



UNIVERSITY OF NAIROBI
SCHOOL OF ECONOMICS

**THE IMPACT OF ICT ON EXPORT BEHAVIOUR OF MANUFACTURING FIRMS IN
KENYA.**

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DECLARATION

I, the undersigned, declare that this research project is my original work and has not been submitted to any other college, institution or university for the award of a degree or any other award.

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This research project has been submitted for examination with my approval as a university supervisor.

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LIST OF ABBREVIATION AND ACRONYMS

ICT	Information, Communication and technology.
KNBS	Kenya National Bureau of Statistics.
WTO	World Trade Organization.
GATT	General Agreement on Tariffs and Trade.
R & D	Research and Development.
KNESWS	Kenya National Electronic Window System.
FDI	Foreign Direct Investment.
OLS	Ordinary Least Square.
VIF	Variance Inflation Factors.

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ABSTRACT

The objective of the study was to determine the impact of Information, Communication and Technology (ICT) on firm export behavior in Kenya. More specifically, the study sought to evaluate how the use of company website, cellphones, emails, foreign technology and mobile money transfer influence the performance of export in the manufacturing sector of Kenya. The study utilized a firm-level panel data analysis from the three waves of World Bank Enterprise Surveys conducted in the years 2007, 2013 and 2018. Using a Random effect model regression analysis, the study findings support the use of mobile money to pay suppliers, use of a company website, using a company's cell phone to communicate to the customers and suppliers to boost firm's export level. However, the study does not support the use of email platform to communicate with the suppliers and customers and use mobile money to receive payments for sales from customers as they were found to have a negative impact on the firm's export. We thus recommend that the Government should invest heavily on ICT infrastructural development and continue to promote ICT usage among the manufacturing firms in their day-to-day activities. Firms should maximize the use of ICT components to pay its orders and suppliers, invest in clear marketing websites that defines who they are and what product they offer, optimal hire workers as well as strategic location of new branches to take care of logistics such as proximity to the exit points (airport, seaport and/or railway stations).

CHAPTER ONE

1.1 INTRODUCTION

In contemporary trade, international telephone calls are increasingly made through the internet's network (Morrar, et al., 2017; Li, et al., 2017). Customers globally are searching for goods and services produced outside their boundaries through internet (Franco & BulomineRegi, 2016). For the economy in general, Information, communication and technology (ICT) development is becoming vital for attaining both long term development goals (such as Vision 2030) and short-term economic goals that includes, but not limited to, creation of wealth and decent jobs with financial stability for occupants of a country. Further, in the global business environment, a key challenge that is getting much attention in the last few decades is how a firm can seize the benefits of Information, communication and technology (ICT) in their export growth.

The rapid diffusion of most types of ICT such as Internet, mobile telephony and broadband networks all demonstrate how relevant this technology has become. Today's firms are using computers in their day-to-day activities and most of them are connected to the internet. Additionally, most of them are using computer networks for business purposes such as buying, selling and outsourcing of goods and services. But how does this use of ICT affect firm export growth? How well can these impacts be measured? This study addresses the first question and provides an overview of the impacts of ICT on firm export behavior using a 3-year panel data of Kenyan manufacturing firms conducted by World Bank enterprise survey in the years 2007, 2013 and 2018.

The real impact of ICT usage in firm export intensity has gained relevancy in recent times, owing to the benefit associated with it in the cross border and international market. For instance, Shah et al. (2017) explains how the R&D in financial sector led to the invention of mobile money transfer (the

Mpesa), which has revolutionized the international market system. The cost of information that is always associated with a lack of proper ICT is effectively reduced when an ICT infrastructure is in place (Gurung and Prater, 2017). The use of ICT is one of the survival strategies adopted by developing countries to face stiff competition (Noe et al., 2017 and Cooper, 2017). Ansoff (2018) indicated that firms with increased export volume rely heavily on ICT development.

Theories such as Competitive Trade explains the comparative advantage in production by countries or firms as a result of technological differences. Similarly, Heckscher-Ohlin model argues that firms or countries comparative advantage is as a result of difference in factor endowment and the intensity of adoption of these factors. Narrowing down the models to a firm-level implies that the firms in specific countries export commodities which they have a comparative advantage over. Hence, Competitive Trade Theory is vital in elucidating the trade that happens between different industries in both the developed and developing nations.

Despite a broad recognition that ICT usage could be having a significant impact on firm export behavior, the study on the impact of ICT usage on the performance of manufacturing firms is still at its infancy (May et al., 2016; Hagsten and Kotnik, 2017) and there is scarcity of empirical evidence on the effect of ICT usage on the performance of manufacturing firms in Kenya. Additionally, the impact of ICT on export in the manufacturing sector is not well understood in the public domain. Owing to this inconclusiveness and the vacuum in developing countries such as Kenya, this study intends to fill this gap by investigating the impact of ICT on export in the manufacturing sector of Kenya based on the firm-level analysis.

1.2 ICT policy in Kenya

Several strides have been made in the policy environment to boost ICT in Kenya. From legal foundation for ICT development through the Kenyan Information and Communication Act of 1998 to various revisions thereafter in 2006 and later, the Kenyan Information and Communication Act of 2013, all with an aim of improving efficiency, in this sector, reveals how crucial it is to the Kenya's development trajectory. It has also, in recent time launched a Digital Blue Economy whose framework aims at among other things, digitization of government services and business, innovation-driven entrepreneurship and digital skills.

The need of ICT policy was partly to lay a legal foundation as well as to give the institution and individual firms with modern and more advanced tools for increased communication and organization management. Equally, for Kenyan industry to perform well in these highly competitive international markets, Kenya required a highly skilled human resource with appropriate skills in the application of ICT in everyday life. Thus, the ICT policy gears towards creation of an enabling environment to support e-commerce, outsourcing of firm inputs that will make production less costly, streamline operations, track market trends as well as boost marketing.

1.3 Overview of exports in Kenya.

The amount of manufactured goods exported from Kenya Increased from 62.2 Billion KES in 2006 to 124.6 Billion KES in 2020, the average amount of manufactured goods exported from Kenya was 104.5 Billion KES (KNBS, 2020). However, it recorded the lowest export of 62.2 Billion Kenya shillings in 2006 and the highest of 127.7 Billion in Kenya Shillings in 2011. Machinery and transport equipment are the major manufactured products that have been exported from Kenya. Others include Chemicals, Soap and Maize (Corn) starch, Glues and Wattle Bark extract, Carbon Dioxide and Sulphates of Aluminum, Leather, Textile yarns, Fabrics, made-up textiles, Wood and Wood Carvings,

Cement, Glassware, Paper and Paperboard, Steel Doors, Windows, and Metal Containers, Aluminum wear, Domestic, Machinery and Footwear Transport equipment and Printed matter. Exports from Kenya mainly to the United Kingdom (UK), the Netherlands, EAC (i.e., Uganda and Tanzania), the US, and Pakistan (KNBS, 2020).

Kenya National Bureau of Statistics, 2020 indicated that all Kenya's export destination except the Democratic Republic of Congo reduced their uptake of Kenya's products. Although this decrease has been associated with the penetration of Chinese products into the market, other factors, for example, taxation, instability in South Sudan, and new competing industries, have contributed a lot to the decrease in trade. Chinese products have penetrated the market in large quantities hence making the Asian giant the biggest exporter to the region. More than 40% of Kenya's manufactured export is absorbed in Africa.

Figure 2 below shows the trend in the level of manufactured goods exported from Kenya over the years. Kenya's export of manufactured goods has been unstable, with a consistently increasing trend in the last 15 years. In 2006 export of manufactured goods in Kenya was 62.2 Billion KES, which increased to 66 Billion the following year. 2008 saw a further increase in exports of manufactured goods to 79.6 Billion KES; however, there was a slight decrease in 2009, to 75.8 Billion KES. The period between 2006 and 2020 was characterized by fluctuations in exports, which stood at 124.6 Billion KES as of 2020. However, the export of Kenya's manufactured goods has been on the increase from 2017, at 113.9 Billion KES in 2017 (KNBS 2020). According to KNBS 2020, the amount of manufactured goods exported increased by 5.6% in 2019 as compared to 2.3% in 2018. In 2016 some sectors, for example, ICT, mining, and trade, experienced a decline. Initially, ICT had contributed significantly in 2014, with an expansion of 13.4% from 12.3% in 2013.

