UNIVERSITY OF KWAZULU-NATAL

THE IMPACT OF FDI ON FIRM-LEVEL PRODUCTIVITY IN KENYA

By

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I Katie Musungu Mutula declare that:

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Abstract

The relationship between FDI and firm-level productivity has not been extensively reviewed and established in the context of Kenya. Although previous studies have examined this relationship in the context of Kenya to some degree, many of them have either based their studies on data that is not current or have studied the relationship in an abstract manner such as through cross-country analyses, which have not been able to specifically isolate the relationship that is currently existent between FDI and productivity in Kenya. Hence this study aims to determine the effect of FDI on the productivity of firms within Kenya's manufacturing sector using fairly recent firm-level panel data covering the periods 2007 and 2013 respectively.

The two stage least squares (2SLS) instrumental variable estimation technique is applied to establish the relationship between FDI and firm-level productivity in Kenya's manufacturing sector for the periods under study. Furthermore, the study makes use of similar approaches used in studies such as Zhou, et.al (2002) and Banga (2004) where two models are estimated; one calculating total factor productivity (TFP) and the other using TFP as the response variable in the equation estimating the relationship between FDI and firm-level productivity.

The results obtained thereof show that the relationship between FDI and firm-level productivity within Kenya's manufacturing sector for the periods under study was positive and significant both in the cases where TFP and labour productivity were used as measures of productivity. Moreover, the study established that in terms of TFP, FDI in the manufacturing sector did yield positive productivity spillovers for domestic and other firms but in terms of labour productivity, FDI had no effect on the productivity of domestic and other firms in Kenya's manufacturing sector during 2007 and 2013.

Keywords: FDI, Firm-Level Productivity, TFP, Manufacturing Sector, Kenya.

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CHAPTER 1

INTRODUCTION

1.1 An Overview of FDI

Since the beginning of the third wave of globalisation in the 1980s, many world economies have bought into the idea of liberating their markets and engaging in multilateral trade as a means of enhancing economic growth. As a result, host countries the world over have seen significant increases in Foreign Direct Investment (FDI) inflows and have consequently witnessed increases in the establishments of Multi-National Enterprises (MNEs) within their industries (Haskel et al., 2007). However, the question of whether the contribution of FDI flows to the industries and accordingly local firms of these host countries is positive or negative remains contestable. Whilst there is general consensus regarding the relationship between FDI and development in the host country, there is no general agreement about the positive link between FDI and indicators of development within the host nation (Hansen and Rand, 2006). This is reiterated by Balcão Reis (2001) who acknowledges that although endogenous growth theory does suggest that FDI enhances economic growth, FDI also has detrimental effects to the national welfare of the host country given that capital transfers are accrued to foreign investor companies resident outside the host country. However, the magnitude of the impact that FDI has on host economies, whether positive or negative is largely dependent on the business environment and other factors within the host nation (Kinuthia, 2010).

The inflow of FDI in host countries is largely observable through the existence of MNEs and as such many studies proxy foreign presence in a host country as an indicator of FDI when evaluating the impact that FDI inflows may have on local firms. The impact of MNEs on local firms is to a great extent due to spillovers of technology and knowledge that emanate from investor countries, which in turn bear either positive or negative outcomes to the host country(Barrios et al., 2005, Lemi, 2004, Markusen and Venables, 1999). For instance, spillovers can be said to benefit local competitor firms which are not affiliated to the investor company through the use of the foreign investor's technology and knowledge base which enhances the productivity of the local firms and enables them to generate more profits. This has an overall positive effect on the industry and economy at large. On the other hand, technology and knowledge spillovers may have a negative effect on local firms and industries through competition, where the operation of MNEs will force local firms out of the industry in cases where such firms utilise basic as opposed to advanced technology. In instances where positive or negative effects from foreign owned firms accrue to local firms operating within the same industry, foreign presence is said to have horizontal spillover effects on local firms. On the other hand, vertical spillovers are observed when positive or negative effects of FDI are attributed to firms in other industries that either supply foreign owned firms with inputs or are customers of foreign owned firms (Marcin, 2007).

1.2 Purpose of the Study

In an increasingly global world, FDI has become a significant determinant of key economic variables in many countries through its impact on human capital, productivity and economic growth. As a result, governments of many nations developed and developing alike strive to create investment climates which ensure FDI inflows into their economies.

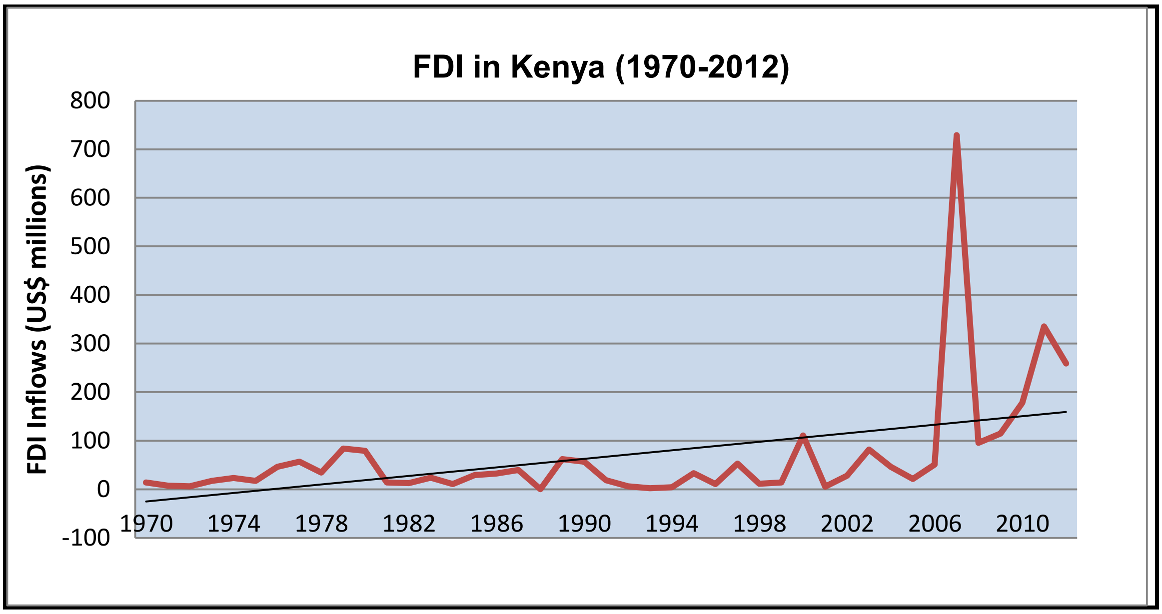
The East African country of Kenya is no different in this regard and as such aims to attract reasonable amounts of FDI to help foster economic growth. Moreover, Kenya is seen as the largest economy in the East Africa region with a more advanced human capital base and more diversified economy relative to other countries in the region. This would ideally make Kenya relatively more attractive to foreign investors and as such make it a more favourable destination for FDI within the region. However, Kenya has not been able to attract reasonable amounts of FDI over the past decade as have its regional counterparts Uganda and Tanzania (EAC, 2013).

Therefore it is of significance to study the relationship between FDI and productivity in the context of Kenya so as to better understand whether the inability of Kenya to attract significant FDI inflows is perhaps due to the competitive environment existent in industries where firms that are already productive, deter the presence of foreign investors. Conversely, it is also probable that of the small amount of FDI that Kenya manages to attract, most of it is concentrated within industries that are already productive. As such, the purpose of the study is to establish the precise relationship that is existent between FDI and firm-level productivity in Kenya’s manufacturing sector for the periods 2007 and 2013 respectively. The manufacturing sector is relevant to study as its industries are the most sought after for FDI in Kenya (see table 1.1). Moreover, unlike other sectors in Kenya, firm-level survey data is generally available for the manufacturing sector.

1.3 Background of FDI in Kenya

Kenya is a country found in the Eastern region of Africa which is bordered by; South Sudan in the North West, Ethiopia in the North, Somalia in the North East, the Indian Ocean in the South East, Tanzania in the South and Uganda in the West. Although Kenya is considered as the largest economy in the East Africa region, it has not been able to attract significant amounts of FDI since the early 1970s when it started receiving FDI inflows. Figure 1.1 below shows the trend of FDI inflows in Kenya from 1970 to 2012. Although FDI inflows to Kenya have generally been upward trending as illustrated, the amounts have not been substantial.

Figure 1.1: FDI Inflows in Kenya for periods 1970-2012



Source: World Bank, World Development Indicators, FDI database, 2014.

Table 1.1: Industries with Potential to Attract FDI in Kenya (2009-2012)

		FOREIGN AFFILIATES	
	INDUSTRY	**Number**	**Number of Parents**
	Total (Merchandise and Services)	**314**	**197**
PRIMARY INDUSTRIES	Agriculture and hunting	6	4
	Forestry and Fishing	3	1
	Mining and quarrying	1	1
	Petroleum	5	5
SECONDARY INDUSTRIES	Food,beverages and tobacco	17	12
	Textiles, clothing and leather	6	5
	Wood and wood products	4	4
	media	5	4
	Coke, petroleum products and nuclear fuel	2	2
	Chemicals and chemical products	19	15
	Rubber and plastic products	2	2
	Non-metallic mineral products	4	4
	Metal and metal products	10	8
	Machinery and equipment	9	7
	Electrical and electronic equipment	5	5
	Precision instruments	5	4
	Motor vehicles and other transport equipment	3	3
	Other manufacturing	7	7
	Recycling	2	2
TERTIARY INDUSTRIES	Electricity, gas and water	1	1
	Construction	8	8
	Wholesale and retail trade	112	86
	Hotels and restaurants	10	9
	Transport, storage and communications	48	37
	Finance	53	40
	Business activities	91	62
	Public administration and defence	3	2
	Education	1	1
	Health and social services	6	6
	Community, social and personal service activities	40	31
	Other services	50	42

Source: Adapted from International Trade Centre (ITC) database, 2014.

Table 1.1 shows the industries in Kenya which had the most potential to attract FDI for the periods 2009 to 2012. As illustrated, the number of foreign affiliates that invested in manufacturing industries relative to other industries was substantial. For instance, the Wholesale and Retail trade industries found within Kenya's manufacturing sector and classified as secondary industries in Table 1.1 solely attracted a total of 112 out of 314 foreign affiliates as investors during the periods 2009 to 2012. Furthermore, the Food, Beverages and Tobacco as well as Chemicals and Chemical Products industries which also fall under the manufacturing sector individually attracted 17 and 19 foreign affiliates respectively out of a possible 314 foreign investors. Moreover, many of the industries classified under the secondary industries category in Table1.1are also industries found within Kenya's manufacturing sector, indicating that the manufacturing sector in Kenya is a preferred sector for FDI.

1.4 Problem Statement

The impact of Foreign Direct Investment flows on economic growth in Kenya has been observed to be significant, based on results from previous studies such as those of Hansen and Rand (2006) who find a strong causal link between FDI and GDP growth in Kenya and other developing countries. In addition studies such as Rasiah and Gachino (2005) and Kinuthia (2010) have investigated the relationship between FDI and productivity and examined the determinants of FDI respectively within the Kenyan context. However, these studies have focussed on previous trends of FDI inflows in Kenya and cannot be relied upon to define the associations that currently exist between FDI and firm-level productivity in Kenya.

In addition, studies such as Hansen and Rand (2006) are based on cross-country analyses which only partially address the issues particular to Kenya's economy, given that the focus of their study is divided across many other economies. As a result, the extent to which FDI is attributable to economic growth in Kenya especially through productivity spillovers is not quite definite, as the channels through which FDI inflows affect the host country have not entirely been reviewed nor established specifically, with respect to Kenya's economy. Therefore it is significant to study such channels in the context of Kenya by analysing how FDI in the form of MNEs affected the productivity of local firms within the manufacturing sector for the periods of 2007 and 2013.

1.5 Research Question

How did Foreign Direct Investment affect the productivity of firms within Kenya's manufacturing sector during the periods of 2007 and 2013?

1.6 Research Objectives

The aims of the study are to:

- Review relevant literature pertaining to the issues of FDI and firm-level productivity.
- Establish the appropriate methods and modelling techniques relevant to apply in estimating the relationship between FDI and productivity.
- Empirically estimate the relationship between FDI and total factor productivity of firms within the manufacturing sector in Kenya for the periods 2007 and 2013 respectively.

1.7 Justification of the Study

Studies such as Rasiah and Gachino (2005) have previously reviewed the relationship between FDI and firm-level productivity in the context of Kenya's manufacturing sector. However, given the wide unavailability of firm-level panel data on Kenyan firms, these studies having been conducted in previous periods are based on panel datasets which are outdated. This study however employs fairly recent firm-level panel data from surveys conducted in 2007 and 2013 and thus ascertains that results obtained from the empirical estimations reflect most recent trends in FDI inflows and productivity levels within Kenya's manufacturing sector.

1.8 Limitation of the Study

The major drawback of the study is that of a limited and incomprehensive panel dataset. Although most panels are short and wide and therefore consist of considerably more observations than time periods, the panel dataset employed in this study contains only two time periods which limits the analysis of observing changes in variables of interest over periods of time. In addition, panel datasets are usually subjected to attrition where respondents in the panel drop out and do not remain in the panel for all waves of the panel. Thus, the dataset employed in the study contains missing data on firms that were not interviewed for both waves of the panel (2007 and 2013). As a result, drawing inferences from such data which is incomplete may prove to be a challenge especially when conducting specification and diagnostic tests.

1.9 Structure of the Study

The following study is presented in five chapters. The first chapter begins by giving an overview of FDI and outlining background information pertaining to FDI in Kenya with a specific interest on the manufacturing sector. The problem statement is also explained and the research questions and objectives outlined. Furthermore the justification of the study is given and the limitations thereof highlighted.

Chapter two reviews the literature pertaining to FDI, economic growth and firm-level productivity in host countries. Here the importance of FDI in the host economy is discussed and the determinants of FDI outlined. The empirical findings of seminal studies on FDI productivity spillovers are also compared and contrasted in this chapter.

Chapter three examines in detail the approach and modelling techniques applied in the study when estimating the relationship between FDI and productivity of firms in Kenya’s manufacturing sector. This chapter also investigates the different methods and modelling techniques applied in other related studies and highlights the methodologies from these studies that are most suitable to adopt for this particular study.

Chapter four presents and discusses the results obtained from estimating the relationship between FDI and the productivity of firms in Kenya’s manufacturing sector. The causal inference between FDI and productivity is also examined and discussed here.

Chapter five gives a comprehensive synopsis of the study as a whole. Here, a summary of the findings from the study are outlined and conclusions based on the objectives of the study are drawn.

1.10 Summary

This chapter highlighted the purpose of the study by specifying the problem statement and clearly stating the research questions that the study aimed to address and outlining the objectives to be achieved at the end of the study. Furthermore the reasons for undertaking such a study were given and the limitations of the study explained. Therefore, by examining the theoretical and empirical literature concerned with FDI and firm-level productivity, the following chapter aims to establish a starting point from which the research questions of the study can be addressed and consequently the overall objectives of the study can be achieved.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter aims to review and discuss the issues pertaining to FDI, economic growth, and productivity in host economies. The theories and different schools of thought, including empirical literature focussed around these issues are critically analysed here. The rest of the chapter proceeds as follows. Section two discusses FDI and its importance to the host country and the different types of FDI that exist. Section three proceeds to look at the determinants of FDI by analysing the environment in the host economy that would be conducive for attracting such investment. Section four then examines the growth-FDI relationship, where the direction of causality is discussed and the channels through which FDI impacts on growth are highlighted. This section also presents a discussion with a backing of empirical evidence on how FDI impacts on the productivity of firms and industries within host countries. The final section summarises the chapter.

2.2 Foreign Direct Investment

According to the Organisation for Economic Co-operation and Development, OECD (2013), FDI is defined as the investment that occurs across borders, in which the investment is made by a company resident in one country with the aim of obtaining ownership of 10% or more of voting rights in a company which is resident in another country. Such an objective to claim ownership demonstrates a lasting interest by the foreign corporation in the domestic corporation which indicates a long lasting relationship between the investor company and the investee company and is also indicative of the extent to which the foreign corporation has control over the administration of the domestic corporation (OECD, 2013).The extent to which FDI impacts on a country's economy is largely dependent upon the type of investment that is being made by the foreign corporation into the domestic enterprise. Whereas FDI is a kind of investment that deals with productive assets, it differs from portfolio investment which refers to investment specifically in financial assets such as stocks and bonds. In the case where a foreign entity owns less than 10% of voting rights in a domestic enterprise, this is also considered as portfolio investment. In addition, FDI can also be categorized into Greenfield FDI or Mergers and Acquisitions; where Greenfield FDI refers to investment in new assets and Mergers and Acquisitions involve investing in already existing assets.

FDI can also be distinguished by inward FDI and outward FDI; where inward FDI refers to that stock or flow of investment that originates externally from a foreign economy into a domestic one and outward FDI is that investment that proceeds from within the domestic economy and into international markets. The difference between the two types of FDI gives rise to net FDI flows of a country which is reflective of the country's involvement in international trade. Both types of FDI are crucial in explaining the effects of FDI on the economy of a country, however inward FDI is usually the focal point of discussion in a vast amount of literature that centres on the FDI-growth relationship. This is perhaps because outward FDI is in most cases attributable to developed countries which have the capacity to invest in outside economies and seldom apply to less developed countries or more specifically developing countries which lack the capacity to invest in outside economies.

There are also other less popular classifications of FDI not commonly referred to in the literature. These include market-seeking FDI and rent-seeking FDI. Market-seeking FDI refers to that investment by a foreign corporate which is geared towards penetrating a domestic market with the primary goal of directly supplying to that market and not by means of exporting. On the other hand, rent-seeking FDI constitutes that investment which is concerned with searching for low cost production opportunities in the host domestic market which may not be within reach in the foreign investor's home market (Nachum and Zaheer, 2005). Although such classifications of FDI may not directly hint their association with productivity spillovers, according to Narula and Dunning (2000), the motive behind either type of FDI may help explain which stage of development an economy of a host country is likely to be in. Whereas resource-seeking FDI is more likely to exist in least developed countries, market-seeking FDI tends to be prevalent in transition economies. Consequently, the rate at which technology and knowledge spillovers occur in a host country largely depends on the stage of development of its economy. Furthermore, market-seeking FDI is more likely to yield greater benefits from spillovers than resource- seeking FDI as stated by Lall and Narula (2004). This is due to the capital intensive nature of resource-seeking FDI which does not make much use of the labour resource. In this case, knowledge spillovers tend to be limited.

