamics and export participation of new export entrants for the period 1991-2003. I specifically study firm dynamics and export market participation focusing on how the presence of sunk costs shape firm dynamics and export market participation of new exporters. The dataset allows the study to track productivity trajectory of new export entrants over a long horizon to evaluate how sunk costs of export market entry affect the productivity dynamics of these new entrants, before and after entry.

I track new entrants five years before entry into the export markets and five years after export market entry. The major findings are: (1) that sunk costs of exporting are significant and influence the firm's decision to enter the export market and that exporters are different from non-exporters and large firms are more productive and grow at faster rates before export market entry, (2) firms that enter export markets for the first time perform better than old firms and have superior growth rates; while exiting export markets is associated with low performance, (3) that future exporters (new entrants today) possessed superior characteristics some years into export market entry showing a pattern of self-selection and the importance of sunk costs associated with exporting in the firm's decision to export, (4) that after entry, new entrants improve their performance further and expand their presence in the export markets by growing at faster rates than never entrants, (5) that when firms engage in international trade, they improve their performance better than firms who serve domestic markets, and (6) this study establishes the importance of size in export market entry and participation, new entrants who are large experience faster growth years to export market entry, than small firms, but new entrant who are small grow at faster rates after entry into the export markets, than other firms. The policy implication of the findings in Chapter two is that governments that hope to maximize and expand the benefits from trade liberalization should provide incentives that ease the burden of sunk costs of export market entry, by for-instance, providing tax holidays to exporters and providing information on possible export markets and entry possibilities.

In Chapter three, the study focused on providing an alternative explanation to the observed pattern in the firm-level data which shows the nature of new export entrants: they are small, enter export markets on a yearly basis, start by selling small quantities to neighboring countries to gain experience of exporting to distant and advanced markets. If sunk costs of exporting are indicative of export entry barrier, so that only the large and more productive firms initiate international trade, how can we reconcile this pattern with the self-selection hypothesis? I attempt to provide an alternative explanation to export entry pattern of firms by using firm-level investment.

The major findings from this chapter are: (1) a firm's market selection and growth is the outcome of distinctive productivity improvements, (2) market selection and firm growth is inversely correlated with size whereby the spread of growth rates of small firms tends towards higher growth rates after market selection. The findings in chapter two have strong policy implications; (1) extending access to finance for firms, especially the small ones, will help these firms invest in capital stock crucial for switching their status from non-exporting to exporters. This is in line with the view that firm-level investment is an important catalyst in easing export market entry and improving the performance and survival of firms, clearly indicating that there is investment premium that accrues to firms that engage in firm-level investment. This establishes the fact that, although firm productivity differences can be explained by self-selection factors as one channel, firm-level investment holds the key to a possible explanation to export market entry by small firms, often with low productivity. This study establishes a clear indication that when firms invest in physical capital, especially plant and equipment, they gain capability to produce effectively and so more productive firms produce more output at lower unit costs as postulated in my theoretical model. Additionally, export promotion policies should be tailored at facilitating small firms to access the financing for investing activities.

In Chapter four, I consider the implication of the Melitz (2003) model and examine the impact of trade liberalization on firm productivity and export market performance. Using firm-level data from Kenya, I examine the impact of trade liberalization on the evolution of firm-level productivity and export performance in the Kenyan manufacturing sector. I approach the analysis using a three-step method and pay keen attention to various methodological challenges that daunted previous empirical studies on trade reforms. In the first step, I derive a productivity measure for each firm using the Levinsohn and Petrin (2003) econometric methodology that generates consistent and reliable estimates of the production function indices. Further, using the correct identification strategy, I identify the trade variables to facilitate econometric analysis. In the second step, I analyze the impact of liberalized trade on firm-level productivity using import duties as a percentage of total imports as my measure of trade openness. Aware of the criticisms on using other measures of trade reform, like trade ratios, I use a unique measure of import duties as a percentage of total imports because this measure can be viewed as the most direct indicator of trade restrictions.