Figure 1: Total Exports of Manufactured Goods (2006-2020)



Source: Kenya National Bureau of Statistics (KNBS, 2020)

1.4 Mpesa

Safaricom and its mobile innovation Mpesa is been used in many countries to transfer money from one mobile subscriber to another and to transact other business services. According to Mas & Morawczynski, 2009, Mpesa is the largest and the most successful money transfer service across the globe. Through the conceptualization of money transfer services, a team of researchers and Safaricom invented Mpesa with the objective of solving the desires and the wishes of unbanked population. Mpesa was developed through intensive Research and Development with the aim of developing and designing money transfer software (Shaikh & Karjaluo, 2014). Moreover, Safaricom did extensive marketing aiming at extending the use of Mpesa services in both urban and rural areas. Mpesa can be

considered as a breakthrough in financial inclusion. Currently, Mpesa services have been used by many countries, for example, Rwanda, Tanzania, India, Afghanistan, Uganda, Egypt, Albania and Romania of which Kenyan export can be paid (Mas and Morawczynski, 2017)

1.5 Overview of ICT and Exports in Kenya.

Kenya is one of the WTO members. In the more recent time, ICT's role in promoting international trade cannot be underestimated. For instance, from the WTO's trade facilitation agreement concluded in 2014, it was noted that there was a dire need to clarify and improve the relevant aspects of GATT Article V, VII, and X. These articles do emphasize the need for speeding up: goods movement, goods release, and goods clearance, including goods in transit. Most countries involved in international trade have established an electronic single window that uses ICT, which has advanced harmonization and data sharing among government institutions, bringing relevant gains to all the parties involved. In this regard, through a legal notice 6 of January 2011 Kenya, Kenya Established KenTrade, an agency that is responsible for trade facilitation and implementation of the Kenya National Electronic Single Window System (KNESWS). This Window has integrated to other Kenyan government agencies to form a single common platform that facilitates, among other goods, the exports.

From the firm-level data, ICT has been linked in assisting the firms/industries to increase/gain market share. For instance, empirical evidence points out that: ICT has leveraged firms that have adopted them at the expense of those that have not in the form of less cost of production. Intuitively implying the overall rise of productivity of such firms (Albuquerque et al., 2018; Chaney, 2016), ICT has also been linked to a firm's innovative capability. That is, it has assisted firms to respond better to both internal market and external market demand, to diversify their product range or to customize the services they offer to clients. Lastly, ICT has, on many occasions, reduced inefficiency in the firm's utilization of both capital and labor (Lema et al., 2017).

Despite all these potential benefits of ICT to export growth, these benefits are never guaranteed. They depend on whether the investments are complementary or not. For those that are complementary, firms that adopt them do increase/gain/expand their market. That assist them to enjoy higher productivity gains than other firms (Tidd and Bessant, 2018). Equally, ICT adoption has enabled the firms to adjust to the fluctuating demand and hence innovate with a superior product that is more valuable (Tidd and Bessant, 2018).

For an extended period, the internet has remained one of the telecommunication technologies responsible for the convergence, while devices such as desktops, laptops, and mobile phones have assumed a strategic role in the connectivity. Convergent ICT is spreading faster than the internet or conventional communication technology. In comparison between internet and mobile phone connectivity, mobile phone subscription has surpassed the internet. The current statistics reveal that approximately 5.1 billion individuals have access to a mobile phone, while 67% of them have a mobile device (Tidd and Bessant, 2018). What is of interest is that the only ICT in which the developing nations have beat the developed nations in terms of ICT connectivity is the mobile phone use.

1.6 Statement of the Problem.

Over the last ten years, Kenya has witnessed substantial progress in ICT. The manufacturing sector is quickly adopting technology for production, dissemination of information, enhancement of service delivery, and easy market access. Massive amounts of capital have been invested to achieve technological change. Most firms have realized that reliable and effective ICT systems can help them achieve and realize their goals quite easily. Through the establishment of an online presence, a firm can take advantage of connecting cheaply and swiftly with a large number of customers locally and internationally through establishing virtual branches and avoiding unnecessary physical asset investment abroad. Equally, ICT usage can leverage quite a number of tasks by a firm such as

international advertising, information gathering on existing international markets, and communication. With Kenya Export remaining volatile and a sustainable trade imbalance with its major international trading partners, the role of ICT which seems to be country-specific and heterogeneous across the globe on export performance for manufacturing firm need to be investigated. Despite potential benefits relating to ICT usage by manufacturing firms, existing literature mainly focuses on multinationals and the role of trade in technology adoption. There is a lack of in-depth study in this area in developing nations such as Kenya whose firms are struggling with too many obstacles to globalize their export. Thus, this research intends to fill this gap through especially investigating how the utilization of mobile money (making and receiving payments) affects exports in the Manufacturing Sector of Kenya as well as to investigate how the use of company websites, emails, cell phones and foreign technology effects exports in the manufacturing sector of Kenya. Owing to this inconclusiveness and the vacuum in developing countries such as Kenya, this study aims to fill this gap by investigating the impact of ICT usage on firm export intensity in the manufacturing sector in Kenya using firm-level data.

1.7 Research questions

1. How does the use of mobile money transfer (in making and receiving payments) affect firm exports intensity in the manufacturing sector in Kenya?
2. How does the use of website, emails and cellphones affect firm exports intensity in the manufacturing sector in Kenya?
3. How does the use of foreign technology affect firm exports intensity in the manufacturing sector in Kenya?

1.8 Study's Objectives

1.8.1 General objective

To investigate the impact of ICT usage on firm Export intensity in the manufacturing sector in Kenya.

1.8.2 Specific Objectives

1. To investigate how the use of mobile money transfer (making and receiving payment) affect firm exports intensity in the manufacturing sector in Kenya.
2. To establish how the use company websites, emails and cellphones affect firm exports intensity in the manufacturing sector in Kenya.
3. To investigate how the use of foreign technology affects firm exports intensity in the manufacturing sector in Kenya.

1.9 Significance of the Study.

The findings will be important to policymakers, mainly the regulators with regards to exports. The results will be beneficial to the Export Promotion Council in the formulation of policies towards the promotion of Kenya exports abroad. More specifically, it will be policies focusing on the usage of ICT in promoting Kenya's exports abroad. In addition to the export promotion council, it will be necessary for the government of Kenya to achieve one of the big four agenda regarding the increase in the manufacturing share of GDP to 15 percent. By eliciting the effects of ICT, the government can formulate policies on incentives towards the promotion of ICT usage among the manufacturing firm to enhance their efficiency. The results will also be important to the management of the firms. By eliciting impact of ICT on exports, the management of the firms can leverage on investment in Information and Communication Technology in their endeavor to maximize their export quantities.

Additionally, the findings will be significant to literature. As evidenced by the empirical studies in chapter two of this study as well as in literature critique, summary and research gap, analytical work on how ICT affects exports among the firms in the manufacturing sector, the study will elicit new knowledge, thus expanding the existing body of literature in this area of study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter comprises of review of theoretical literature, which provides insight on the theories that underpin the study. Furthermore, it provides the empirical literature review, which looks at previous studies relating to the effect of ICT on exports.

2.2 Theoretical Literature Review.

The comparative advantage theory postulated by David Ricardo (1817) predicts that a firm specializes in exporting what it enjoys a comparative advantage in and import those which it has a comparative disadvantage in. The difference in comparative advantage may rise from knowledge-based differences (Krugman, 1995; Balassa 1963). With labor as the only production factor, a firm should export goods in which it has high labor productivity relative to its labor productivity in other goods. Therefore, the Ricardian theory bases trade on the differences in labor productivity. Heckscher-Ohlin (H-O) theory, builds on it by stating that firms export because of differences in their relative factor endowments (labor, capital, and land) and differences between commodities in the intensities with which they use these factors. As a result, this theory uses two concepts to explain trade; trade in goods and trade in factor content. The former is basically about a specific product such as a laptop, while the latter is about the content of inputs in a product. This theory provides evidence in predicting the variation in technological differences given that one of its premises is based on similar production functions among trading countries (Appleyard, Field & Cobb, and 2008:127). Competitive Trade Theory describes how the comparative advantage regulates trade in the Heckscher-Ohlin and Ricardian trade models. According to the Ricardian trade model, the comparative advantage result from technological

differences among countries and firms. Equally, the Heckscher-Ohlin model indicates that comparative advantage is a result of differences in relative factor endowments and the intensity with which firms or countries use such factors. Hence, a nation's comparative advantage under this model is dependent on the nation-level factors. Narrowing down the models to a firm-level implies that the firms in specific countries export commodities which they have a comparative advantage over. Hence, Competitive Trade Theory is vital in elucidating the trade that happens between different industries in both the developed and developing nations.

2.3 Empirical Literature Review

With the current globalization wave, it is becoming more apparent that developing countries are shifting their focus from local trade to international trade. Of note is the rise of innovation to meet the global standards of cross border trading. For instance, Shah et al. (2017) reveal that the innovation of Mpesa is a clear indication that money transfer development is a result of investment in research and development and has sealed the gaps in the international market systems.