2.2.1. Importance of FDI

Foreign direct investment is desirable to both the investing and host economy. For the investing corporation, investment could be motivated by either the low costs of labour and/or production in the host economy, or by the lucrative nature of establishing a business in the host economy. As indicated by Nachum and Zaheer (2005), the former motivation will constitute rent-seeking FDI whereas the latter motivation will constitute market-seeking FDI. In the case of the host economy, FDI is desirable for presumptuously evident reasons of which include the known benefits of technology spillovers which are attributable to FDI. When multinational corporations (MNEs) decide to set up stage in a host economy, they bring with them advanced technology, managerial skills and know-how as well as training opportunities which are absorbed into the economy of the host country. By so doing, FDI impacts on the host economy positively by means of creating job opportunities, enhancing technology and advancing the economy at large.

Furthermore, because of the available and vast empirical evidence that is suggestive of how FDI generally affects economic performance in a positive manner, of course subject to certain factors presiding in the host country, governments of host countries generally desire to attract FDI from foreign corporations so as to boost economic performance in their respective economies. In addition FDI plays an important role in the growth of the economy either through poverty alleviation, improvement of corporate governance or through provision of safety nets for the poor from generated FDI revenues (Chowdhury and Mavrotas, 2006). However, in spite of the known benefits of FDI, it is still essential to find out whether FDI is indeed fundamental for the growth and development of the host economy.

Although the positive role that FDI plays in host economies is what generally drives the motivation behind host economies' governments to pursue trade policies that advocate for FDI, it is not always the case that FDI brings about positive effects on economic growth of host economies. In fact, there is open disagreement on the role that FDI plays in the development of host countries' economies. For instance,Balcão Reis (2001), acknowledges the immense contributions in empirical literature that support the positive relationship between FDI but points out that such evidence does not explain the welfare effects of FDI, which she finds to bear negative implications.

Balcão Reis (2001) explains that when a foreign investing company discovers that it has the advantage of offering goods and services in the host economy at low costs due to the knowledge and innovative skill it has, then the cost of innovation in the host economy becomes low, prompting economic growth. However, welfare losses occur in the host economy when profits made are repatriated by the foreign corporation. In addition, welfare losses may occur where MNEs fiercely increase competition in the industry. Although increased competition may be beneficial in the sense that it will encourage local firms to efficiently utilise existing resources and to seek out more advanced technologies for efficient production, competition may in the very same manner kick out other local firms who are unable to keep up. If more local firms are forced out of the industry, welfare losses from FDI result.

Similarly, Hanson (2001) finds little evidence at the firm level to suggest that FDI positively impacts on the productivity of domestic firms in host countries. In fact, the established evidence seems to indicate that the greater the presence of multinational corporations within firms and industries, the lower will be the productivity growth rates experienced over time. Hanson (2001) investigates three conditions where it would be beneficial for host countries to endorse FDI. First is the case where multinational corporations intensively utilise factors of production that are elastically supplied by domestic firms. The second case is where FDI does not dampen the market share of local firms and the final case is where FDI leads to positive productivity spillovers for the host economy. The results from the investigation hint that the first and third conditions do not pass the empirical test and that only the second condition applies empirically. Given this rationale,Hanson (2001) recommends that countries ought to be more cautious over the claims instigating that FDI increases overall welfare for host economies. Hanson (2001) further advices that policy makers should instead take for granted that FDI is not necessary for the economy unless there exists evidence that implies that social returns from FDI outweigh private returns.

In slight contrast , Xu (2000) finds that whether or not FDI is beneficial to the economy of the host country is highly dependent upon the ability of the country to absorb such benefits. When addressing issues concerned with technology diffusion and productivity growth in host countries, Xu (2000) finds that while developed countries meet the cut off criteria of human capital that is necessary to make technology diffusion possible, less developed countries fail to meet this requirement. As a result, technology transfers from FDI do not positively impact on the economies of the less developed countries as they do on economies of developed countries. This is because less developed countries do not have the capacity to utilise such technology. In this instance, certain conditions become necessary in determining whether or not FDI will have a positive or negative impact on the economy of the host country. It can then be argued in this case that the level of human capital is significantly dependent on whether a country is developed or not and therefore, tends to segregate the positive impacts of FDI to developed countries whilst leaving less developed countries to bear the negative impacts. This is because the level of human capital is dependent on factors such as; high levels of education, training opportunities and innovation, which aid in the development of the human resource and such factors are usually known to be prominent in developed economies.

The ambiguity surrounding the empirical evidence on positive FDI spillovers in host economies is explained by Görg and Greenaway (2004) who attribute the diversity of the empirical results to several certain possibilities. They propose that either spillovers from FDI may just happen to be insignificant in reality or that foreign corporations may effectively know how to prevent such benefits from spilling over into the economy of the host country. Further, they explain that existing statistical methods may be unable to detect the positive spillover effects which may constitute a part of the residual term. If not so, Görg and Greenaway (2004) suggest that perhaps due to the possibility of heterogeneity in spillovers, aggregate studies may not be able to capture their effects in estimation models. In addition, because of the unavailability of good-quality firm-level data, research in the area of FDI becomes a challenge.

2.3 Determinants of FDI

The very first condition required for FDI to exist in a host economy is the presence of an imperfect market (Xu, 2000 ; Hanson 2001) . In order for FDI to receive special attention from the host economy as stated by Hanson (2001), a market failure must exist which is particular to the production by the foreign corporation. If perfect markets were to exist within host nations, then foreign corporations would not find it advantageous to make investments in such economies and neither would host nations be mandated to warrant FDI. In the case of a perfect market, both market-seeking FDI and resource-seeking FDI would be pointless from the point of view of investors. However, taking into consideration the fact that market imperfections are the norm in practice and that perfect markets often occur in theory, there remains certain other issues that ought to be well thought out in order for FDI to exist within a host economy. These issues by large determine the location of FDI by the foreign corporation and are usually thought of to vary from one host economy to another depending on certain characteristics pertaining to each individual economy.

Traditionally the factors that are said to influence the decision of foreign corporations to set up production affiliates in host economies range from labour costs, costs of capital, market size, closeness to the home market as well as infrastructure (Biswas, 2002, Kravis and Lipsey, 1982, Brainard, 1997). However there have been studies such as those of Blonigen (2005) and Schneider and Frey (1985) which find non-traditional factors that influence the investing behaviour of multinational corporations especially in developing countries. These factors include political instability and quality of institutions within host economies. In addition, Blonigen (2005) include exchange rate movement effects, taxation and trade protection as factors that determine the location of FDI.

2.4 FDI-Growth Relationship

The relationship between FDI and economic growth finds its underpinning in the endogenous growth theory, which advocates for research and development as well as innovation as key tools for promoting continuous growth in an economy. Since FDI provides such benefits for host economies as technology transfers and knowledge spillovers, it is well thought of as the relevant engine for driving economic growth in countries that open up their economies to Multinational corporations(Balcão Reis, 2001, Borensztein et al., 1998, de Mello, 1999, Bende-Nabende and Ford, 1998). Nonetheless, studies such as Durham (2004) have reported a negative relationship between FDI and economic growth. Whereas studies such as Nair-Reichert and Weinhold (2001) and Yang (2007) find the relationship between economic growth and FDI to be heterogeneous.

Although endogenous growth theory may be considered by various authors as accurate in explaining how spillovers from FDI affect growth, the relationship between

FDI and growth is in itself unstable. That is the direction of the causality is not definite. Whilst some studies do find the direction of causality to be one way, others indicate that there is bi-directional causality between the two variables. Yet in the case where causality is unidirectional, it could still be that FDI causes growth or that growth causes FDI. For instance, Chowdhury and Mavrotas (2006) test for causality in the relationship between FDI and growth for three developing countries; Chile, Malaysia and Thailand which differ in their histories, growth patterns, policy systems and macroeconomic experiences. They find that causality is unidirectional in the case of Chile and specifically that economic growth causes FDI. In the case of Malaysia and Thailand, they find a strong bi-directional relationship between economic growth and FDI. Hansen and Rand (2006) similarly test for Granger causality in the given relationship using annual data across different countries and find that FDI strongly Granger-causes GDP and similarly that GDP Granger-causes FDI but however do not find the latter results to be consistent with the long-run FDI ratio.

Whether the relationship between FDI and economic growth is unidirectional or bi-directional, one thing is certain; there is a relationship that exists between the two variables. In the case where FDI causes economic growth, it is assumed that FDI will do so through spillover channels. These channels are commonly divided into two; horizontal spillages and vertical spillages. Horizontal spillages in the economy occur when the effects from FDI spillover whether negative or positive affect domestic firms which are not multinational within the same industry. On the other hand, vertical spillovers occur when the impact of the spillover is directed towards domestic firms external to the foreign corporation's industry, where such firms are either suppliers or customers of the foreign corporation. Empirical evidence shows that both channels are found to work to influence economic growth to a considerable degree (Lin et al., 2009, Marcin, 2007).

2.4.1 FDI-Growth Relationship through Productivity Spillover Channel

The FDI-growth relationship can also be reviewed by means of establishing how FDI impacts on the productivity of firms and the industry at large. Factors that are said to impact productivity include firm specific factors such as firm ownership, firm size as well as capital intensity amongst others. Firm ownership gives an indication of whether a firm is foreign owned or is a domestic firm. Firms that are foreign owned tend to be more productive than domestic firms. The size of a firm may either increase firm productivity or reduce it. Larger firms are said to benefit from higher productivity levels. However, in other cases larger firms may result in lower productivity if efficiency and competition is crowded out by the motive to expand (Zhou et al., 2002). In addition, capital intensity of a firm is known to increase its productivity given that it increases the efficiency of workers.

The impact of FDI on productivity of firms has been extensively reviewed in previous empirical literature where different models and approaches have been applied to observe how productivity of firms varies in the presence of foreign corporations within an industry. One such study is that by Banga (2004) which analyses the impact of Japanese and US FDI on productivity growth of Indian firms. In this particular study two sets of variables are employed in the analysis; the first constitutes variables that assess the production function so as to derive estimates of productivity, whereas the second is made up of variables which are applied in regression analysis to explain the variations in the growth of productivity. Therefore, two models each incorporating either of the two sets of variables are estimated. The first model estimated is a Cobb-Douglas production function based on 4 inputs namely; labour, capital, material and energy. In this model TFP is estimated using the ‘time-variant firm-specific’ technical efficiency approach. In the second model TFP is regressed on firm specific control variables including a variable for FDI. Banga (2004) finds that the firm specific variables of firm size and capital labour ratio are positive but insignificant whereas those of exports intensity and age of the firm are negative but insignificant. The FDI variable is found to be positive and significant but only in the case of Japanese owned firms. The FDI variable on US owned firms is found to be positive but not significant. The results obtained in this study point towards the conclusion that foreign owned firms, specifically those of Japanese descent increased productivity of Indian firms during the period of study.

Another study by Javorcik (2004) examines whether the productivity of local firms in Lithuania is in any way associated with the presence of foreign corporations by means of vertical spillovers. By studying vertical spillovers in the economy, Javorcik (2004) mainly focuses on the influence of MNEs in both downstream and upstream industries. Downstream industries constitute potential customers to the foreign corporation whereas upstream industries are made up of domestic suppliers that provide foreign corporations with intermediate output. Javorcik (2004) estimates an augmented production function where output is regressed on input variables, foreign share and proxies for spillovers of FDI that operate through horizontal, forward and backward linkages. He finds that productivity spillovers occur through backward linkages. More specifically he finds that an increase in foreign presence in a downstream sector by one standard deviation will raise the output of domestic firms by 15 percent. Furthermore Jarvocik's results indicate that the benefits from the spillovers in productivity are accruable to firms that are partially and not fully owned MNE affiliates. In addition, no evidence is found that is indicative of intra-industry productivity spillovers in Javorcik's study.

In the case of China, Zhou et al. (2002) investigate the effects of FDI on the productivity of domestic firms. Their findings reveal that the impact of FDI on domestic firms yields different outcomes owing respectively to the region and industry to which a firm belongs. Zhou et al. (2002) apply a multiple linear regression model to estimate the effect that several factors have on productivity after controlling for firm, industry as well as region related variables known to affect productivity. They first apply a standard Cobb-Douglas production function and transform it by taking logs of the exponential function. By doing so Zhou et al. (2002) simplify the model so that the log of output per worker which represents a proxy for productivity is regressed on the log of capital per worker and the log of the Solow residual which incorporates all control variables including a proxy for FDI. For foreign owned firms, the level of productivity is found to be significantly higher than that of domestic firms. In addition, Zhou et al. (2002) find that the history of FDI in a region has positive effects on domestic firms. This implies that the longer FDI has been present in a region and the larger this FDI is; the higher the productivity of domestic firms in that region. Zhou et al. (2002) attribute this positive association to the possibility that domestic firms take initiatives to improve on their operations and service delivery, administration and in general their competitiveness. However their results also show that within an industry, the relationship between FDI and firm productivity is negative.

A more recent study by Lin et al. (2009) also focusing on productivity spillovers from FDI in Chinese domestic firms specifically in the manufacturing industry for the period 1998 to 2005 shows evidence of both horizontal and vertical productivity spillovers owing to FDI. Lin et al. (2009) apply the formulae used in the calculation of horizontal and vertical spillovers as used in Javorcik (2004), but make use of the Fixed Effects (FE) and Random Effects (RE) estimation techniques simultaneously to assess their results. They calculate the log of TFP by subtracting the log of value added of a firm from the log of labour input and the log of capital input. The log of TFP is further regressed on the variables for horizontal, backward and forward linkages including a variable for industry concentration and an error term. The consequential evidence shows that FDI originating from export destinations when compared to FDI sourced from the domestic market are quite similar in that they equally result in positive backward and forward productivity spillovers. However, such spillovers become weaker given an increase in the export to sales ratio of foreign owned firms.

In addition, Lin et al. (2009) find robust evidence indicating forward spillovers for both Hong-Kong, Macau and Taiwan (HMT) FDI and Non-HMT FDI. However, FDI sourced from HMT yield lesser forward productivity spillovers compared to FDI sourced from Non-HMT firms specifically those from OECD countries. Horizontal spillovers are also seen to exist amongst HMT and Non-HMT invested firms, but are negative and significant for HMT FDI and positive and significant for Non-HMT FDI. Lin et al. (2009) explain this finding to be a result of the crowding-out of Chinese domestic firms by HMT invested firms owing to their labour intensive nature and their production of close substitute Chinese merchandise. Their results also show a negative association between industry concentration and firm productivity.

Each of these studies yield diverse empirical evidence with regard to the relationship between FDI and firm productivity. For instance, the findings of Banga (2004) indicate that the source of FDI is paramount in determining the full extent of the impact of FDI on productivity in which case FDI from Japanese firms in India significantly increases the productivity of domestic firms whereas that from US firms does not. In the same manner Lin et al. (2009) find that FDI originating from HMT invested firms has negative horizontal spillover effects on domestic firms whereas FDI from Non-HMT invested firms results in positive horizontal productivity spillovers. However, they do find strong forward spillovers for both HMT and Non-HMT invested firms signifying an overall beneficial effect of FDI on Chinese domestic firms. In contrast, Javorcik (2004) demonstrates that productivity spillovers from FDI occur only vertically and not horizontally; where the benefits of the spillovers are experienced by firms belonging to different industries as opposed to those within the same industry. Javorcik's results are also selective on the basis of firm ownership, so that firms with perfect foreign ownership do not experience the benefits of FDI spillovers whereas those with partial foreign ownership do.

Furthermore the independent studies on Chinese domestic firms by Zhou et al. (2002) and Lin et al. (2009) do not show similar results with regard to the effects of FDI on firm level productivity even though these studies are centred around firms operating in the same country and within the same industry. Whilst the results of Zhou et al. (2002) show no intra-industry productivity spillovers from FDI to domestic firms, the findings from Lin et al. (2009) reveal evidence of negative horizontal spillovers as well as positive vertical productivity spillovers from FDI to domestic firms. This raises enquiry as to whether time factor also plays a role in determining the extent to which FDI impacts on the productivity of domestic firms.

2.5 Conclusion

This chapter clearly established that although the presence of MNEs in host economies is beneficial and in some instances fundamental to the economic growth of host nations, such benefits do not unambiguously accrue to each and every host economy by virtue of being an FDI location. Whereas some economies benefit from the limitless opportunities brought about by technology spillovers, still others bear the negative effects that accompany such spillovers. Furthermore in order for a host economy to benefit from FDI spillovers, there ought to be favourable conditions to enable the economy absorb the benefits from such spillovers.

However, it is still possible for productivity spillovers to occur in the absence of such conditions, in which case such a spillover will be seen as an externality. In the case where an economy lacks the ability to provide a favourable environment for the absorption of productivity spillovers, such an economy has to forgo the opportunities for economic growth that are attributable to FDI productivity spillovers. However, it can only forgo such opportunities given that the direction of causality indicates that FDI causes economic growth; but if the direction of causality indicates otherwise, then FDI does not become fundamental in determining firm-level productivity and consequently economic growth. Therefore in order to establish whether FDI is a significant contributor towards the productivity of firms within Kenya's manufacturing sector, the next chapter lays out the methods and modelling approach used to investigate this relationship.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter presents the methods applied in investigating the relationship between FDI and firm level productivity in the context of Kenya with specific reference to the manufacturing sector. Recent empirical literature related to FDI and productivity is reviewed here with much concentration given to the various modelling techniques applied. Data sources as well as model specifications applied in this study are also explained in detail. The rest of the chapter therefore proceeds as follows. Section two discusses the background to the methodology applied in the study while section three explains the research design plan and justifies the inclusion of select predictor variables within the model of interest. Section four explains the data used in the study and describes the population sample whereas section five discusses the methodology and data concerns expected to arise within the estimated model. Section six discusses diagnostic tests carried out on the model of interest and the final section concludes the chapter.