The major findings from chapter four are: (1) the increase in the exposure of Kenya's manufacturing sector to trade generated large firm-level productivity of 33.7 percent, with the textile industry benefiting the most, (2) trade liberalization leads to aggregate productivity growth rates of 14.6 percent in manufacturing sector. The relationship between trade liberalization and productivity is robust to other measures of trade openness, like index of openness and trade freedom index. The above findings imply that trade liberalization has immense benefits for the traded sector. For-instance, this study establishes that there is a general increase in total factor productivity of about 370.49 percent between the pre-liberalization and post-liberalization periods, which possibly indicates that production inefficiency may have been eliminated as a result of trade liberalization or there has been some industry rationalization that is occasioned by trade liberalization. To conclude, this paper notes that liberalizing trade has a positive and statistically significant impact on productivity growth and on the performance of exporting firms. Therefore, African countries that seek to generate higher productivity growth in manufacturing sectors should put in place policies that facilitate, rather than restrict, trade. To

this end, reducing duties on imported goods, especially intermediate inputs would go a long way in raising firm-level productivity growth.

5.3 Major contributions of this thesis to the literature

The theoretical model of Melitz (2003), and the empirical work of Ericson and Pakes (1995) and Roberts and Tybout (1997) provide significant background work on the evolution of international trade literature. Moreover, the ground breaking work of Eaton et al. (2008) presents opportunity of studying most of the micro elements of firms engaged in international trade. This study makes significant contributions to the international trade literature in various ways. Firstly, there has been much debate on the implication of the Melitz (2003) model on the firm's decision to break into the export market; with studies presenting differing views on the observed patterns in the micro-data: the more productive firms engage in international trade and that firms participating in the export market improve their productivity as a consequence of export market participation.

This study therefore contributes to: firstly, the literature on firm dynamics focusing on new exporters in the context of Sub-Saharan Africa. As shown by Eaton et al. (2008) study, firm-level data presents unique patterns of firm entry and exit in the international trade. This study establishes empirical evidence that new export entrants in Sub-Saharan Africa display remarkable performance before and after export market entry. This finding is in line with the argument that export market entry involves incurring significant sunk entry costs, which may never be recovered in the event that the firm stops or fails to export atall, as was first shown by Roberts and Tybout (1997).

The findings that new exporters grow faster and expand their presence in the export market when they stay in exporting activity is consistent with (1) the view that exporting is beneficial to exporting firms because of the learning-by-exporting mechanism, (2) in a typical year, there are firms that enter and exit the export markets regardless of the productivity shock they face; those who exit miss out on the benefits of engaging in the international markets, while those who stay, improve their performance further and expand their presence in the export markets by growing at faster rates than never entrants as first shown by Eaton et al. (2008) and later reaffirmed by Timoshenko (2015). As in several other studies, this study contributes to our understanding of yet another salient feature present in the firm-level data, the dynamics of new export entrants. New export entrants who temporarily stop exporting activity and re-start it later, have reduced growth rates and improve only when they stay in the export market. This finding is consistent with the view that firms that exit the export market must incur sunk export entry costs when they resume engagement in the international market, because whatever they invested during the previous attempt to sell in the export market could have fizzled out or may have depreciated drastically. Perhaps the most important finding in this study is the fact that firm-size matters for both self-selection and learning-by-exporting to take place. I find that future exporters that are large grow faster than firms of other sizes, controlling for sector, year and country effects. Future entrants who employed one hundred or more people experienced faster growth years to export market entry, than firms that employed fewer workers. This finding is consistent with the view that firm size has a significant impact on export behavior as is shown by William (2011), and that it influences self-selection and learning-by-exporting mechanisms as posited by Mańez-

Castillejo (2010). Importantly, initial productivity draw is binding for self-selection mechanism to operate as shown by the Melitz (2003) model.

Secondly, this study contributes to the literature studying firm selection and growth in new markets, first suggested by Luttmer (2007) and recently extended by Arkolakis (2016) who presents an analytical framework for studying firm and exporter growth. In Arkolakis (2016) framework, a firm's market selection and growth is the outcome of distinctive productivity improvements or firm-level productivity enhancing mechanisms such that market selection occurs only if the firm has evaluated profitability of doing so. In this way, market selection and firm growth is inversely associated with size whereby the spread of growth rates of small firms tends towards higher growth rates. I use this framework to analyze the impact of firm-level decisions on export dynamics, with a special focus on small exporters, using firm-level data from two Sub-Saharan African countries.