Similarly, Information technology capability is a critical component for any meaningful growth of SMEs. In China, studies by Pick, Nishida, and Zhang (2018) have shown that export-based SMEs that utilize Information Technology tend to perform better than those that have not tapped into information Technology. It then follows that, for any SME to make any meaningful steps in both local and global markets, it must tap into information technology capability. That is to say, both human skills, research, and other elements of production must be aligned to current Information technology standards. However, this study was centered on China. The current study will be centered on manufacturing firms in Kenya, which has similar findings as to the study by Kabaklarli, Duran and ÜÇLER, (2018).

Liu and Nath (2016) did research on the effect of ICT on imports and exports in ten service categories using panel data in 49 economies from the year 2000 to the year 2013. Different from the previous studies, seven distinct ICT variables were utilized to build an all-inclusive ICT development index (IDI), which encapsulates utility, access, and the skill aspects of technology. The findings revealed that ICT development has a positive and strong impact on exports of transportation services and imports of travel, telecommunication, and insurance services. The results are strong under different estimation techniques. Among the three components of ICT, ICT use was found to be more critical than the skills of trade and access in several services. More so, when the techniques are separately estimated for the emerging market economies (EMEs) and Advanced Economics (AEs), ICT development seems to be more critical for exports from AEs and imports by EMEs. Finally, ICT utility is more critical in EMEs than AEs, in particular for imports. The outcome provides essential policy insights for growth in service trade and ICT development.

Montobbio and Rampa (2017) conducted a study of nine enormous developing nations. The Structural decomposition analysis showcase that these nations incline towards innovative activities in industries undergoing stagnation across the globe, with the international trends partly offsetting the national enhancements in patent shares. A similar scenario is seen in the world of export shares, even though nations do display a more significant adaptation to the world's demands. The study findings showcase that technological activity is highly linked to the export gains in high-technology sectors if a nation expands its industries with technological opportunities in the medium-technology sectors, that is, if it moves away from the low opportunities in the low-technology sectors. That can only happen if it specializes in the growing sectors of the economy. In the low and high-tech sectors, the performance of export is affected by growth in technical capabilities, technical skills, productivity and foreign direct investments and in the medium tech by the rates of FDI.

The cost of information is effectively reduced when an ICT infrastructure is in place. According to research by Gurung and Prater (2017) on the effect of ICT on international trade, ICT was found to be a critical element in cross border trading. According to the test of the study assumptions using the Asian Chinese network, it was realized that the relationship network is more significant than ICT, but as much as that was the result of his studies, the place of ICT in trade and other factors cannot be wished away.

Yifei Mu, Zhen Chen, Yibing Ding, Yuqing Wang, Bo Pang (2020) investigated the impact of internet usage on China's export. They tested the objective through Heckman two-stage estimation on the data from the World Bank Enterprise Survey of Chinese firms conducted in 2012. The findings revealed that the usage of ICT was positively related with increased export volume. The study provided the empirical and theoretical evidence for the formulation of internet application policy relevant to manufacturing firms. According to Pergelova et al. (2019), firms achieve successful exporting through both the back-end¹ integration of online technology and front-end functionality. ICT is used in sharing information, searching for information and in the online transaction. Xing (2018) studied the data on bilateral trade, and their study results indicated that an increase in websites in a country explains the growth in the following year.

Studies by Tidd & Bessant (2018) showed that for a small-scale industry to break even and perform well in terms of exports, there is a need for innovation by such firms. In his analysis, he considered the innovation activities, technological and financial position of the firm. Firms therefore need to invest in technological innovation in order to survive the competitive global markets and even break the local and regional boundaries. Similarly, Bartelsman et al. (2018) studied the link between productivity and

¹ Back-end integration of online technology implies that web applications are connected to back office databases and this gives the firms the advantage to identify international opportunities.

ICT taking into consideration the percentage of employees connected to broadband internet. The estimation was done on data from the firms involved in innovation activities and ICT usage between the years 2002-2010 which encompassed 117,000 firm. The findings revealed that there is a strong relationship between firm productivity and innovation. The strength of the relationship varies across countries and manufacturing firms.

2.4 Overview of Literature.

From theoretical literature review different theories have emerged to explain why countries export. According to comparative advantage theory, a country or firm exports goods that it has an advantage over in terms of labor productivity. Heckscher Ohlin (H-O) theory builds on comparative advantage by stating that firms export because of differences in their relative factor endowments and the difference between commodities produced is the intensity with which these factors are utilized by firms. The comparative advantage is as a result of technological differences among countries and firms. The review of literature revealed that several studies have been undertaken on the impact of ICT on export performance of manufacturing firms. However, most of these studies were based on developed countries such as Europe, China, India, Indonesia etc. The findings of these studies cannot be applied in developing country like Kenya because the market size and marketing integration is small. This study aims to investigate the impact of ICT on firm export in Kenya using firm level data.

CHAPTER THREE

RESEARCH METHODOLOGY

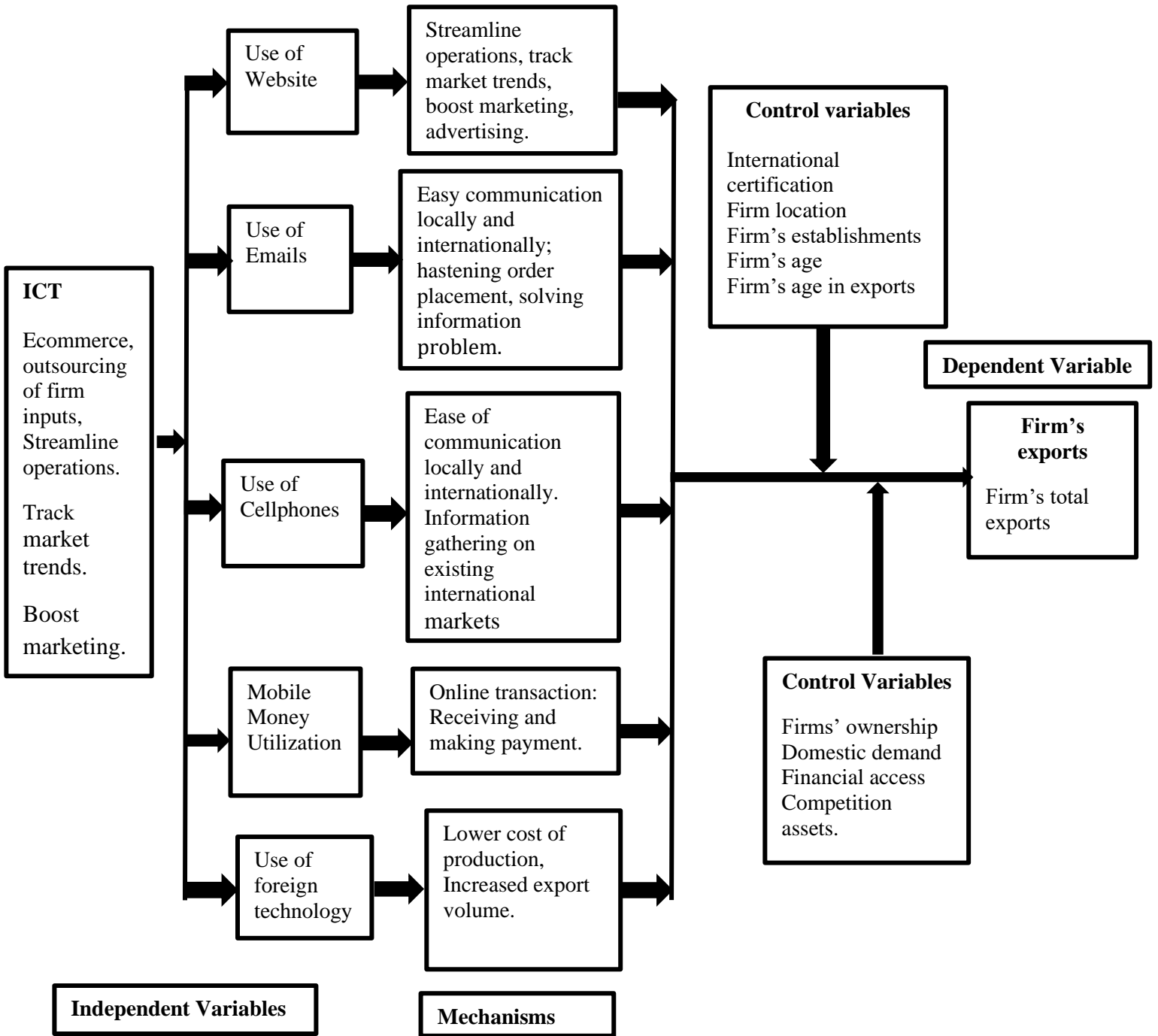
3.1 Introduction.

The chapter explains the methodological research that will be adopted in carrying out the study to attain the research objectives. More specifically, the chapter will cover the conceptual framework, theoretical framework and the econometric model for the study, operationalization of variables, data and data sources for the study and lastly the data analysis.