3.2 Background to Methodology

Previous studies have applied different methods in estimating the relationship between FDI and productivity. For instance, studies such as Ngoc Thi Bich (2012), Haskel et al. (2007) and Javorcik (2004) all estimate augmented production functions where output is regressed on input variables, foreign ownership and proxies for spillovers of FDI that operate through horizontal, forward and backward linkages. On the other hand ,Liu et al. (2000) estimate a traditional augmented Caves-type model which unlike other conventional augmented production functions does not account for bi-directional causality between FDI and productivity. Although the models estimated are generally the same across studies, each employs different estimation techniques. For example,Haskel et al. (2007) combines time differencing and Fixed Effects (FE) methods whereas Ngoc Thi Bich (2012) and Javorcik (2004) apply the General Method of Moments (GMM) and Ordinary Least Squares (OLS) techniques respectively to their models. However studies such as Zhou et al. (2002)and Banga (2004) first estimate Total Factor Productivity (TFP) through the Cobb Douglas production function and then relate it to FDI in a separate function.Zhou et al. (2002) incorporates TFP with other control variables into one model with output as the dependent variable and apply the multiple linear regressions technique to their model. In Banga's study two separate models are estimated; one calculating TFP using the 'time-variant firm specific' technical efficiency approach and the other regressing TFP on firm specific variables and a proxy for FDI.

Although a number of estimation techniques are at the disposal of the researcher in terms of choice, the question of which is most suitable to be applied within a model is to a great extent dependent on the type of data employed, its availability and its relevance within the model. An estimation technique could also be chosen on the grounds that the dependent variable within a model under estimation is either continuous or limited. Whereas OLS and GMM estimation techniques may be applied to models with continuous dependent variables, probit and logit estimation techniques are suitable for application in models with limited dependent variables. In the case where the researcher faces no constraints in relation to availability or type of data, preference over estimation techniques may depend on the complexity of techniques and on techniques most likely to yield the most accurate estimations.

This particular study makes use of an approach similar to those adopted by Zhou et al.(2002) and Banga (2004) where two separate models are estimated; the first calculating TFP and the second incorporating TFP as the dependent variable in the determination of FDI productivity spillovers. The difference however between the approach used in Banga (2004) and this study is that TFP is not calculated using the 'time-variant firm specific' technical efficiency method as is the case with Banga's study but is instead calculated by means of estimating production functions for each firm, where the residuals obtained thereof then serve as measures of TFP. The study justifies the use of such an approach given that the data used and consequently the variables included in the models of this study largely correspond to the kind of variables incorporated into the models used by Zhou et al. (2002) and Banga (2004). Furthermore, given the limitation of the dataset, it is particularly relevant in this case to compute TFP as residuals of output, labour and capital (as these are the variables available in the dataset) before estimating a separate model to determine the effect of FDI on productivity spillovers. In particular, it would have been ideal to incorporate into the production function other contributing factors such as human capital and raw materials, however, measures for these variables in the given dataset were either inadequate or not entirely satisfactory.

3.3 Research Design and Plan

In this study, a basic production function will be estimated for each firm in order to calculate TFP. The output variable in this case is characterised by each firm's sales revenue, whereas the input variables of capital and labour are characterised by the value of each firm's fixed assets and the number of employees in each firm respectively. The production function to be estimated is therefore given by:

$$Y_{it} = A_{it}F(K_{it}, L_{it})$$

From the function; Y_{it} represents output, K_{it} represents capital, L_{it} represents labour and A_{it} represents the parameter which measures TFP. The subscripts i and t denote the firm and time period respectively. To compute TFP, the left hand side of the equation (output) will be regressed on the right hand side variables (capital and labour), after which the residuals of the estimation will be obtained. These residuals represented by A_{it} in the production function will serve as the TFP variable for each observational unit and will as such be the response variable in the subsequent regression estimating the relationship between FDI and TFP. TFP will as a result be regressed on a proxy for FDI and on various factors known to influence firm productivity which will serve as control variables in the second regression.

Assuming heterogeneity of firms, the regression should ideally be estimated using the Fixed Effects (FE) method which controls for unobserved characteristics that are fixed within individual observations (firms) overtime. If however the unobserved characteristics of firms are random and as such do not correlate with any one of the predictor variables in the model, then applying the FE method will result in inefficient estimates and only then would the Random Effects (RE) method be most appropriate to employ. Therefore, in order to determine which method to employ between the FE and RE methods, the Hausman (1978) test is applied. The test statistic follows a chi squared distribution with 9 degrees of freedom and the null hypothesis is such that there is no systematic variance in the coefficients of the two models.

A large and significant chi squared value is indicative of the presence of fixed effects as it implies that the difference in the coefficients of the two models is systematic. In this case however, the chi squared value is small and insignificant which suggests that there are no fixed effects and therefore that the RE model is the most appropriate to employ of the two models (see Appendix A, Test 1). However to make certain of the aptness of the RE model, the Breusch and Pagan (1980) Lagrange Multiplier test for random effects is applied, where the null hypothesis of no variation in individual unobserved effects is not rejected, implying that random effects within the model are non-existent (see Appendix A, Test 2).Therefore in this case, the model should be estimated using the pooled OLS method given that individual unobserved effects are known to be equal.

However, because of potential endogeneity bias likely to arise due to reverse causality between FDI and productivity and between exports and productivity, using pooled OLS to estimate the model will most likely yield biased estimates. Therefore, it would be most appropriate to apply the Two Stage Least Squares (2SLS) estimator in estimating the relationship between FDI and productivity. However if FDI and exports are in fact not endogenous, then the pooled OLS estimator will be the most appropriate to apply in the estimation. Although less consistent than the OLS estimator, the 2SLS estimator yields unbiased estimates. The 2SLS method works by employing the instrumental variable (IV) technique which substitutes the variable/s assumed to be endogenous within the model with instruments which have to satisfy two conditions of relevance and strength.

A good instrumental variable must therefore, first be highly correlated with the potentially endogenous variable and secondly have no correlation with the error term in the first stage regression. However, finding an instrument that satisfies both conditions of relevance and strength is in itself a challenge. For instance, although one may find a relevant instrument (one that has zero correlation with the error term), such an instrument may only be weakly correlated with the potentially endogenous variable and as such will be a weak instrument. According to Stock and Yogo (2001) a weak instrument used in an IV estimation may lead to a bias of estimates that is just as great as or even greater than the bias that would result if the estimation were carried out by the OLS technique. It is therefore paramount to carry out statistical tests to determine the relevance and validity of potential instruments.

To determine the endogeneity of the FDI and exports variables, the Durbin and Wu-Hausman test is applied with the null hypothesis that the variables under investigation are exogenous (see Appendix B, Test 1).The P-values with respect to the FDI variable indicate that at all levels of significance, the null hypothesis of endogeneity must be rejected. In the case of exports, the P-values indicate that at significance levels above 1.6% (Durbin test) and 1.7% (Wu-Hausman test), the null hypothesis of exogeneity must be rejected. This therefore confirms that the FDI and exports variables are indeed endogenous variables in the estimation, and that the 2SLS estimator is the most efficient estimator that will yield unbiased estimates. A number of variables are considered as potential instruments for the endogenous variables in the model. These include; sales revenue, capacity utilisation, the rate of corruption, the tax rate and the ease of access to business licences and permits. However, after carrying out validity tests to determine the relevance and strength of these variables as potential instruments, most variables are reconsidered as instruments for the endogenous variables in the model.

From the selected variables, the log value of sales revenue (LSALES) and the capacity utilisation (CAPUTIL) of each firm are identified as instrumental variables for the FDI and exports variables respectively. As the gross domestic product (GDP) of a country is an indicator of a country's wealth, so is the sales revenue of a firm an indicator of a firm's wealth. Potential foreign investors are therefore most likely to consider a firm's sales revenue amongst other factors when deciding to invest within a firm. For this reason, it is ideal to consider the sales revenue of a firm as a potential instrument for FDI. Similarly, the capacity utilisation of a firm which measures how well a firm makes use of its production potential, can be considered as a potential instrument for exports because in essence, a firm which makes efficient use of its production capacity maximises on production and as such has the potential to supply its products to larger markets including international markets.

In order to test for the validity and relevance of the choice instruments, tests of under-identification and weak identification are carried out on the model under investigation (see Appendix B, Test 3). A model is said to be overidentified if the number of instruments in the model is greater than the number of endogenous variables. Similarly, an under-identified model is one in which the number of instruments is less than the number of endogenous variables. On the other hand, weak identification refers to a case where instruments are only weakly correlated with the included endogenous variables in a model of interest. Underidentification and weak identification in a model equally pose a risk to the relevance of instruments and consequently to the efficiency of estimates, if estimation is carried out through the IV technique. A test for under-identification tests the null hypothesis that the model under investigation is under-identified, against the alternative hypothesis that the model is identified. The P-value of 0 for the test of under-identification suggests that the null hypothesis of an under-identified model must be rejected at all levels of significance (see Appendix B, Test 3). This indicates that the model is in fact identified and that unbiased estimates of the 2SLS model can be obtained. In addition, the Sargan statistic which tests for the over-identification of all instruments within the model confirms that the model is exactly identified (see Appendix B, Test 3).

To test if the model is weakly identified, the Cragg-Donald Wald F statistic is compared to the Stock-Yogo weak ID critical values at the 10%, 15%, 20% and 25% maximal IV size (see Appendix B, Test 2). In this case, the Cragg-Donald Wald F statistic of 10.60 is greater than the Stock-Yogo weak ID critical values at every maximal IV size and as such, the null hypothesis of weak identification of the model is rejected. These series of tests verify that the log value of sales revenue and firm's capacity utilisation in that order, are valid and strong instruments for the FDI and exports variables respectively. Hence, the 2SLS method can be efficiently applied to estimate the relationship between FDI and productivity without concern of endogeneity in the model. The general form of the model to be estimated by the 2SLS method is as follows:

$$\begin{aligned} \boldsymbol{LTFP_{it}} &= \beta_0 + \beta_1 \boldsymbol{AGEFIRM}_{it} + \beta_2 \boldsymbol{SIZE}_{it} + \beta_3 \boldsymbol{R\&D}_{it} + \beta_4 \boldsymbol{CAPUTIL}_{it} \\ &\quad + \beta_5\ \boldsymbol{LSALES}_{it}\ \beta_5 \boldsymbol{DOMESTIC}_{it} + \beta_6 \boldsymbol{OTHER}_{it} + \beta_7 \boldsymbol{INDUSTRY}_{it} + \boldsymbol{\varepsilon}_{it} \end{aligned}$$

From the model, LTFP represents the log value of the level of total factor productivity for each firm and will be regressed on the following: a constant β_0, age of the firm AGEFIRM, size of the firm FIRMSIZE, research and development R&D, capacity utilisation CAPUTIL (instrument for exports in the model), log of sales LSALES (instrument for FDI in the model), domestic ownership DOMESTIC, other ownership

OTHER, INDUSTRY variable (represents 22 of 23 industries found within Kenya's manufacturing sector) and an error term ε to capture the unobserved characteristics of each firm. Subscripts $_i$ and $_t$ represent each firm and time period respectively. The coefficients on each explanatory term in the model are represented by the β_s (β_1 to β_7).

3.3.1 Model Specifications

Although the main measure of productivity in this study is Total Factor Productivity (TFP), it is also necessary to consider Labour Productivity (LP) as an alternate measure of productivity. Labour productivity is simply calculated as the ratio of total output to the number of employees. A second model of the initial general form will therefore be estimated but in this case specifying labour productivity as the response variable. From here on, the model estimating TFP will be referred to as model 1 and that estimating LP will be referred to as model 2. Different specifications of model 1 and model 2 will be estimated. These specifications will largely represent interaction terms between the FDI variable and other predictor variables of interest. Moreover, through the interaction of the FDI variable with various industry variables, it will be possible to assess whether foreign presence in Kenya's manufacturing sector during the period under study was either largely concentrated in industries already considered to be productive, or whether foreign presence actually contributed to the productivity of industries which were initially not as productive. In this case however, because the FDI variable FOREIGN will be instrumented by the log of sales variable LSALES in the 2SLS technique, all interaction terms involving the FDI variable will instead be represented as products of the LSALES variable and other predictor variables of interest. The coefficients obtained from these interactions involving the LSALES variable will then be interpreted as if the interactions were involving the FDI variable.

3.3.2 Description of Variables

FIRMSIZE: This variable measures whether a firm is small, medium or large in size and is determined by the number of employees that a firm has. A firm with 19 or less employees is considered a small firm whereas one with 20 to 99 employees is a medium sized firm and that with 100 or more employees is considered a large firm.

AGEFIRM: This variable measures the age of a firm and is determined by the number of years that a firm has been operating for in its respective industry within the manufacturing sector.

EXPORTS: This variable measures the quantity of total exports by a firm. It is calculated as a combined measure of direct and indirect exports each as a percentage of total annual sales revenue.

CAPUTIL: This variable measures the capacity utilisation of each firm, meaning how well a firm makes use of its production potential. This variable serves as an instrumental variable for the EXPORTS variable in the estimation.

R&D: This is a limited explanatory variable which measures whether or not a firm invests in research and development activities.

DOMESTIC: This is a categorical variable which measures domestic ownership of a firm; that is whether 10% or more of a firm's shares are owned by private domestic individuals, companies or organisations.

FOREIGN: This is a categorical variable which measures foreign ownership of a firm; that is whether 10% or more of a firm's shares are owned by private foreign individuals, companies or organisations. This variable represents the FDI variable in the estimation.

LSALES: This variable represents the log value of sales revenue for each firm in the manufacturing sector. This variable serves as an instrumental variable for the FDI variable in the estimation.

GOVT: This is a categorical variable which measures state or government ownership of a firm; that is whether 10% or more of a firm's shares are owned by state or government. This variable serves as the base category for firm ownership.

OTHER: This is a limited explanatory variable which represents firms within the manufacturing sector that are neither classified as domestic owned, foreign owned or government owned.

PAPER: This is a dummy variable for the Paper industry and measures whether or not a firm operates within the Paper industry. Given that the Paper industry is one of the least productive industries in terms of average productivity (see Fig 4.10), this variable serves as the base category for the industries found within the manufacturing sector.

FOOD: This is a dummy variable for the Food industry and measures whether or not a firm operates within the Food industry.

TEXTILES: This is a dummy variable for the Textiles industry and measures whether or not a firm operates within the Textiles industry.

GARMENTS: This is a dummy variable for the Garments industry and measures whether or not a firm operates within the Garments industry.

LEATHER: This is a dummy variable for the Leather industry and measures whether or not a firm operates within the Leather industry.

WOOD: This is a dummy variable for the Wood industry and measures whether or not a firm operates within the Wood industry.

PPRMEDIA: This is a dummy variable for the Publishing, Printing and Recorded Media industry and measures whether or not a firm operates within the Publishing, Printing and Recorded Media industry.

CHEMICALS: This is a dummy variable for the Chemicals industry and measures whether or not a firm operates within the Chemicals industry.

PLASTRUBB: This is a dummy variable for the Plastics and Rubber industry and measures whether or not a firm operates within the Plastics and Rubber industry.

NONMETMIN: This is a dummy variable for the Non-metallic Mineral Products industry and measures whether or not a firm operates within the Non-metallic Mineral Products industry.

BASICMET: This is a dummy variable for the Basic Metals industry and measures whether or not a firm operates within the Basic Metals industry.

FABMET: This is a dummy variable for the Fabricated Metal Products industry and measures whether or not a firm operates within the Fabricated Metal Products industry.

MACHEQ: This is a dummy variable for the Machinery and Equipment industry and measures whether or not a firm operates within the Machinery and Equipment industry.

ELECTRONICS: This is a dummy variable for the Electronics industry and measures whether or not a firm operates within the Electronics industry.

TRANSMACH: This is a dummy variable for the Transport Machines industry and measures whether or not a firm operates within the Transport Machines industry.

FURNITURE: This is a dummy variable for the Furniture industry and measures whether or not a firm operates within the Furniture industry.

CONSTRUCTION: This is a dummy variable for the Construction industry and measures whether or not a firm operates within the Construction industry.

SERVICESMV: This is a dummy variable for the Services for Motor Vehicles industry and measures whether or not a firm operates within the Services for Motor Vehicles industry.

WHOLESALE: This is a dummy variable for the Wholesale industry and measures whether or not a firm operates within the Wholesale industry.

RETAIL: This is a dummy variable for the Retail industry and measures whether or not a firm operates within the Retail industry.

HOTRES: This is a dummy variable for the Hotel and Restaurants industry and measures whether or not a firm operates within the Hotel and Restaurants industry.

TRANSPORT: This is a dummy variable for the Transport industry and measures whether or not a firm operates within the Transport industry.

IT: This is a dummy variable for the Information Technology industry and measures whether or not a firm operates within the Information Technology industry.

3.3.3 Justification of Variables

Firm specific variables FIRMSIZE, AGEFIRM, and firm ownership variables FOREIGN, DOMESTIC and OTHER are included in the regression as control variables since they are known to affect firm productivity. The variable FOREIGN, a proxy for FDI is especially included in the model, for estimation of the relationship between FDI and firm-productivity. Firms which export are usually thought to be relatively more productive than firms which do not export, hence the EXPORTS variable although not considered to be firm specific is included in the estimation model. In addition the LSALES variable is incorporated into the model as an instrumental variable for FDI whilst the CAPUTIL variable is included as an instrumental variable for the EXPORTS variable. Given that investment towards research and development is known to improve productivity of firms, the variable R&D is also included in the model of estimation as a control variable. Dummy variables representing 22 out of the 23 manufacturing industries are included in the model because they are specifically concerned with the manufacturing sector, which is the main sector under study. Moreover as previously mentioned, interaction terms between the LSALES variable (an instrument for the FDI variable) and other predictor variables of interest will be included in different specifications of the model to demonstrate the effects of foreign presence on other important variables within the model.