The major contribution of this study to the literature is that, there is evidence to show that firm-level investment increases total factor productivity by 30.6 percent and increases market selection by 3.3 percent. Moreover, this study observes that non-exporting firms that engage in firm-level investment have a high probability of becoming exporters than non-exporters who do not invest. The implication of this result is that a firm's market selection and growth is the result of unique firm-level productivity enhancing mechanisms that raise the firm's odds of becoming an exporter or switching its status, from non-exporting to exporting. When firms incur sunk costs of exporting, their decision to switch firm status (from non-exporting to exporting) is correlated with their firm-level investment. This implies that firm-level investment can be viewed as a form of technology upgrading that expands a firm's productive capacity, allowing for intertemporal investment and export decisions. Rational profit-maximizing firms first evaluate whether engaging in firm-level investment provides them with a leverage to enter the export markets. Based on the options available, a firm will engage in international market only if it is profitable to do so (Arkolakis, 2016). Consistent with the observed pattern in the data, this study establishes that new exporters invest in new capital stock as they gradually venture into the international markets, a view supported by Rho and Rodrigue (2015; 2016) and Wu and Miranda (2015). Most importantly, this study has also demonstrated how firms who engage in international trade increase their probability of engaging in firm-level productivity, rationalizing Arkolakis' (2016) analytical framework. Moreover, these findings suggest that firm-level investment expenditures are associated with better export market participation outcomes. This is a key finding that provides empirical evidence to Arkolakis' (2016) framework.

Thirdly, this paper contributes to the literature on the impact of trade liberalization on aggregate productivity growth as first discussed in the Melitz (2003) model. This line of literature examines the role of international trade in stimulating productivity growth and within firm and industry re-allocation of resources. The Melitz (2003) model emphasizes how exposure to trade induces only the more productive firms to initiate export activity while the less productive remain to serve the domestic market or are forced out of the market altogether. First, examining the impact of trade liberalization on firm productivity, this study finds evidence to support the view that liberalizing trade enhances firm-level productivity in the traded sector. Specifically, using recovered productivity indices, there is evidence showing that increase in the exposure of Kenya's manufacturing sector to trade generated large firm-level productivity of 33.7 percent. This implies that trade liberalization eased some input pressures faced by the manufacturing

industry before trade reforms, a view that is consistent with the findings of Njikam and Cockburn (2011), Topalova and Khandelwal (2011), Amiti and Koning (2007) and Hu and Liu (2014) among others. Additionally, this paper addresses the methodological issues that plagued previous studies examining the impact of trade policy on productivity growth.

Previous studies that have examined the impact of trade liberalization on total factor productivity growth, causality was attributed simply by association whereby if there is observed increase in total factor productivity in the post-liberalization period, then such increased must have been caused by trade liberalization (Chand and Sen, 2002). This study addresses this methodological issue by using a generally accepted measure of tariff protection- import duties as percent of total imports, as a measure of trade protection to analyze how changes in trade policy impact productivity growth. Earlier studies that used other measures of trade protection, like openness index, black market premium, import penetration ratios, dollar indexes and other measures were criticized as not backed by economic theory and their failure to capture the impact of policy changes on trade. This is a major contribution to the literature examining the impact of trade liberalization on productivity growth.

5.4 Limitations and areas for further research

This study examined trade liberalization, firm dynamics and export market participation in Sub-Saharan Africa. With the availability of firm-level data in some countries, researchers have found it possible to examine most of the components of the data. However, there were problems encountered during the study. At the industry and firm-level, the main limitation faced during the study was related to the availability of the data. Since the study focused on five African countries, it was difficult to provide answers to these research questions by analyzing data in all the countries because of missing data. For-instance, data on firm investment status for Nigeria, Kenya and South Africa were missing which is why the study to used only data from two countries-Ghana and Tanzania to study firm-level investment and productivity. Additionally, only one country-Kenya, had figures on import duties as a percentage of total imports- the measure of trade openness that the study adopted in measuring trade liberalization.