3.2 Conceptual framework

Based on the study's review of the existing literature and the database of the World Bank Enterprise Survey conducted in the years 2007, 2013 and 2018 the conceptual framework on effects of Information Communication Technology on exports among the manufacturing firms in Kenya is presented as follow:

Figure 2: Conceptual Framework.



3.3 Theoretical Framework.

According to the dynamic model theory developed by Roberts and Tybout (1997), firms that are involved in the export business and are guided by the profit maximization objective on the backdrop of making rational decisions in their operations, the decision to export is internally determined within the firm. In addition are the decisions to produce new products for the export market. The significant source of export persistence by firms is sunk costs, and probability of firms to export is determined by unobserved heterogeneity across all firms. Given the fact that the model is considerate of market entrance cost, it has proved to be fit in empirical studies regarding the analysis of the firm’s exporting behavior. As such, the model considers the heterogeneity of the firms in their production as well as in making decisions on whether to export their products or not (Roberts and Tybout (1997)). It is based on the concept of increasing return to scale arising from increased knowledge and technology used by the firms of which accounts for a rise in the firm’s productivity of exportable.

First, let us assume that the firm’s profitability upon deducting the fixed market entry cost is positive. Prior to obtaining the expected value of profits for multiple periods, the single-period case for profit maximization with zero market entry cost is given by equation 1. In this case, it is assumed that the firm is involved in the production and selling of its produce in a foreign market. In this case, it is assumed that the firm is involved in the production and selling of its produce in a foreign market. The amount of produce that maximizes revenue and profits is given by q_{it} .The profit function of the firm is given by equation (1)

$$\pi_{it}(X_{it}, Z_{it}) = P_t x q_{it}^* - C_{it}(X_{it}, Z_{it} / q_{it}^*) \dots \dots \dots (1)$$

Where;

- P_t -Price of the goods sold abroad.
- $C_{it}(\cdot)$ -Variable cost of producing.
- X_{it} - Exogenous factors affecting profitability of the firm.
- q_{it} - Firm specific factors affecting profitability of the firm.

Therefore, if the profit function is positive, the firm will sell its products abroad. Considering a multiple period analysis without sunk entry cost, the profit function of the firm is given by equation 2 specified as follows:

$$\pi_{it}(X_{it}, Z_{it}) = E \left[\sum_{s=t}^{\alpha} \delta^{s-t} (P_{is} q_{is} - c_{is}(X_s, Z_s / q_{is}^*)) \right] \dots \dots \dots (2)$$

Where,

δ -one-period discount rate.

This means that if there is any effect of today's production on the costs tomorrow i.e., learning-by-doing in export production, the current firm export status will have some effects on the decision to export the next period. Therefore, the cost function facing the firm in the production of export will be;

$$C_{it} = c_{it}(X_t, Z_t, q_{it-1}^* / q_{it}^*) \dots \dots \dots (3)$$

With $\frac{\delta C_{it}}{\delta q_{it-1}} \neq 0$

Further, introducing the sunk cost into the analysis, we take into consideration the new market entry cost. These costs include adjustments to cope with competition in the international market. They may

include cost of establishing distribution networks, management of customer expectations, among others. It is always assumed that exporting firms will not incur the entry cost if they exported previously. If there are entry costs associated with exporting, a progressive firm will look beyond today in its decision to export. Exporting today carries an additional option value of being able to export tomorrow without paying the sunk costs of exporting.

Let the sunk cost be denoted as N , the firm's profit function will be as follows:

$$\pi_{it}(X_{it}, Z_{it}) = P_t x q_{it}^* - C_{it}(X_{it}, Z_{it} / q_{it}^*) - N(1 - Y_{it-1}) \dots \dots \dots (4)$$

Therefore, if the firm's profit function is positive, the firm will always export.

Therefore, the firm will maximize its profit as follows:

$$\pi_{it}(V_t, Z_{it}) = E_t \left(\sum_{s=t}^{\infty} \delta^{s-t} (\pi)_{is} Y_{is} \right) \dots \dots \dots (5)$$

The form of the value function is the same as that in the case of without entry cost

$$V_t(.) = \max_{q_{it}} \left(\pi_{it} Y_{it} + \delta E_t (V_{i+t}(.)/q_{it}) \right) \dots \dots \dots (6)$$

Therefore, the decision of the firm to export will be:

$$Y_{it} \begin{cases} 1 - \text{if } \pi_{it} + \delta E_t [V_{i+t}(.)/q_{it}^* > 0] - \delta E_t [V_{it}(.)/q_{it}^* = 0] \geq 0 \dots \dots \dots (7) \\ 0 - \text{Otherwise} \end{cases}$$

Throughout the production process and profit maximization objective, the manufacturing firms continuously employ different ICT components such as Websites, emails, cellphone, foreign technology and mobile money transfers in making and receiving payments. Therefore, the aforementioned, theoretical framework helps in the specification of the empirical model for the study as defined in the empirical model specification section.

3.4 Econometric Model

Based on the theoretical model above, the empirical model for the study is defined as follows:

$$X_{it} = \alpha_0 + \alpha_1 ICT_{it} + \alpha_2 Z_{it} + \varepsilon \dots \dots \dots (8)$$

Where:

- ❖ X_{it} - Export measured as a Percentage of total sale.
- ❖ ICT_{it} - Refers to a set of our ICT components (Website, emails, cellphones, foreign technology and mobile money transfer) in a given firm i at a time period t .
- ❖ Z_{it} - Represents the firm characteristics which include the size of the firm, location, age and the number of years the firm has been exporting, the number of competitors, source of finance, the total number of entity establishments in the firms, the trend in the domestic demand of the main product produced, ownership of international certification and the nature of the firm's ownership by shareholding.
- ❖ ε - Represent error term.

The Independent variables are further defined as follows;

ICT Components (ICT_{it}).

- MMP_i is the use of the mobile money by the i^{th} firm to make payments to suppliers
- MMR_i is use of the mobile money by the i^{th} firm to receive payments for sales from customers
- $Website_i$ the i^{th} firm having a company website
- $Emails_i$ the use of email platform to communicate with the suppliers and customers by the i^{th} firm.

Cellphones_i the firm using company cell phone to communicate with the suppliers and customers by the i^{th} firm.

Foreigntech_i the firm using technology that is licensed in a foreign country

Firms' characteristics (Z_{it}).

Internationalcert_i the firm having an international certification as a requirement to meet the international standards for exports

Location_i the region of establishment of the entity

Firmsize_i the size of the company as measured by number of employees.

Establishments_i the total number of entity establishments in the firms.

Age_i the number of years the firm has been in operation.

Ageexpo_i the number of years the firm has been exporting.

Firmownership_i the nature of the firm's ownership by shareholding.

DomesticDD_i the trend in the domestic demand of the main product produced by the firm.

Finacess_i the firm's source of finance to finance working capital.

Competition_i the number of competitors faced by the firm.

3.5 Operationalization of model variables.

The variables utilized in the study, their definitions, measurement, and expected are as follows.

Table 1: Variables to be Used and Expected Relationship

Variable	Definition	Measurement	Expected sign
Dependent variable			
Exports	Export measured as a Percentage of total sale.	Percentage of exports from the total sale by the firm in the last 12 months.	
Independent variable			

Mobile money utilization for payment	Refers to mobile money utilization by firms to make payments to suppliers	1 if yes, 0 otherwise	Positive
Mobile money utilization for receivables	Refers to mobile money utilization by firms to receive payments for sales from customers	1 if yes, 0 otherwise	Positive
Use of entity website	Refers to the firm having a company website	1 if yes. 0 otherwise	Positive
Use of email	Refers to the firm using the email platform to communicate with the suppliers and customers	1 if yes, 0 otherwise	Positive
Use of cell phone communication	Refers to the firm using a company cell phone to communicate with the suppliers and customers	1 if yes, 0 otherwise	Positive
Technology licensed from foreign country	Refers to the utilization of technology licensed in the foreign nation by firms.	1 if yes, 0 otherwise	Positive
International certification	Refers to the firm having an international certification as a requirement to meet the international standards for exports	1 if yes, 0 otherwise	Positive
Location	Is the region of the establishment of the entity	1 if located in Central 2 if located in Nyanza 3 if located in Mombasa 4 if located in Nairobi 5 if located in Nakuru	Positive / Negative
Firm size	A company's size estimated by the number of employees.	The number of employees that the firm has.	Positive
Number of establishments	Is the total number of entity establishments in the firms	Total number of establishments that the firm has within the country	Positive
Age of the firm	This is the number of years a firm has been operational.	The difference in between the year the survey was conducted and the year the firm was established	Positive
Age in exports	Is the number of years the firm has been exporting	The difference in between the year of survey and the year firms established the first direct/indirect exports	Positive

Firm ownership	Is the nature of the firm's ownership by shareholding	1 if private domestic ownership 2 if private foreign ownership 3 if government/ state, 4 if others	Negative / Positive
Domestic demand	Refers to the trend in the domestic demand of the main product produced by the firm	1 if increased in 12 months, 0 otherwise	Negative / Positive
Financial access	Is the firm's source of finance to finance working capital	1 if retained earnings, 2 if loan from banks, 3 if loan from NBFIs, 4 credit purchases, 5 if other money lenders	Positive
Competition	Is the competition that the firm faces from potential competitors both domestic and foreign competitors	Number of competitors faced by the firm	Negative

Source: Author's Computation

3.6 Data Source and Type

This study will utilize secondary data. More specifically, the study will employ panel data to achieve the objectives. The data will be from the World Bank Enterprise Survey conducted in years 2007, 2013 and 2018. The choice of the database is informed by the fact that the database contains all the variables that the study model entails. From this database, the study will sample 1001 enterprises (657,781 and 1001 for 2007,2013 and 2018 respectively) relating to the manufacturing sector, which accounted for 53.01 percent of total enterprises covered by the survey. As such, the study will not capture the dataset for enterprises in the retail sector and dataset for enterprises listed under others, which accounted for 21.25 and 25.74 percent of the surveyed enterprises, respectively.