3.3.4 Expected Signs of Variables

FIRMSIZE: The expected sign on this variable is ambiguous. In as much as large firms will be expected to have higher levels of productivity attributed to economies of scale, imperfections in the labour market and complexities including diseconomies of scale that surround large firms may result in larger firms having lower levels of productivity.

AGEFIRM: It is expected that the longer a firm has been in operation, the more established it will be within its industry and as such the more productive it is expected to be relative to younger firms operating within the same industry. Hence this variable is expected to be positive and significant.

R&D: The greater the investment in research and development activities by a firm, the higher the expected total factor productivity within that firm. This is because advancement in knowledge, skills and technologies which increase firm productivity are birthed through innovation which involves research and development. However, this variable is limited and not continuous hence it may not be possible to entirely observe the effect of an increase in this variable on productivity. Nevertheless, the variable is expected to be positive and significant.

EXPORTS: According to the learning-by-exporting hypothesis which states that firms acquire knowledge spillovers through exporting to various markets, the relationship between exports and TFP of a firm is expected to be positive.

FOREIGN: The coefficient on this variable is expected to be positive and significant given that foreign owned firms are in most cases known to be more productive than government owned firms (base category for firms in the estimation), which are commonly observed to be unproductive due to inefficiency in resource allocation.

DOMESTIC: The coefficient on this variable is expected to be positive and significant given that domestic owned firms are assumed to be more productive than government owned firms (base category for firms in the estimation), which are commonly observed to be unproductive due to inefficiency in resource allocation.

OTHER: The expected sign and significance of this variable is unknown, given that this variable represents firms within the manufacturing sector which were neither classified as domestic owned, foreign owned or state owned. Therefore the coefficient on this variable could either be positive and significant or negative and significant.

3.4 Data and Population Sample

The study will make use of firm-level panel data obtained from the World Bank Enterprise Surveys database in order to estimate the impact of FDI on the productivity of firms in Kenya. The study will focus on Kenyan firms operating in 23 different industries within the manufacturing sector for the periods 2007 and 2013 respectively. The type of data contained in this dataset is primarily firm-level manufacturing data based on firm size, firm ownership, number of employees and market share amongst other variables. The initial population sample consists of a total number of 1370 observations which constitute 1287 total firms operating within the 23 industries found in Kenya's manufacturing sector. Out of the 1287 firms, 630 were surveyed in 2007, 574 were surveyed in 2013 and 83 were surveyed in both 2007 and 2013 respectively. This illustrates that the given panel dataset is unbalanced and highlights the problem of attrition which is commonly associated with panel datasets. Attrition occurs when respondents (firms) do not participate or stay in the panel for all waves of the panel, which in turn results in missing observations. For instance if the given panel was balanced, the number of observations would equal NT=2574; where N is the number of firms in the panel which is 1287 and T is the number of time periods which in this case is equivalent to 2. When observations are missing in a panel dataset, it is possible to exclude the missing observations from and proceed with estimating the model of interest without the missing data. However, this would only be efficient if the number of excluded observations is minimal.

In the case where missing observations in the dataset are significant, proceeding to estimate the model of interest without the missing data will be inefficient and may lead to inconsistencies in the estimated results of the model of interest. In this specific case, dropping missing observations from the panel dataset will be an inefficient approach, hence the method of random multiple imputation which assumes that observations are missing at random, is used to create imputed values for the missing observations. Goldstein (2009, p 65) defines imputation as “a procedure for handling missing data that works by constructing a complete dataset, replacing a missing value by an ‘imputed’ value that is generated by a specified algorithm”. In this particular case, the specified algorithm applied in imputing missing observations is embedded as a command in the stata statistical programme, which is used to create the missing observations.

3.5 Methodology and Data Concerns

The problem of endogeneity is usually a cause for concern in cases where there is potential reverse causality between the response variable and any one of the predictor variables within a model. Reverse causality occurs when the response variable within a model is observed to cause or give rise to a predictor variable within the same model. For instance in the case of FDI and productivity, it is expected that FDI (a predictor variable) will give rise to productivity (a response variable), however if productivity is also observed to give rise to FDI, then reverse causality or endogeneity occurs. As previously mentioned in the chapter, the FDI and the exports variables are expected to give rise to endogeneity within the model of interest, which may in turn lead to biased estimates if the model is estimated using erroneous estimation techniques. The problem of endogeneity can be accounted for by using the instrumental variable technique. This technique requires that a suitable instrumental variable be identified and included in the estimated model in place of the predictor variable expected to be endogenous. The instrumental variable should be such that it is highly correlated with the predictor variable of interest (it should be relevant), but should be uncorrelated with the disturbance term within the model (it should be exogenous and valid). Once a suitable instrumental variable is found, the model is estimated using the Two-Stage Least Squares (2SLS) method. After conducting various tests to test for the validity and relevance of potential instruments, the log value of sales revenue (LSALES) and capacity utilisation (CAPUTIL) are identified as suitable instruments for the FDI and exports variables respectively, which are assumed to give rise to endogeneity within the model of interest.

The issue of multicollinearity is also expected to arise within the model of interest due to certain correlations that are likely to exist between the predictor variables within the model. Therefore, various specifications of the model of interest will have to be run, where one explanatory variable at a time of those which are expected to be correlated with each other will each be included in a different specification of the initial model. Furthermore, because interaction terms are already expected to be highly correlated with their main terms, they cannot be simultaneously included in one model specification with other interaction terms, as this will further escalate the problem of multicollinearity within the model.

Moreover with regards to data limitations, the given dataset may not be sufficiently comprehensive to obtain the most accurate and most desirable results from estimations. For instance, the data on research and development is such that the R&D variable is limited and not continuous. In such a case it would be rather difficult to entirely measure the magnitude of the impact of this variable on productivity than if the variable were continuous. In addition given that the study is limited to only two time periods it will be impossible to measure firms' productivity growth overtime and as such it will only be possible to observe the effects of FDI on productivity for these two periods. However, because firm-level data is largely unavailable and more so in developing countries, such data will be useful at the very least in obtaining a relationship between FDI and the productivity of firms in Kenya's manufacturing sector for the given periods of study.

Another issue of concern to be considered within the model of interest is that of omission bias which is caused by a bias in the selection of certain predictor variables within the model. By definition, foreign ownership is determined on the basis of whether a foreign entity owns 10% or more voting rights in a domestic corporation resident in another country (OECD, 2013). Therefore, foreign ownership was determined on the basis that foreign affiliates owned at least 10% of voting rights in any given corporation operating within the manufacturing sector. Similarly, domestic, government and other kinds of ownership were determined using the same criteria to ensure uniformity across the board. As a result, omission bias automatically results given that firms which did not meet the specified selection criterion were not included in the model for estimation. However, in this case the selection bias and consequently the omission bias cannot be helped because ownership is technically defined in this manner.

3.6 Diagnostic Tests

3.6.1 Pre-Estimation Diagnostics: Tests for Heteroskedasticity and Serial Correlation

Heteroskedasticity and serial correlation are common problems observed with panel data models, where the former is associated with the cross-sectional component of panel data and the latter with the time series component of panel data. In the case where the panel is short and wide, heteroskedasticity is highly likely and more so than serial correlation because the cross-sectional component of the panel data is much more apparent than the time series component. With regards to this study, the time series component consists only of two time periods being 2007 and 2013, whereas the cross-sectional component is made up of a considerable number of units (1370 firms). Therefore prior to testing for heteroskedasticity and serial correlation it was expected that the latter would be of much concern than the former in providing biased 2SLS coefficients.

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity is applied in testing for the presence of heteroskedasticity within the model of interest; where the test statistic follows a chi squared distribution with one degree of freedom and the null hypothesis states that there is constant variance in the residuals. A large and significant chi squared value is suggestive of the presence of linear heteroskedasticity. In this particular case, the chi squared value is large and significant at all levels of significance, which requires that, the null hypothesis of constant variance be rejected and the presence of heteroskedasticity within the model be assumed (see Appendix A, Test 3).

Given that serial correlation is anticipated within the model of interest, the Wooldridge (2002) test for autocorrelation would ideally be the most preferred test to apply in the detection of autocorrelation within the model. In the case of the two stage least squares (2SLS) technique, the Wooldridge test for autocorrelation is conducted by means of estimating the first stage least squares model in first difference form and predicting the residuals of the model. The residuals are then regressed on their first lag and the coefficient tested for serial correlation. However, because some variables within the given dataset had missing values, this test could not be effectively run. Nevertheless serial autocorrelation is still assumed within the model of interest, and as such 2SLS regressions with robust standard errors are run to control for both heteroscedasticity and serial correlation.

3.6.2 Post-Estimation Diagnostics: Robustness Checks

As previously mentioned different specifications of the model of interest will be run, in this instance, to ascertain whether estimators remain robust under different model conditions. In addition, as a measure to verify the strength of the model, the 2SLS estimates will be compared to those of the General Method of Moments (GMM) estimator so as to establish how the coefficients and standard errors compare between the two different methods of estimation.

3.7 Conclusion

This chapter reviewed the approaches and estimation methods employed in various empirical literatures to measure the effect of FDI on firm level productivity. It was highlighted that the models used in the literature are generally similar across the board, although different estimation techniques are usually applied to these models depending on the availability of data, the nature of the dependent variable and the complexity of the estimation technique amongst other deciding factors. Following an approach similar to those adopted by Zhou et al. (2002) and Banga (2004), it was decided that the study would estimate two separate models; one to calculate TFP and the other to estimate the impact of FDI on this productivity. Through conducting model specification tests, it was established that the 2SLS model which employs the instrumental variable technique would be the most suitable to apply in estimating the relationship between FDI and firm-level productivity. It was highlighted that because endogeneity bias was likely to arise due to the potentially endogenous FDI and exports variables in the model of interest, estimating the model using pooled OLS would yield biased estimates and that although the 2SLS estimator is less efficient than the pooled OLS estimator, it would yield unbiased estimates. In addition, the methodological and data concerns of the model were outlined and the ways in which to deal with them highlighted. The problem of endogeneity in the model would be accounted for by instrumenting the log value of sales (LSALES) and the capacity utilisation of each firm (CAPUTIL) in that order, with the endogenous variables FDI and exports respectively.

To control for heteroskedasticity and serial correlation, it was decided that 2SLS regressions with robust standard errors would be run for each model of interest. Moreover, it was concluded that different specifications of the model of interest would be estimated and that 2SLS estimates would be compared to GMM estimates to ensure robustness of coefficients across different specifications of the same model and across different types of model techniques respectively.

CHAPTER 4

DATA ANALYSIS

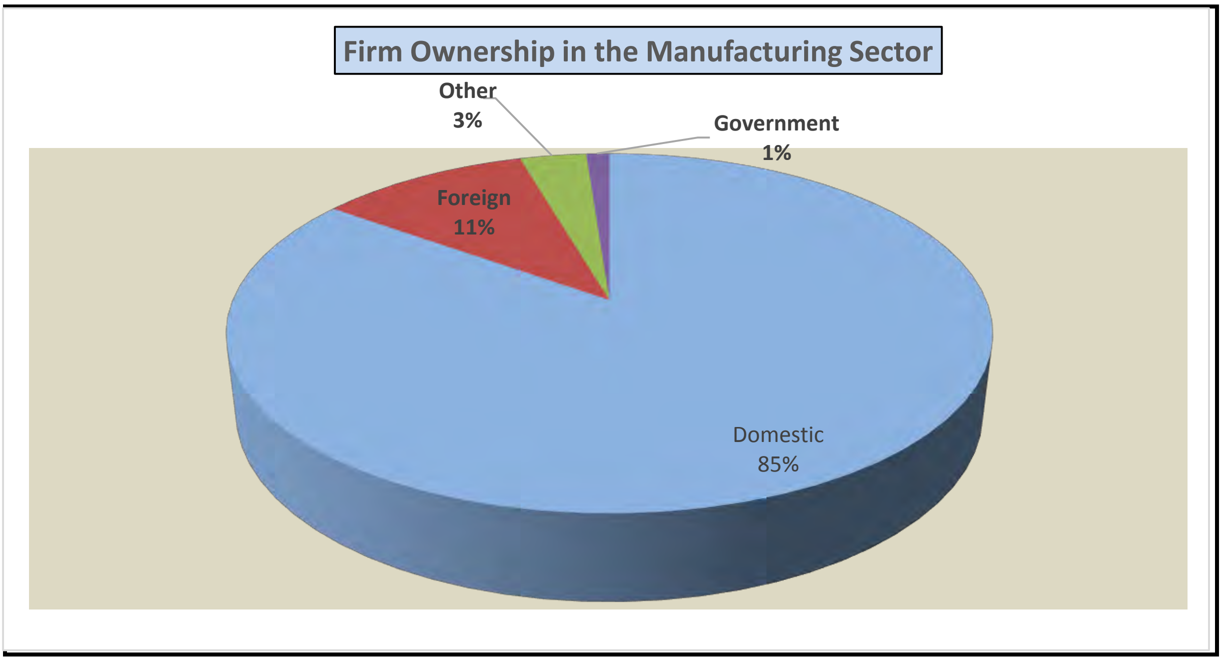
4.1 Introduction

The previous chapter discussed in detail the modelling technique which is to be applied in the study when measuring the impact of FDI on firm level productivity within Kenya's manufacturing sector. This chapter presents the results from the estimations carried out through application of the modelling technique discussed in the previous chapter. The rest of the chapter proceeds as follows. Section two provides a descriptive analysis of the population sub-sample by illustrating how FDI was concentrated and distributed across Kenya's manufacturing sector by industry, firm size and other characteristics during the periods of 2007 and 2013. In addition, a descriptive analysis on the performance of firms based on research and development activities, total exports and productivity levels is presented here. Furthermore, multicollinearity between predictor variables in the model of interest is discussed in this section with specific attention paid to interaction terms. Section three presents and discusses the empirical findings of the study. Results of robustness checks on the estimated model are also presented and discussed here. Section five constitutes a summary of the chapter.

4.2 Descriptive Statistics

Based on percentage of ownership for 2007 and 2013, 85% of firms within Kenya's manufacturing sector were owned by domestic private individuals or entities, 11% were foreign owned, 3% were owned by other entities, whereas 1% of firms were government owned (see Figure 4.1). Although firm ownership does not imply that a specific entity or corporation exclusively owns the rights to the shares of a firm, it in fact gives an indication of the distribution of market share within an industry. For instance in the case of Kenya's manufacturing sector for the periods under study, firms that dominated any given industry within the sector were most likely to be domestic owned and least likely to be state or government owned. This distribution of market share is expected given that the manufacturing sector in Kenya predominantly operates within the private domain and therefore state owned firms operating within any given industry of the sector were quite few as indicated by 1% representing government ownership in Figure 4.1.

Figure 4.1: Distribution of Firm Ownership within Kenya's Manufacturing Sector for Periods 2007 and 2013



Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

The 11% representing foreign ownership within the manufacturing sector for the periods 2007 and 2013 gives a clear indication that FDI inflows within Kenya's manufacturing sector were relatively small during these two periods. This figure is however not representative of the fact that, industries within Kenya's manufacturing sector have the most potential to attract the largest number of FDI compared to industries in other sectors (refer to Table 1.1: Chapter 1).

Table 4.1: Distribution of Firms within Kenya's Manufacturing Sector based on Firm Size for periods 2007 and 2013

	FIRM SIZE			Total
FIRM OWNERSHIP	**Small (%)**	**Medium (%)**	**Large (%)**	
Domestic	608 (90.9)	366 (82.1)	189 (74.1)	**1163**
Foreign	33 (4.9)	61 (13.7)	51 (20.0)	**145**
Other	26 (3.9)	14 (3.1)	6 (2.4)	**46**
Government	2 (0.3)	5 (1.1)	9 (3.5)	**16**
Total	**669**	**446**	**255**	**1370**

Note: Firm size is defined by the number of full time employees a firm has, where; 1-19 employees (small sized firm), 20-99 employees (medium sized firm) and 100+ employees (large sized firm

Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

During the periods under study, Kenya's manufacturing sector was largely made up of small sized firms (see Table 4.1). In total, there were 669 small sized firms, 446 medium sized firms and 255 large sized firms distributed across the 23 different industries making up the manufacturing sector. Domestic owned firms largely constituted small sized firms whereas foreign owned and state owned firms were dominantly large sized firms. This distribution suggests that most domestic owned firms within the manufacturing sector were either sole proprietorships or partnerships considering the small number of employees making up a small sized firm. Moreover, being that foreign owned firms were dominantly large sized firms indicates that foreign investors preferred to invest mainly in public or private limited corporations where their losses would be limited in the case of liquidation or insolvency. This is further illustrated by Table 4.2 which shows the legal status of firms within Kenya's manufacturing sector for the periods under study. The majority of domestic owned firms within the manufacturing sector were sole-proprietorships (35.3%) whereas most foreign owned firms (56.6%) were shareholding corporations with non-traded shares in the stock market. State owned firms were mainly shareholding corporations with either traded or non-traded shares in the stock market. In addition, as expected, none of the state owned firms were found to be sole-proprietorships.