To conclude, this study has shown how important sunk costs of exporting are on the firm's decision to export regardless of any productivity shock. However, it would be important to estimate how much cost new entrants from sub-Saharan Africa would have to pay to access (1) the African market and (2) the international market, and how these costs either promote or prevent export market entry in the various export destinations. This would be the first area for further research. Furthermore, this study provides an explanation for the existence of small firms in the export markets contrary to the notion that only the more productive firms venture into international trade. Using firm-level investment, I have provided evidence of entry patterns by small firms, however due to limitations in the data; this study cannot provide empirical evidence of other channels that could explain the presence of small firms in the international market. This is yet another avenue for future empirical work. Finally, my empirical evidence shows that liberalizing trade has a positive and statistically significant impact on productivity growth and on the performance of exporting firms. However, we would like to estimate by how much Sub-Saharan African countries would gain from trade liberalization. This would be a third and fruitful area for future theoretical and empirical work.

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ANNEXTURES

Appendix 1: Measuring Productivity

In this study, with the help of a Stata code (levpet), I use LP approach to derive a measure of firm-level productivity.

Consider a firm with a Cobb-Douglas production function;

$$Y_{it} = A_{it}(\Upsilon)L_{it}^{\beta_l}K_{it}^{\beta_k}O_{it}^{\beta_o}M_{it}^{\beta_m} + \varepsilon_{it} \tag{A1.1}$$

Where Y_{it} denotes output of firm i at time t which is a function of labor, L_{it} , capital, K_{it} , other intermediate inputs, O_{it} , and materials, M_{it} . Υ , denotes trade policy stance, ε_{it} represents two components: the observable and unobservable components.

In the first step, I can take the natural logarithms of eq. (A1.2.1) above, and denote using small letters, so that I can write the production function as:

$$y_{it} = \beta_0 + \beta_1 l_{it} + \beta_2 k_{it} + \beta_3 o_{it} + \beta_4 m_{it} + \varepsilon_{it} \tag{A1.2}$$

Let ε_{it} compose of two components:

$$\varepsilon_{it} = \omega_{it} + \psi_{it}$$

Where ω_{it} denote the predictable component- in this case, firm i's transmitted productivity component in time t, while ψ_{it} represent the disturbance (unpredictable component), for instance, demand changes. We can observe that the basic difference between ω_{it} and ψ_{it} is that the term ω_{it} affects input choices of the producer in the production process because it measures the productivity and is not observed by the econometrician when estimating production, hence leading to simultaneity bias and inconsistent estimates.

Denoting demand for intermediate inputs for firm i in period t as m_{it}, it is assumed that this demand relies on state variables capital, denoted by k_{it}, and productivity denoted by , ω_{it}. Thus we can write this as:

$$m_{it} = m_{it}(k_{it}, \omega_{it}) \tag{A1.3}$$

According Levinsohn and Petrin (2003) demonstrate that the above demand function is consistently increasing in ω_{it}, and this permits us to invert the intermediate demand function above as:

$$\omega_{it} = \omega_{it}(k_{it}, m_{it}) \tag{A1.4}$$

Writing eq(A1.2.3) this way allows us to isolate the unpredictable productivity component and express it exclusively as a function of two variable or inputs, k_{it} and m_{it} which can be predicted.

I use value-added to estimate TFP using LP(2003) approach, and proceed as follows:

Denote value added for firm i in period t as, va_{it}, then the production function can be written as:

$$va_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + \psi_{it} \tag{A1.5}$$

$$= \beta_l l_{it} + \lambda_{it}(k_{it}, m_{it}) + \psi_{it}$$

Where

$$\lambda_{it}(k_{it}, m_{it}) = \beta_0 + \beta_k k_{it} + \omega_{it}(k_{it}, m_{it}) \tag{A1.6}$$

Inserting a third-order polynomial approximation in $\lambda_{it}(k_{it}, m_{it})$, we can routinely derive estimates of value-added from a regression equation using OLS. Thus,

$$va_{it} = \varphi_0 + \beta_l l_{it} + \sum_{i=0}^{3}\sum_{j=0}^{3-i} \varphi_{ij} k_{it}^i m\sigma_{it}^j + \psi_{it} \tag{A1.7}$$

Where β_0 is not independently identified from $\lambda_{it}(k_{it}, m_{it})$. Moreover, once consistent estimates are derived from the regression equation using OLS, we are done with stage one of Levinsohn and Petrin (2003) estimation routine, where we have derived parameters for β_l and φ_0 to the intercept.