3.7 Diagnostic Tests

3.7.1 Multicollinearity.

Multicollinearity occurs when two predictor variables are linearly dependent. Its presence exacerbates parameter estimates variance, which leads to incorrect conclusions in estimating the coefficients. The study will utilize the collinearity matrices or the Variance inflation factor to establish its presence.

3.7.2 Heteroscedasticity test

Heteroscedasticity is a problem that occurs when the error terms of the values of the variables vary from one observation to another. It is a severe problem in econometrics and have consequences on the Ordinary Least Square (OLS) estimators. Upon estimating the empirical model, the Breusch-Pagan-Godfrey test will be used to examine heteroscedasticity.

CHAPTER FOUR

DATA ANALYSIS, RESULTS, AND DISCUSSION

4.1 Introduction

In this chapter, we present the results of the analysis and discussion of findings. We begin with exploration of our data set through a descriptive statistics and then present diagnostic tests (such as correlation matrix, multicollinearity test and heteroscedasticity test). Further, pre-estimation tests (such as unit root test) and post-estimation tests such as poolability test and Hausman Test for deciding between pooled OLS versus fixed effect models or fixed effect versus random effect models.

4.2 Descriptive statistics.

First, the descriptive statistics for the main variables used in this analysis are computed and reported in Table 2. The summary is done for the overall in years. The reported statistics reveal that, in 2007, the mean of the dependent variable (export) was about 8.73%, of the total sale. In 2013, we observe that export, which in this study was a percentage of total sale, increased to 19.16%. However, there was a reduction in export value in 2018 to 13.34%. Possible reason for this drop in export value can be attributed to disputed election in the country in 2017/2018 financial year.

In regard to mobile money utilization, the study findings reveals that none of the firms in the sample was receiving payments from customers in 2007 through mobile payments. However, we observed that, on average, about 73.06% of the firms in the sample were receiving payments from customers through the mobile money in 2013. By 2018, firms receiving payment through the mobile money had improved to about 86.57% implying some level of convenience in this mode of receiving payments. In contrast, we observed that there were less than 50% of firms that were using mobile money to pay

suppliers. For instance, in 2013, about 34.64% of firms were paying their suppliers through mobile money. This marginally increased in 2018 as about 34.65% of them were paying their suppliers through mobile money.

The findings further revealed that an average of 16.13% of the firms in the sample had a company website. There was a great improvement in 2013 as the average firms with a company website increased to about 52.11%. However, in 2018, there was a slight decline for firms with a company website to about 50%. The number of firms using the email platform to communicate with the suppliers and customers consistently increased from 57.08% to 81.10% to 86.05% in the years 2007, 2013 and 2018 respectively. In contrast to this, the number of firms using a company cell phone to communicate with the suppliers and customers decreased marginally from 95.37% to 94.36% to 91.37% over the same period. This implies probably that the company email was gaining usage to the traditional cell phone as a form of communication to the suppliers and customers.

The number of firms utilizing international technology was found to be below 30% across the study period. In particular, in 2007, we observed that approximately 13.72% of firms had international certificate to utilize foreign technology. The number increased to 29.16% in 2013 but dropped in 2018 to about 20.78%.

The study further revealed that only three locations (Nakuru, Kisumu and Nairobi) had firms represented in the three survey waves. The rest were represented in only one wave. In all the sampling, Nairobi location had more firm representation. If the representation was proportional, this could imply that most of the firms are located within Nairobi. Equally, statistics reveals that although small firms formed the largest units in the sample in all the three waves, there was a marginal decline in the number of small firms in 2013 and 2018. For instance, small sized firms formed about 64% of the total sample

in 2007 but declined to about 42% in 2018. In contrast, we see an increase in the representation of both medium and large firms in the three waves.

Further, we observed that on average, the firms had three establishments in 2013 with an improvement in 2018, where the mean number of establishments increased to about 6. The average age of firms in the study, by the last survey was about 29 years while the average number of years in export was found to be 24 years. In regard to ownership status, we found out that majority (over 80%) of the firms in the sample were private domestically owned in the three waves. Of interest is the state-ownership which despite, being less than 10% of total ownership in the three waves, it was also declining over the period under study.

The domestic demand for the main product of the firm was found mixed episodes of increase and decrease. For instance, the increase episode for the firm’s main product declined sustainably from about 73% in 2007 to about 45% in 2018. However, the episodes in which the domestic demand remain unchanged in the three waves increased over time from 13% in 2007 to about 32% in 2018.

Equally, we observed that, on average, less than 1% of the firms had one competitor in the three-wave period. Majority (about 75%) of the firms reported to having more than five competitors in the period under study. Lastly, all firms reported that they were accessing financial assistance in 2007 and 2018. However, in 2013, only about 64% of the firms accessed financial assistance. See Table 2.

Table 2: Descriptive Statistics

Variable	2007	2013	2018
Export (%)	8.732268 (19.52949)	19.16517 (34.21253)	13.34665 (28.94023)
mobile_money_receivables (1/0)		.7305699 (.4442395)	.8656934 (.3412306)
mobile_money_payments (1/0)		.3463542 (.8348401)	.3463542 (.8348401)
Firm Website (1/0)	.1613394	.5211268	.4965035

	(.368124)	(.4998736)	(.6559251)
Firm Email (1/0)	.5707763 (.4953425)	.8104994 (.3921569)	.8604994 (.3421569)
Firm Phone (1/0)	.953662 (.2107211)	.943662 (.2307211)	.913662 (.2607211)
Technology from Foreign (1/0)	.1439394 (.3514723)	.0772947 (1.263692)	.0772947 (1.263692)
International Certification (1/0)	.1371951 (.3443158)	.2915531 (.4547875)	.2077789 (.4059255)
Location			
• Nakuru	.1248097 (.3307549)	.1144414 (.3185637)	.09826 (.2978183)
• Kisumu	.130898 (.3375458)	.126703 (.3328668)	.0696008 (.2546034)
• Nairobi	.6118721 (.4876952)	.4482289 (.4976516)	.3039918 (.4602147)
• Kirinyaga		.020436 (.1415827)	.0747185 (.2630713)
• Kiambu		.0490463 (.216112)	.1064483 (.3085685)
• Nyeri		.0326975 (.1779651)	
• Murang'a		.0190736 (.1368769)	
• Kilifi			.0696008 (.2546034)
• Machakos			.0706244 (.2563275)
• Trans Nzoia			.0409417 (.1982566)
• Uasin Gishu			.0706244 (.2563275)
Firm Size			
• Small (5-19 Employees)	.63927 (.212134)	.444142 (.08231)	.4165813 (.023456)
• Medium (20-99 Employees)	.3211568 (.4672766)	.2997275 (.458451)	.381781 (.4860721)
• Large (100+ Employees)	.2039574 (.4032447)	.2561308 (.4367926)	.2016377 (.4014285)
Number of Establishments	0	3.19346 (20.70439)	5.588571 (18.68129)
Firm Age	23.14404 (18.3309)	26.78988 (17.75907)	29.27004 (18.25061)
Age of Firm in Export (Years_of_export)	21.116 (18.00955)	24.00893 (15.06101)	24.00893 (15.06101)
Firm Ownership (1/0)			
• Private_domestic_owned	89.22427 (29.42741)	88.99062 (27.68326)	88.94227 (28.71903)
• Private_foreign_owned	10.07191 (28.62597)	6.594044 (21.60375)	9.664488 (27.33361)
• State_owned	.7038168 (7.67403)	.6677116 (6.220889)	.1938998 (3.62493)
Domestic Demand			