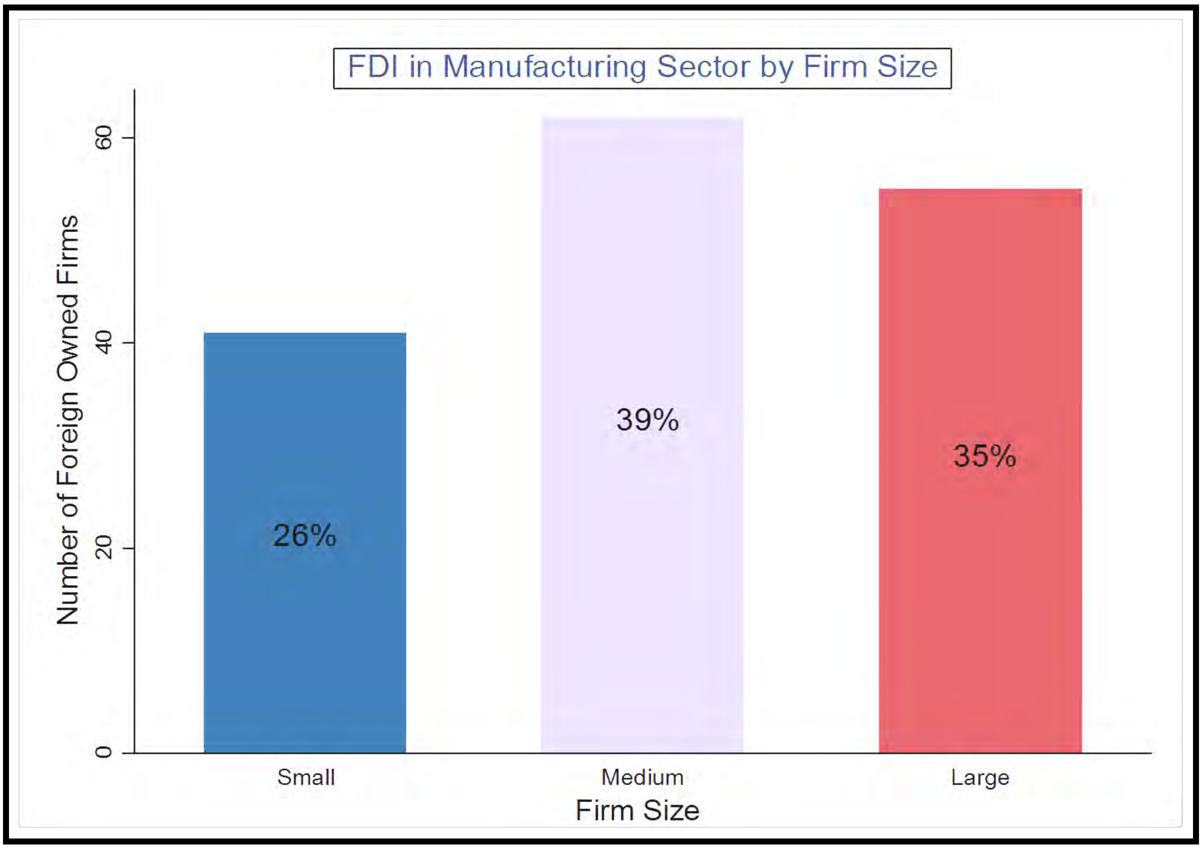
Table 4.2: Legal Status of Firms within Kenya's Manufacturing Sector for the periods 2007 and 2013

LEGAL STATUS OF FIRM	FIRM OWNERSHIP				Total
	Domestic (%)	Foreign (%)	Government (%)	Other (%)	
Shareholding(traded shares)	6 (0.5)	6 (4.1)	6 (37.5)	1 (2.2)	**19**
Shareholding (non-traded shares)	367 (31.6)	82 (56.6)	6 (37.5)	11 (23.9)	**466**
Sole-Proprietorship	410 (35.3)	6 (4.1)	0 (0.0)	0 (0.0)	**416**
Partnership	149 (12.8)	17 (11.7)	1 (6.3)	8 (17.4)	**175**
Limited Partnership	218 (18.7)	32 (22.1)	1 (6.3)	16 (34.8)	**269**
Other	12 (1.0)	2 (1.4)	2 (12.5)	6 (13.0)	**22**
DK				3 (6.5)	**3**
Total	**1163**	**145**	**16**	**46**	**1370**

Note: DK represents firms classified as other ownerships which did not know their legal status.

Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

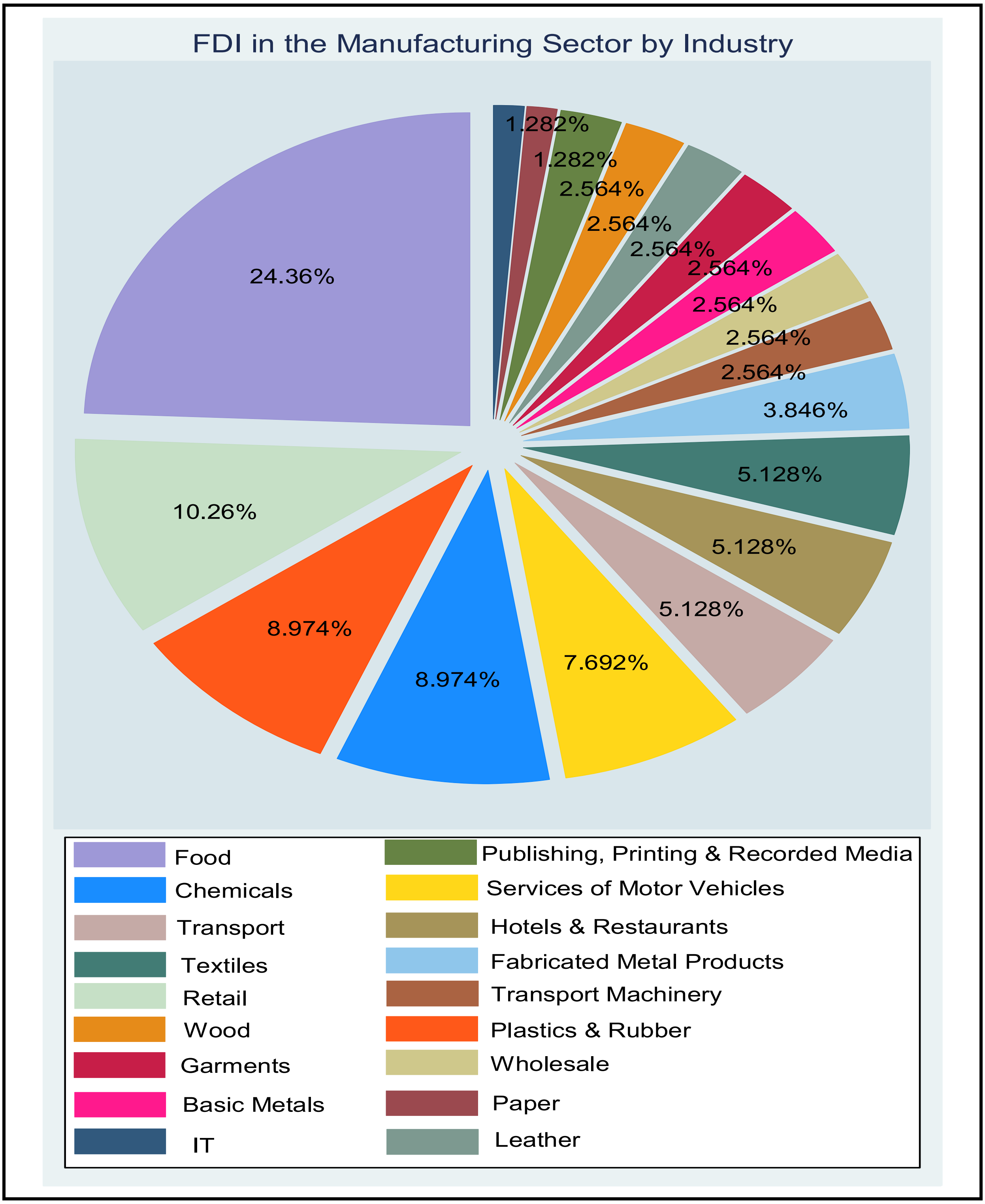
Figure 4.2: Classification of Foreign Owned Firms within Kenya's Manufacturing Sector by Size for periods 2007 and 2013



Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

The classification of foreign owned firms within the manufacturing sector in terms of size for the two periods under study is illustrated by Figure 4.2. Majority of the FDI, 39% was directed towards medium enterprises, 35% towards large enterprises and 26% towards small enterprises respectively. These foreign owned firms constituted 18 out of the 23 industries found within the manufacturing sector. Figure 4.3 shows these industries where FDI was largely concentrated within the manufacturing sector during the periods of 2007 and 2013. The Food industry received the most FDI having 24% of the total share of FDI within the sector. The Retail industry was the second most concentrated industry with FDI having a total of 10.26% of total FDI, followed by the Plastics and Rubber and Chemicals industries each receiving a share of 8.97% of total FDI.

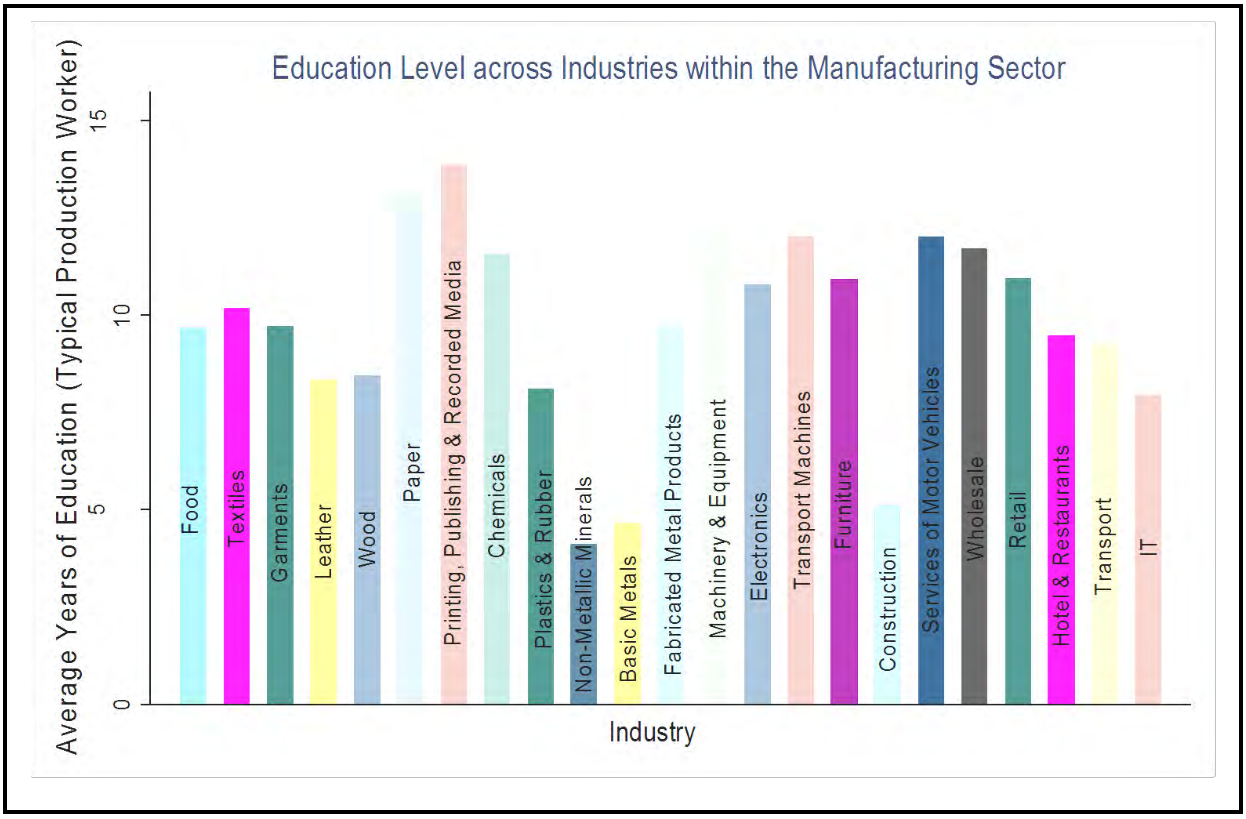
Figure 4.3: Classification of Foreign Owned Firms within Kenya's Manufacturing Sector by Industry for periods 2007 and 2013



Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

The Services of Motor Vehicles, Transport, Hotels and Restaurants and Textiles industries were also amongst the industries that received a considerable share of total FDI within the manufacturing sector during the periods under study. Out of the 23 industries making up Kenya's manufacturing sector, the Garments and IT industries were the least concentrated industries in terms of FDI, each receiving a little over 1% of the total share of FDI. However, in terms of the level of education of workers, the Food industry did not have the highest level of human capital found within the manufacturing sector (see Figure 4.4). The highest levels of human capital were instead found in the Printing, Publishing and Recorded Media, Paper, Machinery and Equipment, Transport Machines and Services of Motor Vehicles industries respectively.

Figure 4.4: Education Level of Workers across Different Industries within Kenya's Manufacturing Sector for the Periods 2007 and 2013



Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from the World Bank Enterprise Surveys database, 2014.

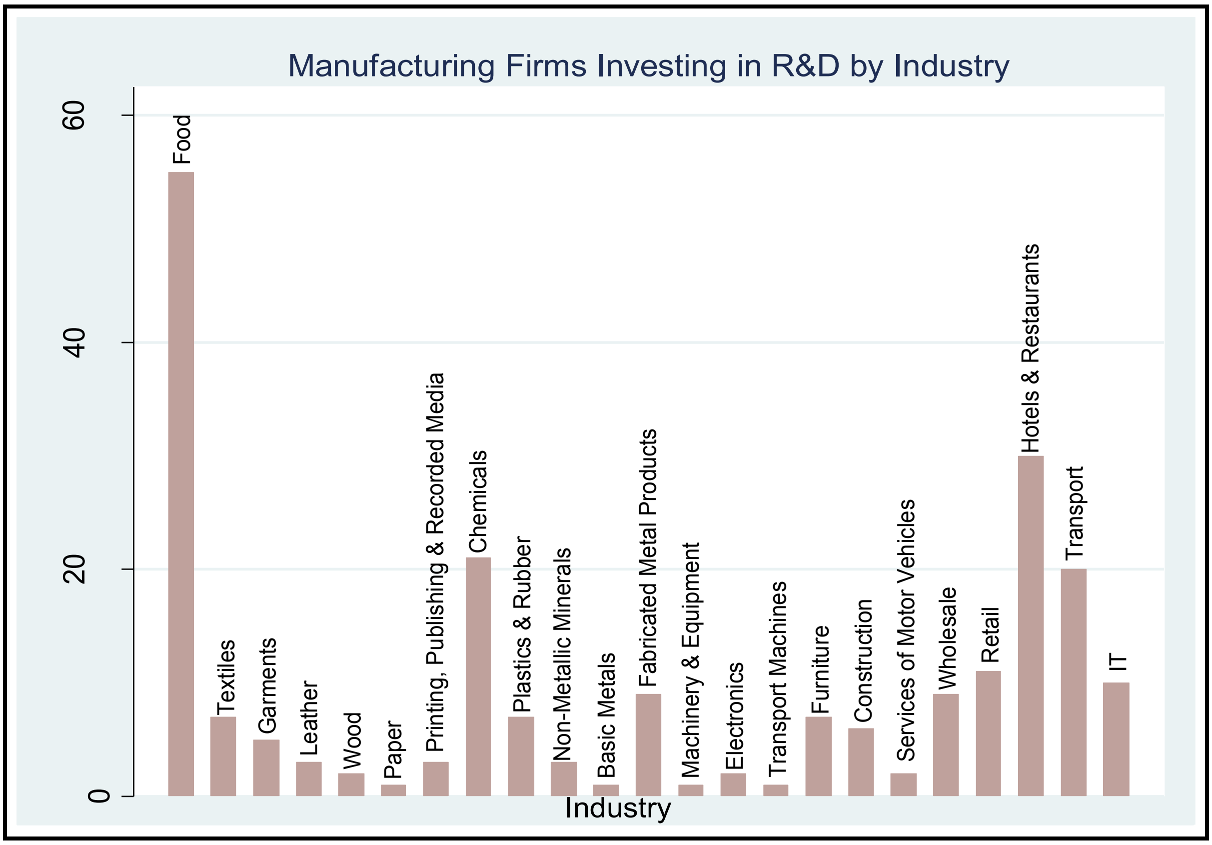
Table 4.3 shows the distribution of firms in the manufacturing sector which invested in research and development activities (R&D) during 2013 by firm size and ownership. Firms which invested in R&D activities during 2007 were not captured as data on R&D activities were not available in the dataset for the year 2007. Therefore out of a total of 713 manufacturing firms surveyed in 2013, only 216 firms invested in R&D indicating that approximately 70% of manufacturing firms did not make investments towards R&D activities during the period 2013. As illustrated by Table 4.3, firms that invested the most in R&D activities during 2013 were large enterprises, whereas small enterprises invested the least towards R&D during this period. In terms of ownership, government owned firms invested more in R&D activities relative to other firms within the sector. Moreover, 50% of foreign firms invested in R&D activities compared to 29.5% of domestic firms which invested in R&D activities. In terms of R&D activities by industry the Food, Hotels and Restaurants and Chemicals industries respectively, were observed to be the most active in investing towards R&D activities within the manufacturing during the period 2013 (see Figure 4.5).