Next, we then engage in the second stage of the estimation routine which identifies coefficient for β_k, where we start by calculating the estimated value for φ_0 using the equation of the form:

$$\hat{\lambda}_{it} = \hat{va}_{it} - \beta_l l_{it} \tag{A1.8}$$

$$= \hat{\varphi}_0 + \sum_{i=0}^{3} \sum_{j=1}^{3-i} \hat{\varphi}_{ij} k_{it}^i m_{it}^j - \hat{\beta}_l \, l_{it} \tag{A1.9}$$

Writing eq. (A1.2.7) this way, we can compute all the values of β^*_k for productivity ω_{it}, for all time periods by applying the following:

$$\hat{\omega}_{it} = \hat{\lambda}_{it} - \beta^*_k k_{it} \tag{A1.10}$$

Following LP, we can recover the predicted firm-level productivity estimates and build an index of the firm's total factor productivity (TFP), thus we can then write our estimates as:

$$\overline{\omega}_{it} = TFP_{it} = y_{it} - \overline{\beta}_1 l_{it} - \overline{\beta}_2 k_{it} - \overline{\beta}_3 m_{it} \tag{A1.11}$$

Where the bar denotes the recovered productivity estimates from each variable of interest (labor, capital, and materials).

Appendix 2: Description of Variables

In the study, the following variables are used to facilitate the analysis:

Variable	Explanation
Bank crisis *(bcriss)*	This is coded 1 if country experienced bank crisis crises in the period under examination, zero otherwise.
Currency crash *(curr)*	This is coded 1 if country experienced currency crash in the period under examination, zero otherwise.
Herfindah-Hirschman index,(HHI), *(dcom)*	Captures the degree of competition in the industry (World Bank)
Investment *(invest)*	Dummy =1 if firm invested in any asset in previous year(s)
Inveq	Dummy=1 if firm invested in equipment and machinery in previous year(s)
Invl&b	Dummy=1 if firm invested in land and buildings in previous year(s)
Import penetration rates *(mpr)*	capture intensity of import competition in individual sectors (World Bank)
Inflation crisis *(inf)*	This is coded 1 if country experienced inflation crises in the period under examination, zero otherwise.
Total factor Productivity (TFP)	This is the measure of the firm's efficiency,

	and how well the inputs are put into proper use to produce output. In this study, we derive TFP using the Levinsohn and Petrin (2003) approach, using levpet STATA user written command.
Labor productivity*(lrl)*	Log of real output per worker in US$
Capital intensity *(K:L)*	Log of real US$ capital to labor ratio
Other inputs *(lol)*	Log of real US$ other inputs per worker
Employment (measured by number of workers) *(ll)*	Log of employment
Total Employment *(Emp)*	Total number of employees working in the firm, plus the owner or manager; whether full and part time workers, but excluding periodic workers.
Export Dummy (EXPDUM)	Dummy = 1 if firm exports.
EXPAF	Dummy=1 if firm exported to African countries
EXPNAF	Dummy=1 if firm exported to outside of Africa
Firm Age *(fmage)*	Dummies created based on the year in which the firm first begun to trade (STYEAR).
Ownership Dummy *(anyfor)*	Dummy = 1 for firms with any degree of foreign ownership (including 100%)
Firm Size dummies:	
Micro	Dummy = 1 for micro firms (1 - 9 employees inclusive)
Small	Dummy = 1 for small firms (10-49 employees inclusive)
Medium	Dummy = 1 for medium firms (50 - 99 employees inclusive)
Large	Dummy = 1 for large firms (100 or more employees)
Sector dummies(Aggregated)	
Textile	ISIC 3219
Wearing apparel-garment	ISIC 3220
Wood	ISIC 3319
Furniture and fixtures	ISIC 3320
Food and Bakery	ISIC 3121/3117
Metal, machinery and chemical industry	ISIC 3819/3829/3529