• increased	0.729798 (0.657211)	0.5523151 (1.20456)	0.4523151 (0.20456)
• decreased	.1363636 (.3436084)	.1903945 (.3929495)	.1803905 (.3929495)
• Unchanged	.1338384 (.3409093)	.2572899 (.4375159)	.3172899 (.4375159)
No_Competition			
• One	.0126263 (.1117963)	.0126263 (.1117963)	.0126263 (.1117963)
• Between 2-5	.2171717 (.4128421)	.2171717 (.4128421)	.2171717 (.4128421)
• More than 5	.7525253 (.4320908)	.7525253 (.4320908)	.7525253 (.4320908)
Financial Access (1/0)	1 (0)	.6371681 (.4829586)	1 (0)

4.3 Diagnostic tests

4.3.1 Correlation Matrix

Two reasoning informed our computation of the correlation matrix: to reveal the pattern of the variables of interest and second, to test whether a linear regression analysis is possible for our analysis. In the pattern case, our interest is to check whether the variables are positively or negatively correlated. In the diagnostic check, theory suggest that if the variables are highly correlated then linear regression estimates may be unreliable. In our case presented in Figure 4.0, we observe that all the variables of interest have a low correlation of less than 50%. This implies that linear regression estimates can be relied upon. Further the finding shows that all the regressors are positively correlated with export (depended variables) except domestic demand, location of the firm, age squared and financial access. In other words, an increase in these variables except domestic demand, location of the firm, age squared and financial access, increased export of firms. See Table 3.

Table 3: Correlation Matrix

	exp	mob_payment	mobile_money	No_competitors	Domestic_Demand	f_website	Firm_Email	f_phone	t_from_foreign	i_cert	locatn	f_size
exp	1.0000											
mob_payment	0.0719	1.0000										
mobile_money	0.1802	-0.1510	1.0000									
No_competitors	0.0579	0.2947	0.1018	1.0000								
Domestic_Demand	-0.0344	0.0316	0.1485	-0.1123	1.0000							
f_website	0.0947	-0.0995	0.4055	-0.1720	-0.0720	1.0000						
Firm_Email	0.1588	-0.0142	0.1202	-0.2787	-0.1090	0.5049	1.0000					
f_phone	0.1588	0.0398	0.1202	0.1818	-0.3271	0.1359	0.4412	1.0000				
t_from_foreign	0.2804	0.0813	-0.1210	0.0845	-0.0760	0.0203	0.0102	0.2050	1.0000			
i_cert	0.1290	-0.1176	0.1869	-0.2544	-0.0694	0.5374	0.2713	0.0936	0.0848	1.0000		
locatn	-0.1920	-0.0845	-0.1329	0.1144	-0.1937	-0.0979	-0.1725	0.0352	0.1075	-0.2814	1.0000	
f_size	0.2070	0.1642	0.1300	0.0232	0.0759	0.2398	0.2507	0.1535	0.0036	0.2180	-0.1805	1.0000
n_estab	0.3333	-0.0177	0.1633	0.2261	-0.0596	0.1035	-0.0623	-0.0814	-0.0511	0.1407	0.0277	0.2108
age	0.0360	0.1323	0.3110	0.1365	-0.0165	0.3157	0.1297	0.1813	0.2051	0.1070	0.2439	-0.0657
age_squire	-0.0500	0.1456	0.2296	0.1639	-0.0359	0.2585	0.1131	0.1417	0.2372	0.0877	0.2160	-0.1581
Financial_size	-0.0921	-0.0356	0.2665	0.2604	0.0369	0.0657	-0.2189	-0.0299	-0.2774	-0.0063	-0.4148	-0.0762
		n_estab	age	age_sqare	Financ_size							
n_estab		1.0000										
age		0.1089	1.0000									
age_squire		0.0181	0.9384	1.0000								
Financial_size		0.0973	0.0686	0.1096	1.0000							

4.3.2 Multicollinearity test.

Two or more independent (explanatory) variables are said to be collinear if there exist a linear association between them. If the variance of parameter estimates is inflated leading to provision of wrong magnitude of coefficient estimates and signs hence incorrect conclusions. Variance inflation factors were used to check for its presence. If found to be there, one among the correlated variables is dropped, retained if not highly correlated or sample size is increased (Gujarati, 2003). From the result in Table 4, both the individual VIF and the mean VIF were less than the threshold 10. Thus, multicollinearity was not a serious problem in our data set.

Table 4: VIF Multicollinearity Test.

Variable	VIF	1/VIF
International Certification	2.02	0.494265
Firm Website	1.82	0.548147
Firm Age	1.50	0.667434
Age of Firm in Export	1.41	0.708614
Firm Email	1.38	0.724831
Competition	1.35	0.740013
Location	1.27	0.789868
Firm Size	1.26	0.794561
Mobile Money Receivables	1.25	0.801163
Mobile Money Payments	1.24	0.806873
Technology from Foreign	1.20	0.831551
Domestic Demand	1.15	0.868766
Firm Ownership	1.15	0.870536
Mean VIF	1.38	

4.3.3 Heteroscedasticity test.

Heteroscedasticity occurs when variance of the error term is not constant. Its presence renders inference testing inapplicable. To test heteroskasticity in our study, we applied the Breusch-Pagan-Godfery test. According to this test, heteroskasticity will be present when the P value is less than 0.05 in which the null hypothesis of homoscedasticity is rejected. If found to be there, robust standard error is used (Gujarati, 2003). From our study result in Table 5, the P-value of 0.000 was smaller than the threshold 0.05. We thus rejected the null hypothesis of homoscedasticity and concluded that there was presence of heteroscedasticity.

Table 5: Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

Breusch-Pagan / Cook-Weisberg test for heteroscedasticity	
Ho: Constant variance	
Variables: fitted values of Exports	
chi2(1) = 90.32	
Prob > chi2 = 0.0000	

4.3.4 Poolability test

The first step in choosing the appropriate model in a static panel data is to choose between a pooled OLS models against the fixed effect panel model. To do this, we ran chows's poolability test. This is an F test that helps us to decide whether all fixed effects are jointly equal against at least one fixed effect. That is, the null hypothesis is that all α_i 's are equal against an alternative hypothesis that suggests that at least one α_i 's is different. If we fail to reject H_0 (that is if p-value is large) we stop there and conclude that pooled panel is appropriate model for the dataset. But if the p values of the F test are small, we reject H_0 and conclude that at least one of the alphas is different and thus we proceed to either fixed effect or random effect using the Hausman test.

From Table 6, the probability of 0.000 is small enough to reject the null hypothesis and concluded that either fixed effect model or random effect model could be appropriate models of our data set.

Table 6: Chow's Poolability test

sigma_u	.39056701	
sigma_e	.08332537	
rho	.95646559	(fraction of variance due to u_i)
F test that all u_i=0: F(55, 500) = 23.73		Prob > F = 0.0000

4.3.5 Hausman Test for Fixed and Random Effect

We carried out this test to determine which of the two models (between random effect and fixed effect model) is appropriate for our data set. In this test, the null hypothesis of α_i is UNCORRELATED with the explanatory variables against α_i is CORRELATED with the explanatory variables is tested. The result from Table 7 reveals that we do not reject the null hypothesis and conclude that the random effect model is appropriate for our data set.

Table 7: Hausman Test for Fixed and Random Effect

<pre> b = consistent under Ho and Ha; obtained from xtreg B = inconsistent under Ha, efficient under Ho; obtained from xtreg Test: Ho: difference in coefficients not systematic chi2(1) = (b-B)' [(V_b-V_B)^(-1)] (b-B) = 1.09 Prob>chi2 = 0.2964 (V_b-V_B is not positive definite)</pre>

4.3.6 Random effect regression results.

Table 4 shows the result from a random effect model, which was found to be appropriate for our data set after failing to reject the null hypothesis of α_i being UNCORRELATED with the explanatory variables against α_i CORRELATED with the explanatory variables in the Hausman test in the previous section. We also compared the result with pooled OLS for robustness.

The result revealed that a choice by a firm to use mobile money for paying the suppliers increased firm's export by about 2% than when the firm was not using it when all other factors were held constant. This is confirming with other studies that have found a positive association between firm export and utilization of digital money utilization in settling their dues to supplies such Gosavi (2018). However, the study reveals that if the firm chose mobile money to receive payments for sales from

customers, they would on average reduce their export value by about 12%. This is contrary to our expectation and other findings which have found a positive association between receiving payments digitally and export growth of a firm (Gosavi, 2018; Hughes & Lonie, 2007; Maurer, 2012).

The study reveals that the number of competitors has a negative and a significant influence on firm level of export. For instance, having between 2-5 competitors reduced the firm's export by about 24% as compared to having one competitor. Equally, having more than 5 competitors reduced the firm's export by about 5% as compared to having one competitor. This implies that the level of competition affected firm's export to a certain point before it started declining. Our finding conforms with both theory and empirical studies (see Bocquet, et al., 2017; Fontagné, et al., 2015; Abdu, & Jibir, 2018).