Table 4.3: Distribution of Kenyan Manufacturing Firms which Invested in Research and Development activities in 2013 by Firm Size and Ownership

Firm Size	**Number of firms investing in R&D**	**Ownership**	**Number of firms investing in R&D**
Small	20.2%	Domestic	29.5%
Medium	34.2%	Foreign	50.0%
Large	52.4%	Government	55.6%
		Other	26.7%

Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

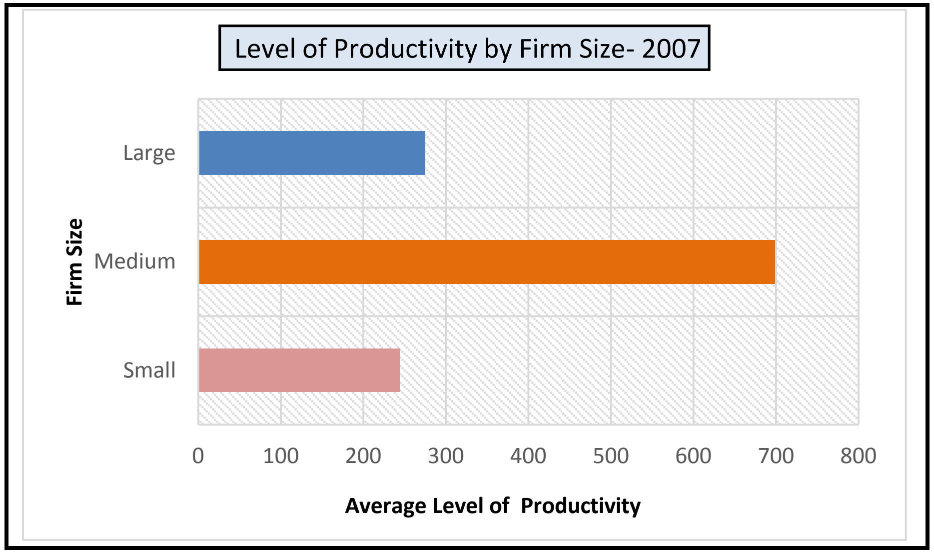
Figure 4.5: Distribution of Kenyan Manufacturing Firms which Invested in Research and Development Activities in 2013 by Industry



Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

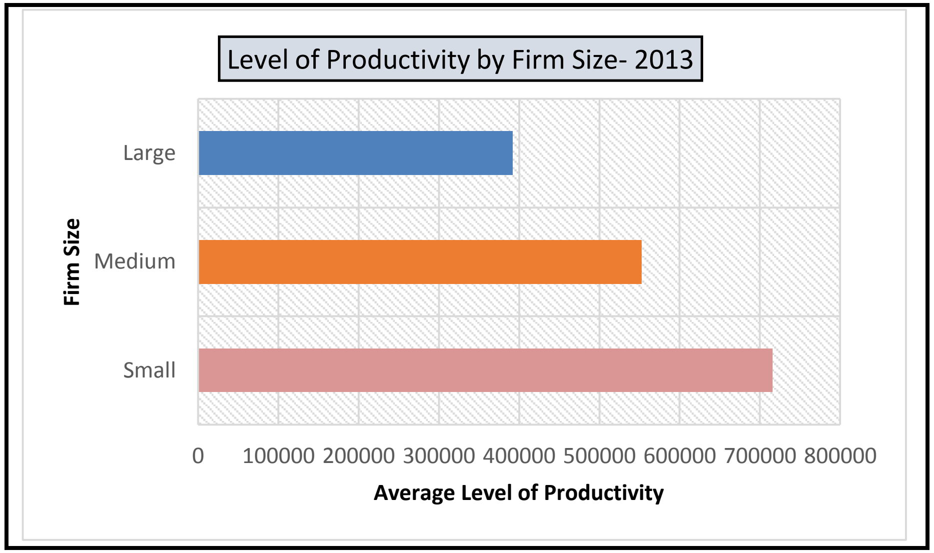
Figures 4.6 and 4.7 illustrate the average level of productivity by firm size in the manufacturing sector for the periods 2007 and 2013 respectively. Based on the level of productivity within the manufacturing sector for the period of 2007; medium enterprises jointly recorded higher levels of productivity relative to small and large sized firms. However, in 2013, small sized firms had higher levels of productivity relative to large and medium sized enterprises. Moreover, the average level of productivity generally increased across the manufacturing sector between 2007 and 2013 for all sizes of firms (see Figures 4.6 and 4.7).

Figure 4.6: Average Level of Productivity in the Manufacturing Sector by Firm Size for the period 2007



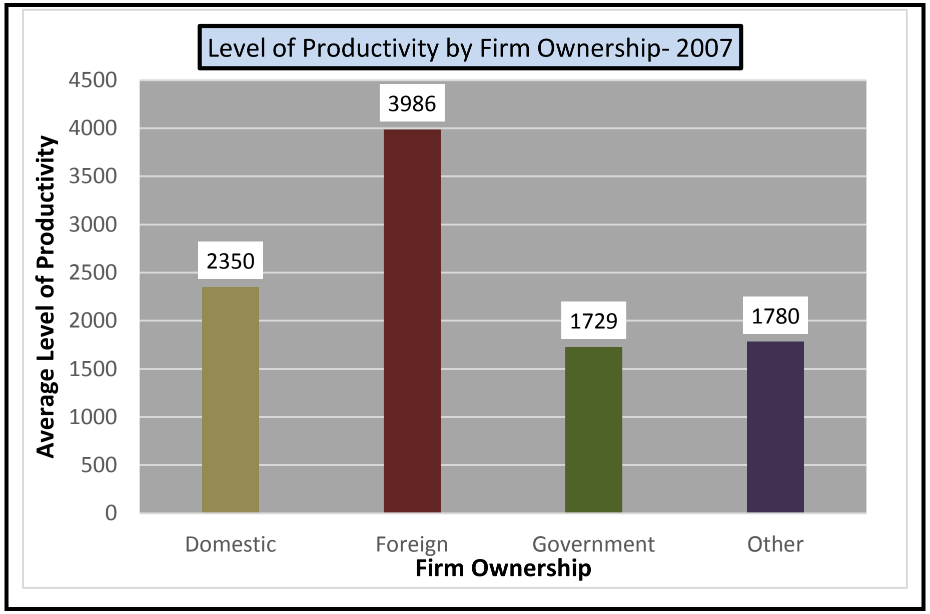
Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

Figure 4.7: Average Level of Productivity in the Manufacturing Sector by Firm Size for the period 2013



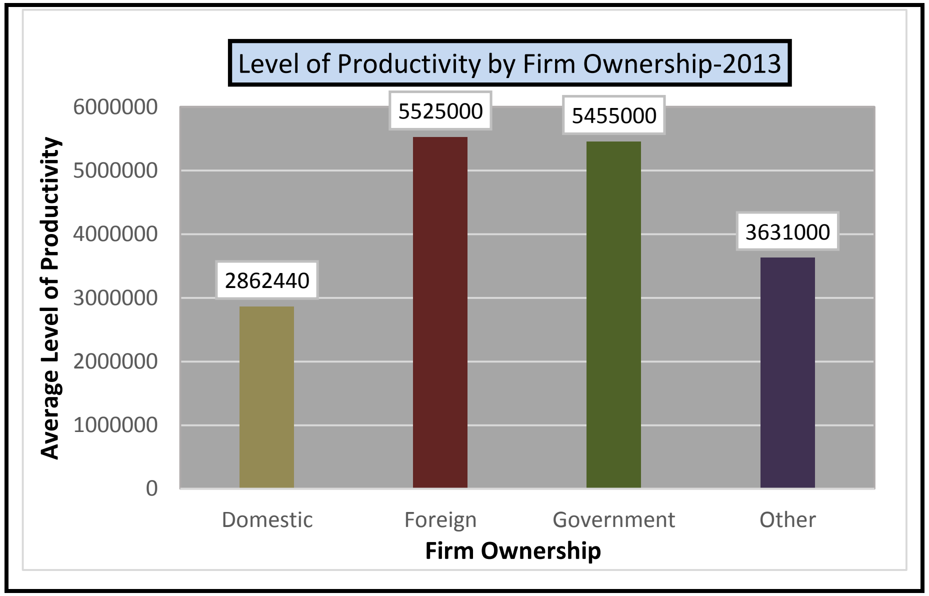
Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

Figure 4.8: Average Level of Productivity in the Manufacturing Sector by Firm Ownership for the period 2007



Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

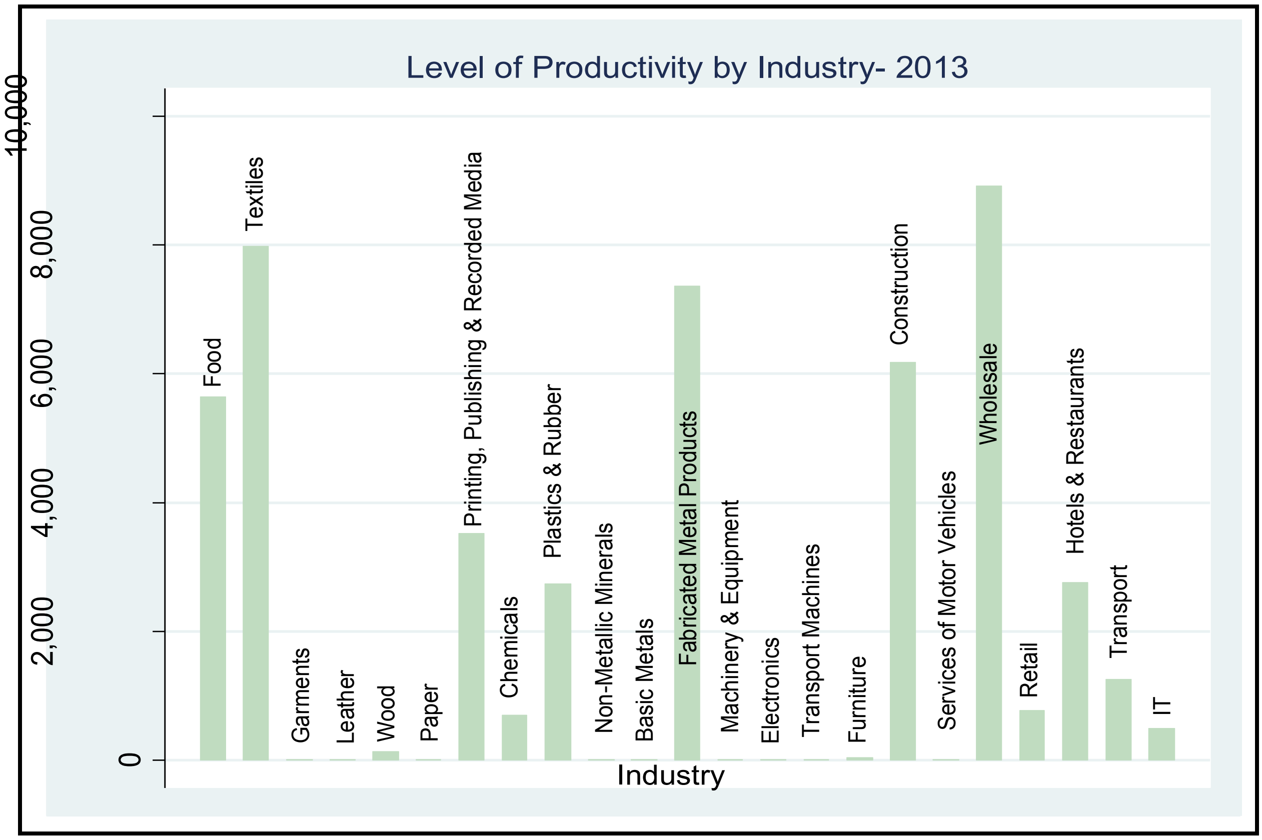
Figure 4.9: Average Level of Productivity in the Manufacturing Sector by Firm Ownership for the period 2013



Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

The average level of productivity by firm ownership in the manufacturing sector during the periods 2007 and 2013 is illustrated by Figures 4.8 and 4.9. Foreign owned firms had the highest levels of productivity relative to other types of firms within the sector for both periods, whereas domestic owned firms recorded the lowest levels of productivity for 2013 compared to 2007. Government owned firms were also noted to have had considerable levels of productivity during the period of 2013. As was the case with firm size, the average level of productivity across all types of firms in the manufacturing sector was observed to increase between 2007 and 2013 (see Figures 4.8 and 4.9). Across industries, the Wholesale industry had the highest average level of productivity within the manufacturing sector for the period 2013. The Food, Textiles, Fabricated Metal Products and Construction industries also had relatively substantial levels of productivity during 2013 (see Figure 4.10). Data on productivity levels by industry for the period 2007 were not captured due to missing values on certain industry variables.

Figure 4.10: Average Level of Productivity in the Manufacturing Sector by Industry for the period 2013

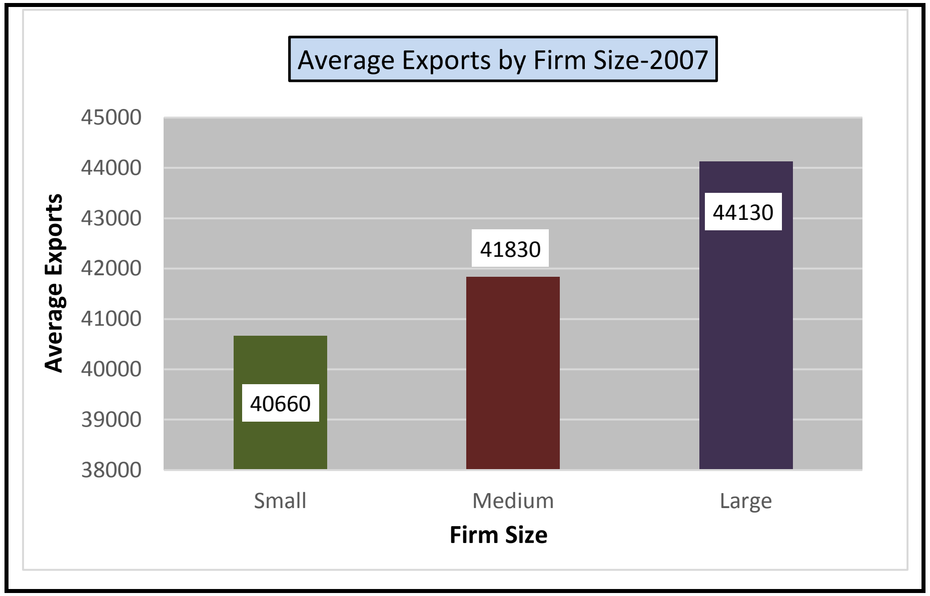


Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

Figures 4.11 and 4.12 illustrate the average exports in Kenya's manufacturing sector by firm size for the periods 2007 and 2013. In 2007, it was observed that large sized firms were dominant in exporting whereas medium sized firms were moderate exporters and small sized firms were the least of exporters within the manufacturing sector. In 2013 however, medium sized firms exported the least, although large sized firms continued to be dominant in exporting. In addition, small sized firms generally increased their exports between the periods of 2007 and 2013, whereas medium and large sized firms observed a decrease in their average exports between these two periods.

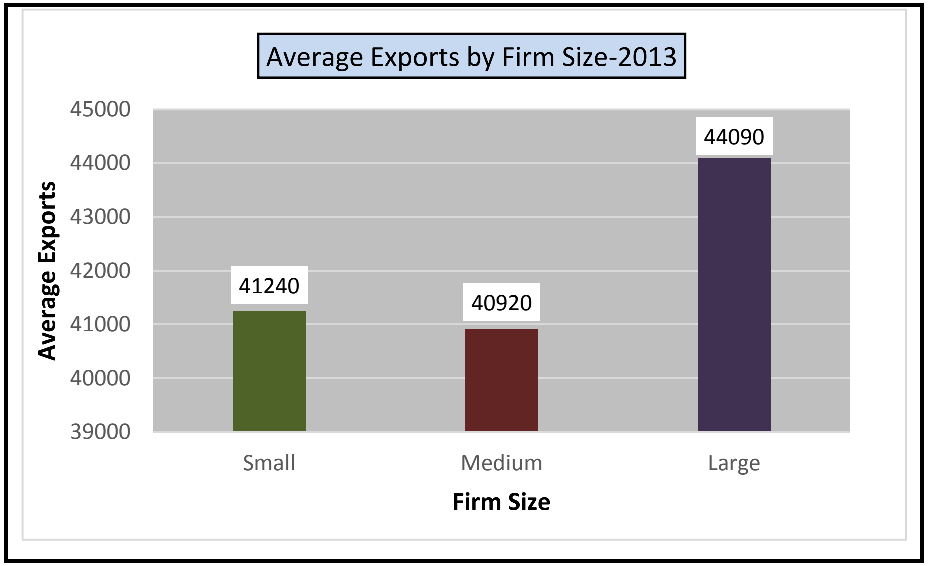
In terms of firm ownership, foreign owned firms exported the most relative to other firms within the manufacturing sector during 2007 (see Figures 4.13 and 4.14). During 2013, government owned firms exported the most on average, although foreign owned firms were also observed to have been considerably involved in exporting during this period relative to domestic owned firms, which had the least amount of exports on average for both periods compared to foreign owned and government owned firms. Moreover, although there was a general increase in average exports between the periods 2007 and 2013 across all types of firms except domestic firms which had less exports on average in 2013 compared to 2007, government owned firms recorded the largest increase in exports between the two periods under study.

Figure 4.11: Average Exports in the Manufacturing Sector by Firm Size for the period 2007



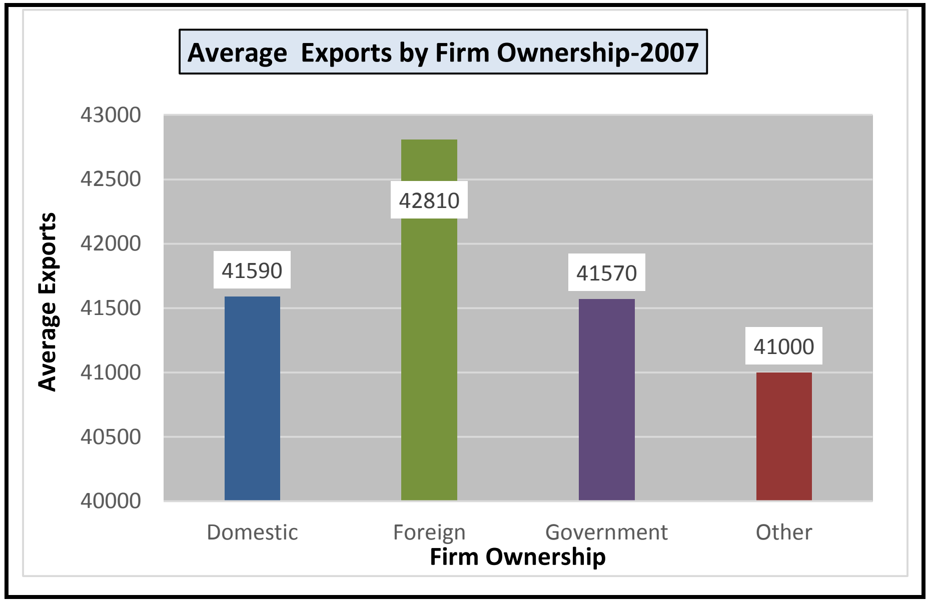
Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from the World Bank Enterprise Surveys database, 2014.