We also found that the domestic demand for the main product of the firm was also found to have a significant influence on the firm's export. For instance, a decrease in the domestic demand led to a decline in firm export by about 10.2% while a constant domestic demand improved firm's export by about 9.32% as compared to when the domestic demand increased. This could intuitively imply the impact of globalization of market in which a decrease in domestic demand reflecting global trend. Our finding is similar to study by Baccaro & Benassi (2017) and Moon (2015) who both revealed that domestic demand was very critical to export behavior of a firm.

Further we established that having a company website and using a company's cell phone to communicate to the customers and suppliers increased the firm's export by 5.62% and 26.23% respectively as compared to those firms not using this ICT components. Interesting, against our expectations, using email platform to communicate with the suppliers and customers was found to have a negative and a significant association with the firm's export. For instance, using email to communicate were found to reduced firm export by about 8% if all other factors were held constant.

Our finding is contrary to the finding by Gregory, et al., (2019) who found a positive association between using email as a means of communication to key stakeholders and firm export.

The study further reveals that usage of technology from foreign has a marginal negative association with firm export. In particular, utilizing of technology licensed in the foreign nation by firms decreased firm export by less than 1%. In contrast, having an international certification as a requirement to meet the international standards for exports improved firm export by about 5% when all other factors were held constant. Our findings contradict study by Battaglia, et al., (2018) but confirm with the findings by Forslid, et al., (2018) who found that having a foreign technology to encourage sale to the domestic market rather than export.

Location was also found to have a significance influence on firm's export behavior. Being located in towns such as Kiambu, Nairobi and Murang'a were found to have a positive association with firm export while being located in Nakuru or Kisumu was found to have a negative association with the firm's export. The variation could be associate with accessibility of these areas to international exit such as international airports or sea port.

Large and medium sized firms were found to increase export by approximately 6% and 5% respectively as compared to small firms. This finding confirms to both theory and recent empirical works by Forslid, et al., (2018); Kersten, et al., (2015) and Ding, et al., (2016) who all revealed that firm size has a critical role in influencing firm's behavior towards exporting, with large firms leveraging on their economies of scale over smaller ones.

Number of establishments that the firm has was also found to have a significance influence on the firm export behavior. For instance, an additional establishment marginally increased firm export by about 0.47% when all other factors were held constant. This confirms with the work by Merino, et al., (2015)

who found that the number of establishments was directly associated with firm's level of export. Further, the study reveals that the age of the firm was an important influencer of firm's export level up to a certain level. For instance, an additional year of the firm increased firm export by approximately 1.1% up to a certain optimal level where the export will start declining marginally by 0.01%. This finding confirms with the studies by Dosi, et al., (2015), Stucki, T. (2016) and Quartey, P., Turkson, et al., (2017) who all found a nonlinear relation between age and export level of a firm.

Lastly, the result reveals that accessing financial assistance had a negative and significant impact on firm export level. This is against our expectation and theory. Further, it contradicts early findings by Hall, et al., (2016), Chaney, (2016) and Chauvet & Jacolin, (2017) who had found a positive association between accessing financial assistance and firm export level.

Table 8: Random Effect Models Results.

VARIABLES	(Model 1) Random effect	(Robustness check) Pooled OLS
mobile_money_payments	1.575*** (0.00205)	1.575*** (0.00186)
mobile_money_receivables	-11.78*** (0.0108)	-11.78*** (0.0106)
Competitor		
• between 2-5	-23.65*** (0.0113)	-23.65*** (0.0105)
• More than 5	-5.084*** (0.0104)	-5.084*** (0.0106)
Domestic Demand		
• decreased	-10.20*** (0.0109)	-10.20*** (0.00983)
• Unchanged	9.324*** (0.0100)	9.324*** (0.0104)
Firm Website	5.618*** (0.00966)	5.618*** (0.0104)
Firm E-mail	-7.712*** (0.0161)	-7.712*** (0.0184)
Firm phone	26.23*** (0.0133)	26.23*** (0.0108)
Technology from Foreign	-0.363***	-0.363***

	(0.00876)	(0.0116)
International Certification	4.979***	4.979***
	(0.00814)	(0.00619)
Location		
• Kiambu	8.794***	8.794***
	(0.0218)	(0.0218)
• Nakuru	-36.92***	-36.92***
	(0.0116)	(0.0130)
• Kisumu	-40.58***	-40.58***
	(0.0158)	(0.0169)
• Nairobi	-25.90***	-25.90***
	(0.0102)	(0.0142)
• Nyeri	-28.51***	-28.51***
	(0.0405)	(0.0368)
• Murang'a	92.16***	92.16***
	(0.0237)	(0.0203)
Firm size		
• Medium	5.059***	5.059***
	(0.0128)	(0.0121)
• Large	6.112***	6.112***
	(0.00852)	(0.00833)
Number of Establishments	0.472***	0.472***
	(0.00112)	(0.000980)
Age	1.070***	1.070***
	(0.000497)	(0.000404)
age squared	-0.00736***	-0.00736***
	(5.62e-06)	(3.97e-06)
Financial Access	-9.595***	-9.595***
	(0.00919)	(0.00823)
Constant	2.507***	2.507***
	(0.0221)	(0.0200)
Number of idstd	38	0.817

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, we present the summary and conclusion of the key findings from our study. From this summary and conclusion, we then present possible policy implication to the key beneficiary of the findings. Lastly, we suggest possible areas for further studies given the limitations of our study.

5.2 Summary of finding

Motivated by the rapid diffusion of ICT components such as Internet, mobile telephony and broadband networks and the fact that global economy turning to an information economy with most firm utilizing some of these ICT components in their daily operations, the question remains on how does this use of ICT affect firm export growth? Thus, this study mainly focused in the investigation of the impact of ICT on firm's export behavior in Kenya. More specifically, the study sought to determine the influence of various ICT components such as the utilization of mobile money transactions on export and second, the effect of various firm characteristics on the firm export. To achieve these objectives, a firm level panel data and panel data techniques such as random effect model, fixed effect model and pooled OLS model were used in regression and robustness check.

There is enough evidence to support firm to use mobile money for paying the suppliers as it was found to increase firm's export by about 2%. In contrast, we found enough evidence to be cautious in use mobile money to receive payments for sales from customers, as it was found to reduce their export value by about 12%. Possible reason could be associated with high level of cybercrime in the use of

mobile money. However, there are amendment to the Kenyan Information and Communication Act of 2013, in 2020 that corrects for the loopholes in this cybercrime.

Further our finding support theory on the impact of competitors on export of firms. However, there was enough evidence that the impact of number of competitors to the firm's export could be nonlinear. For instance, our findings revealed that having between 2 and 5 competitors reduced the firm's export by about 24% as compared to having one competitor. But, having more than 5 competitors reduced the firm's export by about 5% as compared to having one competitor. This implies that the level competition was affected by firm's export to a certain point before it started declining.

We also found that the domestic demand for the main product of the firm to have a significant influence on the firm's export. For instance, a decrease in the domestic demand led to a decline in firm export by about 10.2% while a constant domestic demand improved firm's export by about 9.32% as compared to when the domestic demand increased. This could intuitively imply that the impact of globalization of market in which a decrease in domestic demand reflecting global trend.

Further we established that having a company website and using a company's cell phone to communicate to the customers and suppliers increased the firm's export by 5.62% and 26.23% respectively as compared to those firms not using this ICT components. Interesting, against our expectations, using email platform to communicate with the suppliers and customers was found to have a negative and a significant association with the firm's export. For instance, using email to communicate with clients were found to reduced firm export by about 8% if all other factors were held constant.

The study further reveals that usage of technology from foreign has a marginal negative association with firm export. In particular, utilizing of technology licensed in the foreign nation by firms decreased

firm export by less than 1%. In contrast, having an international certification as a requirement to meet the international standards for exports improved firm export by about 5% when all other factors were held constant. On the other hand, location was also found to have a significance influence in firm's export behavior. Being located in towns such as Kiambu, Nairobi and Murang'a were found to have a positive association with firm export while being located in Nakuru or Kisumu was found to have a negative association with the firm's export. The variation could be associate with accessibility of these areas to international exit such as international airports or sea port.

There was also enough evidence that firm size plays a critical role in firm export behavior. For instance, large and medium sized firms were found to increase export by approximately 6% and 5% respectively as compared to small firms. Equally, the number of establishments the firm has was also found to have a significance influence on the firm export behavior. For instance, an additional establishment marginally increased firm export by about 0.47% when all other factors were held constant.

Further, the study reveals that the age of the firm was an important influencer of firm's export level up to a certain level. For instance, an additional year of the firm increased firm export by approximately 1.1% up to a certain optimal level where the export will start declining marginally by 0.01%. Lastly, the result reveals that accessing financial assistance had a negative and significant impact on firm export level. This is against our expectation and theory.