Figure 4.12: Total Exports in the Manufacturing Sector by Firm Size for the period 2013



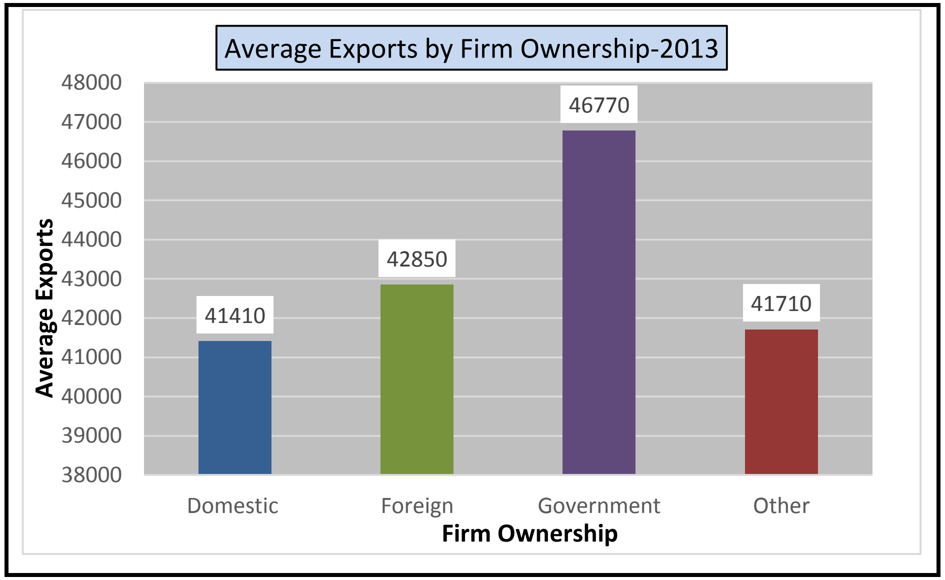
Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from the World Bank Enterprise Surveys database, 2014.

Figure 4.13: Average Exports in the Manufacturing Sector by Firm Ownership for the period 2007



Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from the World Bank Enterprise Surveys database, 2014.

Figure 4.14: Average Exports in the Manufacturing Sector by Firm Ownership for the period 2013



Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from the World Bank Enterprise Surveys database, 2014.

4.2.2. Interaction Terms and Multicollinearity within the Estimated Model

Appendix C shows the correlation matrix of the choice variables of the study contained in the sample of 1370 observations. These variables are as previously defined in the methodology chapter. The correlation coefficient which measures the association between two variables, lies between -1 and 1 inclusive, so that a correlation coefficient equal or close to 1 shows a positive association between the variables under evaluation and a coefficient close to or equal to -1 indicates a negative association between the variables. A correlation coefficient of 0 is indicative of a non-existent relationship between any two given variables under evaluation. Usually a correlation coefficient of 0.8 or greater whether positive or negative is a good indicator of a strong correlation between any two given variables. If a strong correlation is observed to exist between the variables under evaluation, the problem of multicollinearity will result if both variables are included simultaneously as predictor variables in the estimation model.

In cases where interaction terms are included in the regression model, multicollinearity is especially a concern. This is because interaction terms are products of the main terms found within a model and because they have to be simultaneously included in the model with the main terms when estimating the model, multicollinearity is bound to be present. According to Ozer-Balli and Sorensen (2010), omitting main terms from a regression equation may result in significant interaction effects owing to the bias of leaving out variables from the equation. In cases where interaction terms are associations between continuous variables and categorical variables, Smith and Sasaki (1979) suggest that in order to include both variables in the model without being concerned about multicollinearity, the continuous variable must be centered by subtracting its mean from each observation before interacting it with the categorical variable.

However in such cases where the interaction terms are products of categorical variables, centering of the main term by subtracting the mean from each observation in an attempt to mitigate multicollinearity within the model of interest would not be a plausible measure. Therefore in such a case, the most probable way to proceed would be to exclude one of the main terms that is observed to cause high multicollinearity within the model. However, because the main terms have to be included in the model together with the interaction terms when estimating the model, the situation remains as one that cannot be helped and as such the model would have to be estimated allowing for some multicollinearity.

Appendix C shows the correlation coefficients of the interaction terms involving the LSALES variable (an instrumental variable for FDI) and various industry variables. As expected these correlation coefficients lie above 0.8 and hence indicate a significant positive association between the interaction terms and their main terms. However, as mentioned previously, the model cannot be estimated without simultaneously including the interaction term with their main terms. Hence, in order to avoid escalating the multicollinearity caused by the interaction terms, we avoid including all interaction terms in one model specification and instead estimate separate specifications for each interaction term.

The research and development (R&D) variable also seems to be highly correlated with the industry variables in the model, with correlation coefficients equal to 1 showing perfectly positive associations between R&D and the various manufacturing industries. To control for multicollinearity in this case, the R&D variable is included in a separate model specification from that with the industry variables. In addition, the associations involving the different industries within the manufacturing sector also raise concern over multicollinearity within the model of interest. As depicted in Appendix C, the correlation coefficient between any two industry variables is equal to 1, indicating a positive and perfectly robust association. These associations are expected given that the industries are all found within the manufacturing sector and as such exhibit certain characteristics common to this particular sector. Nevertheless these industries are included simultaneously when estimating the model because although they may result in multicollinearity they are control predictor variables and all together characterize the manufacturing sector which is of significant concern in this particular study.

4.3 Regression Results and Discussion of Empirical Findings

The model outlined in the previous chapter is estimated in this section using the Two Stage Least Squares (2SLS) estimation technique. The results obtained from different specifications of the estimated model are presented in tables 4.4 and 4.5. Table 4.4 shows the results from the 2SLS estimation for model 1 in which the log value of Total Factor Productivity (LTFP) is the dependent variable. As stated in the previous chapter, TFP is calculated as the residuals obtained from the production functions of all firms in the manufacturing sector; where the production inputs of each firm (capital and labour) are subtracted from the production output (sales revenue) of each firm. Table 4.5 shows the results obtained from the estimation of model 2 using 2SLS, where the log value of Labour Productivity (LLP) is the dependent variable. Labour productivity as initially mentioned, is calculated as the ratio of total output to the number of employees. For either model, heteroskedasticity and serial correlation are controlled for by running regressions with robust standard errors.

4.3.1 2SLS Estimates: Model 1

Table 4.4: Impact of FDI on the log of Total Factor Productivity (LTFP)

	Specifications of the Estimated Model					
Independent Variable	**A**	**B**	**C**	**D**	**E**	**F**
AGEFIRM	-0.0002 (0.001)	-0.0003 (0.015)	-0.0002 (0.001)	-0.0002 (0.001)	-0.0002 (0.001)	-0.0002 (0.001)
FIRMSIZE	-1.424** (0.643)	-1.328** (0.677)	-1.326** (0.560)	-1.326** (0.560)	-1.327** (0.560)	-1.327** (0.560)
R&D	-0.007 (0.006)					
EXPORTS	-0.288 (0.219)	-0.338*** (0.226)	-0.363* (0.194)	-0.363* (0.194)	-0.363* (0.194)	-0.363* (0.194)
FOREIGN	38.024*** (11.603)	39.643*** (12.518)	27.243** (11.925)	27.332** (11.930)	27.298** (11.912)	27.278** (11.904)
DOMESTIC	28.249*** (8.770)	29.530*** (9.485)	20.427** (8.860)	20.490** (8.865)	20.466** (8.851)	20.452** (8.846)
OTHER	9.077** (3.819)	8.566** (4.063)	7.691** (3.229)	7.696** (3.235)	7.693** (3.232)	7.691** (3.231)
FOOD		2.682* (1.514)	- 0.100*** (0.038)			
PLASTRUBB		-8.935 (5.731)		-0.100*** (0.038)		
FURNITURE		4.441* (2.603)			-0.100*** (0.038)	
		4.265**				-0.100***

	A	B	C	D	E	F
WHOLESALE		(2.103)				(0.038)
FOODLSALES			0.005** (0.002)			
PLASTRUBBLSALES				0.005** (0.002)		
FURNLSALES					0.005** (0.002)	
WHOLELSALES						0.005** (0.002)
Constant	-29.753*** (9.531)	-30.000*** (10.702)	-18.271* (10.716)	-18.325* (10.716)	-18.300* (10.704)	-18.283* (10.701)
R-squared	.	.	.	.	.	.
Prob>Chi2	0.071	0.125	0.000	0.000	0.000	0.000
No. Of observations	1370	1370	1370	1370	1370	1370

Notes: Figures in parenthesis represent robust standard errors.

*, **, *** represent significance at the 10%, 5% and 1% levels respectively.

Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

Table 4.4 shows the estimated results of 6 different model specifications (labelled A to F) obtained by applying the 2SLS modelling technique to estimate the relationship between TFP and FDI in Kenya's manufacturing sector for the periods 2007 and 2013. Model specification A represents the initially specified model excluding the industry variables. This model specification is necessary because the research and development variable R&D is highly correlated with industry variables (see Appendix C), and as such should not be included in the same model specification as that of the industry variables. For this reason, model specification B is estimated and represents the initially specified model including industry variables but excluding the R&D variable.

Model specifications C to F represent estimations involving interaction terms between the LSALES variable (an instrument for FDI) and various industry variables found to have a significant effect on TFP. The interaction terms include; FOODLSALES, PLASTRUBBLSALES, FURNLSALES and WHOLELSALES and represent interactions between the LSALES variable and the Food, Plastics and Rubber, Furniture and Wholesale industry variables respectively.

The AGEFIRM variable is insignificant across all model specifications whereas FIRMSIZE is negative and significant across all model specifications. This indicates that although the age of the firm was not a significant contributing factor towards firm productivity in Kenya's manufacturing sector during the periods under study, the size of the firm was. The negative relationship between the firm's size and its productivity implies that smaller manufacturing firms were relatively more productive than larger firms. This negative relationship may be explained using the concepts of economies and diseconomies of scale, which suggest that smaller firms are able to produce high levels of output at lower costs due to their ability to specialize and that larger firms owing to coordination problems tend to bear increasing costs as they increase their output. Therefore, in cases where smaller firms can produce more output at reduced costs compared to larger firms, smaller firms are seen to be more productive than larger firms.

The coefficient on the *R&D* variable in model specification A is negative and insignificant, implying that research and development did not significantly influence the productivity of firms in Kenya's manufacturing sector during the periods under study. It is expected that a firm which invests in research and development will be in a position to advance the technologies it uses in production, which consequently makes such a firm relatively more productive than those that do not engage in active R&D activities. Hence, although the relationship between R&D and productivity was not positive as expected, it was insignificant.

The coefficient on the EXPORTS variable is negative and significant across all model specifications except for model specification A, where the variable is negative and insignificant. This suggests that firms which engaged in exporting did not experience an increase in their productivity as a result of exporting. This outcome counters the expectation that firms which export learn by exporting and as such adapt technologies from those they export to, making firms that export relatively more productive than firms that do not export.

The FDI variable FOREIGN is positive as expected and highly significant across all model specifications. This implies that foreign owned firms were significantly more productive than government owned firms during the periods under study. In addition, the coefficients on the variables DOMESTIC and OTHER, also positive and highly significant across all model specifications indicate that domestic firms and firms not classified as foreign, domestic or government owned were also significantly more productive than government owned firms in the manufacturing sector during the periods under study. Government owned firms were used as a base category in order to make comparisons with the foreign, domestic and other firms operating within the sector. Although all firms in the manufacturing sector were substantially productive than government owned firms, foreign owned firms seemed to be the most productive when compared to domestic and other firms. This is illustrated by the coefficient on the FOREIGN variable which is moderately higher than that of the DOMESTIC variable and considerably higher than that of the OTHER variable, which is true for all model specifications. This outcome suggests that during the periods under study, foreign owned firms outperformed and were perhaps more competitive than domestic and other firms within Kenya's manufacturing sector.

The industries which had the greatest impact on firm productivity within the manufacturing sector in Kenya for the periods under study were the Food, Plastics and Rubber, Furniture and Wholesale industries (see model specification B). Other industry variables which were found to be highly insignificant are excluded from Table 4.4 but can be found in Appendix D under regression output. The paper industry as previously indicated in the methodology serves as a base category to make comparisons with other industries operating within the manufacturing sector. According to the estimated results, firms found within the Food, Furniture and Wholesale industries were more productive than firms found within the Paper industry. However, firms found within the Plastics and Rubber industry were not as productive as firms found within the Paper industry. This outcome suggests that foreign presence in Kenya's manufacturing sector was not necessarily concentrated in industries initially known to be productive. For instance although 24.36% of foreign owned firms were found within the Food industry(see fig 4.3) which was also found to be significantly productive, only 2.56% of foreign owned firms were found within the Wholesale industry, also found to be significantly productive. Moreover, although firms within the Plastics and Rubber industry were not found to be productive, 8.97% of foreign owned firms were found to be present in this industry compared to the non-existent foreign owned firms in the Furniture industry which was also significantly productive.

The coefficients on the interaction terms between the LSALES variable (an instrument for FDI) and the variables representing the Food, Plastics and Rubber, Wholesale and Furniture industries all show a positive and significant relationship between FDI and these industries. This indicates that foreign presence was a contributing factor to the productivity of these industries in Kenya's manufacturing sector for the periods under study. The Food, Wholesale and Furniture industries were initially significantly productive industries without foreign presence and remained productive even with the introduction of foreign firms. Although this may raise uncertainty as to whether foreign presence did actually contribute to the productivity of these initially productive industries in Kenya's manufacturing sector, it is clear that the existence of foreign firms did not diminish the productivity of these industries. On the other hand, the Plastics and Rubber industry which was initially not productive without foreign presence became productive once foreign firms were introduced into the industry.

4.3.2 2SLS Estimates: Model 2

Table 4.5: Impact of FDI on the log of Labour Productivity (LLP)

	Specifications of the Estimated Model				
Independent Variable	**A**	**B**	**C**	**D**	**E**
AGEFIRM	0.0002 (0.001)	0.00004 (0.001)	0.0002 (0.001)	0.0002 (0.001)	0.0002 (0.001)
FIRMSIZE	-1.916*** (0.558)	-1.850*** (0.592)	-1.892*** (0.520)	-1.891*** (0.520)	-1.891*** (0.520)
R&D	-0.003 (0.006)				
EXPORTS	0.080 (0.199)	0.075 (0.207)	0.060 (0.191)	0.060 (0.191)	0.060 (0.191)
FOREIGN	42.954*** (10.157)	44.566*** (10.952)	40.089*** (11.023)	40.141*** (11.032)	40.098*** (11.012)

DOMESTIC	31.638***	32.876***	29.561***	29.597***	29.567***
	(7.863)	(8.480)	(8.379)	(8.386)	(8.371)
OTHER	5.649	5.715	5.284	5.287	5.284
	(3.702)	(3.950)	(3.520)	(3.524)	(3.520)
RETAIL		2.077*	-0.027		
		(1.130)	(0.042)		
PLASTRUBB		-9.715*		-0.027	
		(5.419)		(0.042)	
MACHEQ		4.098*			-0.027
		(1.351)			(0.042)
FURNITURE		4.120***			
		(1.237)			
SERVICESMV		-5.768*			
		(3.210)			
WHOLESALE		4.083**			
		(1.704)			
ELECTRONICS		6.513***			
		(2.400)			
CONSTRUCTION		5.063***			
		(1.436)			
GARMENTS		2.351*			
		(1.265)			
RETAILSALES			0.001		
			(0.003)		
PLASTRUBBLSALES				0.001	
				(0.003)	
MACHEQLSALES					0.001
					(0.003)
Constant	-20.161**	-22.753**	-17.127*	-17.160*	-17.126*
	(8.949)	(3.684)	(10.353)	(10.358)	(10.343)
R-squared	.	.	.	.	.
Prob>Chi2	0.0008	0.290	0.0001	0.0001	0.0001
No. Of observations	1370	1370	1370	1370	1370

Independent Variable	F	G	H	I	J	I
AGEFIRM	0.0002 (0.001)	0.0002 (0.001)	0.0002 (0.001)	0.0002 (0.001)	0.0002 (0.001)	0.0002 (0.001)
FIRMSIZE	-1.891*** (0.520)	-1.891*** (0.520)	-1.891*** (0.519)	-1.891*** (0.520)	-1.891*** (0.520)	-1.891*** (0.520)
EXPORTS	0.060 (0.191)	0.060 (0.191)	0.060 (0.191)	0.060 (0.191)	0.060 (0.191)	0.060 (0.191)
FOREIGN	40.093*** (11.012)	40.139*** (11.031)	40.071*** (11.004)	40.090*** (11.009)	40.102*** (11.012)	40.102*** (11.015)
DOMESTIC	29.563*** (8.370)	29.600*** (8.385)	29.547*** (8.365)	29.561*** (8.369)	29.569*** (8.371)	29.570*** (8.373)
OTHER	5.284 (3.519)	5.286 (3.523)	5.281 (3.518)	5.283 (3.519)	5.284 (3.520)	5.284 (3.520)
FURNITURE	-0.028 (0.042)					
SERVICESMV		-0.027 (0.042)				
WHOLESALE			-0.028 (0.042)			
ELECTRONICS				-0.028 (0.042)		
CONSTRUCTION					-0.027 (0.042)	
GARMENTS						-0.027 (0.042)
FURNLSALES	0.001 (0.003)					
SERMVLSALES		0.001 (0.003)				
WHOLELSALES			0.001 (0.003)			
ELECLSALES				0.001 (0.003)		

CONLSALES					0.001 (0.003)	
GARMLSALES						0.001 (0.003)
Constant	-17.121* (10.344)	-17.157* (10.356)	-17.101* (10.340)	-17.116* (10.342)	-17.128* (10.344)	-17.129* (10.347)
R-squared	.	.	.	.	.	.
Prob>Chi2	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
No. of observations	1370	1370	1370	1370	1370	1370

Notes: Figures in parenthesis represent robust standard errors.

*, **, *** represent significance at the 10%, 5% and 1% levels respectively.