5.3 Conclusion.

In conclusion, the finding support the use of various ICT component to influence export of firms. Some ICT components such as the use mobile money to pay suppliers, the use of a company website, using a company's cell phone to communicate to the customers and suppliers were found to increase the firm's export. However, the study does not support the use of email platform to communicate with the

suppliers and customers and use mobile money to receive payments for sales from customers as they were found to have a negative impact on the firm's export.

5.4 Recommendations

From the study analysis, we recommend that firm's that would want to increase their exports would at least increase the use of ICT components. Notably, use of mobile money to pay bills such as orders and suppliers will fast-track their export activities. Further, we recommend firms to invest in clear marketing websites that defines who they are and what product they offer as this was found to significantly improve their exports. Optimal allocation of key inputs such as labour was found to be correlated with their export. In this regard, we recommend that firms should be able to optimally hire to a point where they maximize their export. For strategic location, two recommendation stands out based on whether the firm is opening new branches or it is enjoying industrial inertia. Firms that want to open new branches should locate their branches strategically that it takes care of logistics such as proximity to the exit points (airport, seaport and/or railway stations). For those enjoying industrial inertia, effort should be made to mobilize key stakeholders such as government to improve the logistical services. For example, these firms can initiate a private-public partnership to with the government or development agencies such as USAID to improve the logistical services.

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APPENDICES

Appendix I: Random Effect regression result

```
. xtreg exp mob_payment mobil_money_receivables i.No_competitors i.Domestic_Demand f_website Firm_Email f_phone t_from_forgn
> i_cert i.locatn i.f_size n_estab age age_squire Financial_Access [iweight= idstd] ,mle
```

```
Fitting constant-only model:
Iteration 0: log likelihood = -95522953
```

```
Fitting full model:
Iteration 0: log likelihood = -78160532
Iteration 1: log likelihood = -78160532
```

```
Random-effects ML regression           Number of obs   =       38
Group variable: idstd                 Number of groups =       38
```

```
Random effects u_i ~ Gaussian          Obs per group:
                                      min =           1
                                      avg =          1.0
                                      max =           1
```

```
LR chi2(23) = 3.47e+07
Prob > chi2 = 0.0000
Log likelihood = -78160532
```

exp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
mob_payment	1.574681	.002052	767.39	0.000	1.57066	1.578703
mobil_money_receivables	-11.781	.0107628	-1094.61	0.000	-11.80209	-11.7599
No_competitors						
2-5	-23.64944	.0112827	-2096.08	0.000	-23.67155	-23.62733
More than 5	-5.083931	.0104478	-486.60	0.000	-5.104408	-5.063454
Domestic_Demand						
Decrease	-10.19822	.0109403	-932.17	0.000	-10.21966	-10.17678
Remain the same	9.323794	.010044	928.30	0.000	9.304108	9.34348
f_website	5.617751	.0096592	581.60	0.000	5.598819	5.636683
Firm_Email	-7.712451	.0161427	-477.77	0.000	-7.74409	-7.680812
f_phone	26.23148	.0133008	1972.18	0.000	26.20541	26.25755
t_from_forgn	-.3626116	.0087603	-41.39	0.000	-.3797814	-.3454418
i_cert	4.979193	.0081429	611.48	0.000	4.963233	4.995153
locatn						
Kiambu	8.794382	.0217987	403.44	0.000	8.751657	8.837106
Nakuru	-36.92104	.0115941	-3184.46	0.000	-36.94376	-36.89831
Kisumu	-40.58265	.0158433	-2561.51	0.000	-40.61371	-40.5516
Nairobi	-25.90295	.0101726	-2546.36	0.000	-25.92288	-25.88301
Nyeri	-28.50866	.0405139	-703.68	0.000	-28.58806	-28.42925
Murang'a	92.15834	.0236551	3895.92	0.000	92.11198	92.2047
f_size						
Medium	5.059391	.0128161	394.77	0.000	5.034272	5.08451
Large	6.1118	.0085217	717.20	0.000	6.095098	6.128503
n_estab	.4722784	.0011204	421.52	0.000	.4700824	.4744744
age	1.070033	.0004972	2152.12	0.000	1.069058	1.071007
age_squire	-.0073551	5.62e-06	-1309.84	0.000	-.0073661	-.0073441
Financial_Access	-9.595374	.0091857	-1044.60	0.000	-9.613377	-9.57737
_cons	2.506676	.0221493	113.17	0.000	2.463265	2.550088
/sigma_u	0	(omitted)				
/sigma_e	11.02207	.0017227			11.0187	11.02545
rho	0	(omitted)				

LR test of sigma_u=0: chibar2(01) = 0.00 Prob >= chibar2 = 1.000

Appendix II: Pooled OLS regression Result

```

. reg exp mob_payment mobil_money_receivables i.No_competitors i.Domestic_Demand f_website Firm_Email f_phone t_from_forgn i_cer
> t i.locatn i.f_size n_estab age age_squire Financial_Access [fweight= idstd] ,r

```

Linear regression

Number of obs = 20467096
F(21, 20467072) = .
Prob > F = .
R-squared = 0.8167
Root MSE = 11.022

exp	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
mob_payment	1.574681	.0018616	845.86	0.000	1.571033	1.57833
mobil_money_receivables	-11.781	.0106351	-1107.74	0.000	-11.80184	-11.76015
No_competitors						
2-5	-23.64944	.0105333	-2245.20	0.000	-23.67009	-23.6288
More than 5	-5.083931	.010639	-477.86	0.000	-5.104783	-5.063079
Domestic_Demand						
Decrease	-10.19822	.0098305	-1037.40	0.000	-10.21749	-10.17895
Remain the same	9.323794	.0103611	899.89	0.000	9.303487	9.344101
f_website	5.617751	.0103772	541.36	0.000	5.597412	5.63809
Firm_Email	-7.712451	.0184301	-418.47	0.000	-7.748573	-7.676329
f_phone	26.23148	.0108088	2426.87	0.000	26.2103	26.25267
t_from_forgn	-.3626116	.0116131	-31.22	0.000	-.3853728	-.3398503
i_cert	4.979193	.0061865	804.85	0.000	4.967068	4.991318
locatn						
Kiambu	8.794382	.0218072	403.28	0.000	8.75164	8.837123
Nakuru	-36.92104	.0130295	-2833.65	0.000	-36.94657	-36.8955
Kisumu	-40.58265	.0169441	-2395.09	0.000	-40.61586	-40.54944
Nairobi	-25.90295	.0142405	-1818.96	0.000	-25.93086	-25.87504
Nyeri	-28.50866	.0368106	-774.47	0.000	-28.58081	-28.43651
Murang'a	92.15834	.0202846	4543.27	0.000	92.11858	92.1981
f_size						
Medium	5.059391	.0120597	419.53	0.000	5.035754	5.083027
Large	6.1118	.0083339	733.36	0.000	6.095466	6.128135
n_estab	.4722784	.0009804	481.74	0.000	.4703569	.4741999
age	1.070033	.0004038	2649.86	0.000	1.069241	1.070824
age_squire	-.0073551	3.97e-06	-1854.81	0.000	-.0073629	-.0073474
Financial_Access	-9.595374	.0082258	-1166.49	0.000	-9.611496	-9.579251
_cons	2.506676	.0199993	125.34	0.000	2.467479	2.545874

Appendix II: Hausman Test for fixed and Random Effect

	—— Coefficients ——		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fixed	(B) random		
Mob_Money~es	.1805385	.2323231	-.0517845	.1020225
Mob_Money~rs	.1823312	.1383809	.0439504	.0865881
Firm_Website	.6204787	.5977318	.0227469	.0448144
Firm_Email	.8474953	.8160825	.0314128	.0618874
Firm_Phone	-.8370445	-.9017372	.0646927	.1274532
Technology~n	.3547815	.3279918	.0267897	.0527792
Intern_Cert	.9323534	.9280934	.00426	.0083927
Location	-.0632344	-.0641492	.0009148	.0018023
Firm_Size	.0033205	.0033244	-3.84e-06	7.57e-06
Estab_Number	-.0682188	-.066743	-.0014759	.0029076
Firm_Age	.0214851	.021202	.0002831	.0005577
Age_Export	-.0098566	-.0091273	-.0007293	.0014368
Firm_Owner~p	-.9789462	-1.050537	.0715912	.1410442
Domestic_D~d	-.0229072	-.036142	.0132348	.0260743
Competition	.1185011	.1076619	.0108392	.0213546
Finance_ac~s	-.1703263	-.1815324	.0112061	.0220776

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(1) = (b-B)' [(V_b-V_B)^{-1}] (b-B)$
 = 0.26
 Prob>chi2 = 0.6117
 (V_b-V_B is not positive definite)