Source: Author's compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

As important as Total Factor Productivity (TFP) is in measuring the productivity of the firm, it is not the only measure that can be used in this regard. Table 4.5 shows the regression results of the model where the log of Labour Productivity (LLP) is used as an alternate measure of firm productivity. LLP therefore represents the dependent variable in this case. Similar to model 1(which measures TFP), model specification A. in model 2 (which measures LLP) represents the initially specified model excluding industry variables. Model specification B is the initially specified model including significant industry variables but excluding the R&D variable. As with model 1, these two specifications of model 2 are estimated separately due to the significant correlation that is present between the R&D variable and the industry variables.

Model specifications C to I represent estimations involving interaction terms between the LSALES variable (an instrument for FDI) and various industry variables found to have a significant effect on labour productivity. The interaction terms include; RETAILSALES, PLASTRUBBLSALES, MACHEQLSALES, FURNLSALES, SERMVLSALES, WHOLELSALES, ELECLSALES, CONLSALES and GARMLSALES and represent interactions between the LSALES variable and the Retail, Plastics and Rubber, Machinery and Equipment, Furniture, Services of Motor Vehicles, Wholesale, Electronics, Construction and Garments industry variables respectively.

Firm specific variable AGEFIRM is insignificant across all model specifications whereas FIRMSIZE is negative and insignificant across all specifications, indicating that the labour productivity of manufacturing firms was significantly influenced by the size of the firm for the periods under study. As with TFP, smaller firms in the manufacturing sector were more labour productive than larger firms. Similarly the coefficient on the R&D variable is insignificant, indicating that research and development was not an influential factor contributing towards labour productivity of the firm. The industries that contributed significantly towards labour productivity in the manufacturing sector during 2007 and 2013 included the Retail, Plastics and Rubber, Machinery and Equipment, Furniture, Services of Motor Vehicles, Wholesale, Electronics, Construction and Garments industries. Out of these industries, the Plastics and Rubber and the Services of Motor Vehicles industries were the least productive in terms of labour productivity compared to the Paper industry (base category for industry variables). On the other hand, the Retail, Machinery and Equipment, Furniture, Wholesale, Electronics, Construction and Garments industries positively contributed towards labour productivity of manufacturing firms for the periods of 2007 and 2013 respectively, compared to the paper industry.

The coefficients on the interaction terms between the LSALES variable (an instrument for FDI) and the variables representing the various industries all show an insignificant relationship between FDI and these industries. This indicates that irrespective of whether these industries were primarily labour productive or not in the absence of foreign presence, their labour productivity was not significantly altered once foreign firms were established in these industries.

4.3.3 Robustness Checks on the Estimated Model

When dealing with panel data, the most common alternatives to consider in terms of the best model to apply are the Fixed Effects (FE), Random Effects (RE) and Pooled OLS models. Given that panel data is commonly associated with unobserved heterogeneity, which implies that certain characteristics within individual observations remain fixed overtime, the FE method is usually first to be considered. However, it is possible that unobserved heterogeneity may be absent within individual observations, in which case the RE method would be the most appropriate to apply. In the same manner, the Pooled OLS method cannot be ruled out as a possible alternative because given the case where there is an absence of random effects within observations, then applying the RE method will most likely yield biased results.

Therefore as previously discussed in the Methodology the Hausman test was used to verify the aptness of the FE model which was found to be inappropriate, rendering the RE model more suitable (see Appendix A, Test 1). However, after testing for random effects using the Breusch Lagrange Multiplier test (see Appendix A, Test 2), the RE model was also found to be inappropriate. Therefore, the pooled OLS method would be the best model to estimate out of the three possible models. Conversely, due to endogeneity within the model of interest, applying the pooled OLS method to estimate the model of interest would yield biased estimates. Hence in order to ensure robust estimates of the model of interest, the two stage least squares (2SLS) method is applied.

Moreover, the 2SLS model is run with robust standard errors to account for both heteroskedasticity and serial correlation, thereby ensuring robust estimates across various model specifications. In addition, to further guarantee robustness of estimated parameters, the 2SLS estimates are compared with the General method of moments (GMM) and the Limited information maximum likelihood (LIML) estimates to check for any significant disparities between coefficients and standard errors of the two models.

Table 4.6: Comparison of 2SLS Estimates, GMM Estimates and LIML Estimates

Independent Variable	Model 1			Model 2		
	2SLS Estimator	GMM Estimator	LIML Estimator	2SLS Estimator	GMM Estimator	LIML Estimator
AGEFIRM	-0.0002 (0.001)	-0.0002 (0.001)	-0.0002 (0.001)	0.0002 (0.001)	0.0002 (0.001)	0.0002 (0.001)
FIRMSIZE	-1.424** (0.643)	-1.424** (0.643)	-1.424** (0.643)	-1.916*** (0.558)	-1.916*** (0.558)	-1.916*** (0.558)
R&D	-0.007 (0.006)	-0.007 (0.006)	-0.007 (0.006)	-0.003 (0.006)	-0.003 (0.006)	-0.003 (0.006)
EXPORTS	-0.288 (0.219)	-0.288 (0.219)	-0.288 (0.219)	0.080 (0.199)	0.080 (0.199)	0.080 (0.199)
FOREIGN	38.024*** (11.603)	38.024*** (11.603)	38.024*** (11.603)	42.954*** (10.157)	42.954*** (10.157)	42.954*** (10.157)
DOMESTIC	28.249*** (8.770)	28.249*** (8.770)	28.249*** (8.770)	31.638*** (7.863)	31.638*** (7.863)	31.638*** (7.863)
OTHER	9.077** (3.819)	9.077** (3.818)	9.077** (3.818)	5.649 (3.702)	5.649 (3.702)	5.649 (3.702)

Constant	-29.753*** (9.531)	-29.753*** (9.531)	-29.753*** (9.531)	-20.161** (8.949)	-20.161** (8.949)	-20.161** (8.949)

Notes: Figures in parenthesis represent robust standard errors.

*, **, *** represent significance at the 10%, 5% and 1% levels respectively.

Source: Author's Compilation based on firm-level data on Kenya's manufacturing sector, obtained from World Bank Enterprise Surveys database, 2014.

Table 4.6 shows the comparison between 2SLS estimates and GMM and LIML estimates respectively for model 1 where the log of total factor productivity LTFP represents the dependent variable and model 2 where LLP the log of labour productivity represents the dependent variable. For either model, this comparison is made over the initially specified model which does not include industry variables or interaction terms. The coefficients and standard errors of the GMM and LIML estimates are the same as those of the 2SLS estimates for both model 1 and 2. This illustrates that the 2SLS estimates are robust not only across different model specifications as indicated in tables 4.4 and 4.5 but also across different estimators.

4.4 Conclusion

This chapter focussed on applying the two stage least squares (2SLS) technique to estimate the effect of FDI on the productivity of firms within Kenya's manufacturing sector, using firm-level panel data for the periods 2007 and 2013, sourced from the World Bank's Enterprise Surveys database. Based on descriptive analysis of the population sub-sample, it was observed that FDI in Kenya's manufacturing sector for the periods under study was not adequately substantial, given that foreign owned firms made up only 11% of total firms found within the sector. Furthermore, it was established that foreign investors preferred investing in large enterprises which were also dominantly shareholding corporations. In addition, it was observed that out of the 23 industries making up the manufacturing sector, the Food industry was the most preferred industry by foreign investors, given the high concentration of FDI in the industry. The Food industry was also observed to be the industry that invested the most in research and development activities within the manufacturing sector and was also amongst the industries with the highest levels of productivity for the periods under study. Foreign owned firms were also observed to invest relatively more in R&D

activities compared to domestic firms. Furthermore, it was noted that foreign owned firms had the highest levels of productivity and were largely engaged in exporting relative to other firms in the manufacturing sector for both periods of study. Large sized firms were also observed to have substantial exports for either period of study relative to small or medium sized firms in the sector.

The empirical findings of the study presented in this chapter highlighted that FDI did have a positive influence on the level of productivity of firms within Kenya's manufacturing sector, both in terms of total factor productivity (TFP) and labour productivity (LP). Foreign, domestic and other firms were all significantly productive compared to government firms in the manufacturing sector for the periods under study, however foreign owned firms were generally the most productive across the board. In terms of TFP, smaller firms were found to be more productive than larger firms, whereas research and development did not significantly influence the productivity of firms both in terms of TFP and LP as expected. Moreover in the case of total factor productivity, firms that were involved in exporting were not productive as per expectations, although exports did not significantly influence labour productivity in the manufacturing sector.

It was also noted that the Food, Furniture and Wholesale industries were the most productive and the Plastics and Rubber industry the least productive in the manufacturing sector in terms of TFP. In terms of labour productivity however, the Retail, Machinery and Equipment, Furniture, Wholesale, Electronics, Construction and Garments industries were found to be the most productive, whereas the Plastics and Rubber and Services of Motor Vehicles industries were noted as the least productive. Moreover, through interaction terms between the LSALES variable (an instrument for FDI) and the industry variables, it was established that foreign presence (FDI) had positive effects on the productivity (TFP) of domestic and other firms in the manufacturing sector during the periods under study. However in the case of labour productivity, FDI did not seem to have any effect on the productivity of domestic and other firms in the manufacturing sector.

In addition, the robustness of the modelling technique applied in the estimation of the relationship between FDI and firm-level productivity and the empirical results obtained thereof were tested by running the 2SLS model with robust standard errors to account for heteroskedasticity and serial correlation. The robustness of the estimated parameters was guaranteed by comparing the 2SLS estimator with General Method of Moments (GMM) and Limited information maximum likelihood (LIML) estimators. It was established that the 2SLS coefficients and standard errors were the same as the coefficients and standard errors of the GMM and LIML estimators, illustrating the robustness of the 2SLS estimator.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter gives an overall synopsis of the study as a whole. The first section summarises the conclusions drawn from each chapter of the study. The last section gives concluding remarks based on the overall study objective of estimating the relationship between FDI and firm-level productivity of Kenya's manufacturing firms for the periods 2007 and 2013.

5.2 Summary of the Study

The purpose of this study was to estimate and therefore establish the relationship between FDI and firm-level productivity in Kenya's manufacturing sector for the periods of 2007 and 2013 respectively. The study employed both descriptive and panel based methods in the analysis of the empirical relationships of interest.

Chapter 1 outlined the background of FDI in Kenya, where it was established that the East African country has historically not been successful in attracting significant amounts of FDI relative to its regional counterparts. Furthermore, the chapter established the ambiguity n the relationship between FDI and productivity in Kenya and hence provided a rationale for the study which comprised of the following specific objectives:

1) To review relevant literature pertaining to the issues of FDI and firm-level productivity;
2) To establish the appropriate methods and modelling techniques relevant to apply in estimating the relationship between FDI and productivity; and
3) To empirically estimate the relationship between FDI and total factor productivity of firms within the manufacturing sector in Kenya for the periods 2007 and 2013 respectively.

Chapter 2 addressed the first objective by reviewing literature pertinent to FDI, economic growth and productivity. The chapter revealed that the fundamental benefits of FDI such as technology and knowledge spillovers do not necessarily accrue to each and every host economy but are rather dependent on factors such as absorptive capacity, sound business environment and level of human capital base prevalent within the host economy. Furthermore, the empirical literature reviewed in the chapter revealed mixed results concerning the association between FDI and economic growth through the productivity spillover channel; where results from certain studies illustrated the positive spillover effects from FDI whereas others revealed negative associations between FDI and productivity.

Chapter 3 addressed the second objective by establishing the relevant modelling techniques used in the study in estimating the relationship between FDI and productivity in Kenya. The chapter established that the relationship of interest would be estimated in two stages; where productivity would first be calculated through a production function and thereafter applied as a response variable in a second function which would ultimately define the relationship existent between FDI and productivity. Furthermore, it was revealed after comparing various modelling approaches used across similar studies and conducting model specification tests that the two stage least squares (2SLS) technique was the most suitable to apply given the presence of endogeneity in the model of concern.

Chapter 4 addressed the third and fourth objectives of the study by empirically estimating the relationship that was existent between FDI and firm-level productivity in Kenya's manufacturing sector during the periods of 2007 and 2013. The third objective was to a great extent achieved. The chapter revealed that FDI had a positive effect on the productivity of firms both in terms of total factor productivity (TFP) and labour productivity (LP). The chapter also highlighted that FDI yielded positive productivity spillovers for domestic and other firms in the manufacturing sector in the case where TFP was considered as a measure for productivity, but did not have any effect on the productivity of domestic and other firms when LP was used as a productivity measure. In the case of TFP, The chapter further demonstrated the robustness of the results obtained from the estimations by running various specifications of the models of interest and comparing the coefficients and standard errors of the 2SLS model to those of the General Method of Moments (GMM) and the Limited Information Maximum Likelihood (LIML) models.

5.3 Concluding Remarks

The main objective of the study which was to establish the impact of FDI on firm-level productivity in Kenya's manufacturing sector for the periods of 2007 and 2013, was to a considerable level achieved. The positive association that was found to exist between FDI and productivity during these periods indicated that foreign owned firms in Kenya's manufacturing sector were indeed productive and more so than domestic and other firms. However, domestic and other firms were also productive. The study established that in terms of total factor productivity (TFP), foreign presence in the manufacturing sector did yield positive productivity spillovers for domestic and other firms but in terms of labour productivity, foreign presence had no effect on the productivity of domestic and other firms. Moreover, the results of the study confirm that foreign presence did not have detrimental effects on the productivity of local firms which suggests that the negative spillover effects of FDI through competition were not evident in Kenya's manufacturing sector during 2007 and 2013 respectively.

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APPENDICES

APPENDIX A: Diagnostic Tests

Test 1: Hausman Test

	Coefficients (b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Agefirm	-.0000854	-.0000164	-.0000689	.0000282
firmsize	-.1194136	-.0449996	-.0744139	.0396166
RnD	.979082	-.0084099	.9874919	.5416569
Exports	.0579032	.0583351	-.0004319	.
Domestic	1.396001	1.404427	-.0084265	.
Foreign	1.321573	1.39363	-.0720568	.0265955
Other	4.000563	3.976721	.0238415	.

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(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 3.32
Prob>chi2 = 0.7673
(V_b-V_B is not positive definite)

Test 2: Breusch and Pagan Lagrange Multiplier Test for Random Effects

Breusch and Pagan Lagrangian multiplier test for random effects

lTFP[panel,t] = Xb + u[panel] + e[panel,t]

Estimated results:

	Var	sd = sqrt(Var)
lTFP	43.1259	6.567031
e	42.3212	6.505475
u	0	0

Test: Var(u) = 0
chibar2(01) = 0.00
Prob > chibar2 = 1.0000

Test 3 (i): Breusch-Pagan/Cook-Weisberg Test for Heteroskedasticity - Model 1

```
      Source |       SS       df       MS              Number of obs =    1370
-------------+------------------------------           F(  7,  1362) =    4.38
       Model |  1299.53944     7  185.648491           Prob > F      =  0.0001
    Residual |  57739.8185  1362  42.3934056           R-squared     =  0.0220
-------------+------------------------------           Adj R-squared =  0.0170
       Total |  59039.3579  1369  43.1259006           Root MSE      =   6.511

------------------------------------------------------------------------------
        lTFP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     Agefirm |  -.0000164    .000611    -0.03   0.979     -.001215    .0011821
    firmsize |  -.0449996   .2381375    -0.19   0.850    -.5121558    .4221565
         RnD |  -.0084099   .0036682    -2.29   0.022    -.0156058   -.001214
     Exports |   .0583351   .0290781     2.01   0.045     .0012925    .1153778
    Domestic |   1.404427   .8593253     1.63   0.102    -.2813175    3.090172
     Foreign |    1.39363   .7084655     1.97   0.049      .003828    2.783432
       Other |   3.976721   1.051665     3.78   0.000     1.913662     6.03978
       _cons |  -17.24177   1.508395   -11.43   0.000     -20.2008   -14.28274
------------------------------------------------------------------------------

. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lTFP

         chi2(1)      =   296.42
         Prob > chi2  =   0.0000
```

Test 3 (ii): Breusch-Pagan/Cook-Weisberg Test for Heteroskedasticity – Model 2

```
      Source |       SS       df       MS              Number of obs =    1370
-------------+------------------------------           F(  7,  1362) =   19.08
       Model |  374.143252     7  53.4490361           Prob > F      =  0.0000
    Residual |  3815.52618  1362  2.80141423           R-squared     =  0.0893
-------------+------------------------------           Adj R-squared =  0.0846
       Total |  4189.66943  1369  3.06038673           Root MSE      =  1.6737

------------------------------------------------------------------------------
         LLP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     Agefirm |   .0003714   .0001571     2.36   0.018     .0000633    .0006795
    firmsize |   .2497249   .0612163     4.08   0.000     .1296363    .3698134
         RnD |  -.0045522   .0009429    -4.83   0.000     -.006402   -.0027025
     Exports |   .0531942   .0074749     7.12   0.000     .0385306    .0678577
    Domestic |   .2989405   .2209007     1.35   0.176     -.134402     .732283
     Foreign |   .6377731   .1821203     3.50   0.000     .2805065    .9950397
       Other |   .0610763   .2703442     0.23   0.821    -.4692599    .5914124
       _cons |   11.35891   .3877524    29.29   0.000     10.59826    12.11957
------------------------------------------------------------------------------

. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of LLP

         chi2(1)      =    77.26
         Prob > chi2  =   0.0000

.
```

APPENDIX B: Tests of Endogeneity and Instrument Validity

Test 1: Durbin Wu-Hausman Test for Endogeneity

```
. estat endogenous Foreign

  Tests of endogeneity
  Ho: variables are exogenous

  Durbin (score) chi2(1)          =  36.9005  (p = 0.0000)
  Wu-Hausman F(1,1233)            =  37.0779  (p = 0.0000)

. estat endogenous Exports

  Tests of endogeneity
  Ho: variables are exogenous

  Durbin (score) chi2(1)          =  5.85071  (p = 0.0156)
  Wu-Hausman F(1,1233)            =  5.73375  (p = 0.0168)
```

Test 2: Cragg Donald-Wald Test for Weak Instruments

Shea's partial R-squared

Variable	Shea's Partial R-sq.	Shea's Adj. Partial R-sq.
Foreign	0.0177	-0.0045
Exports	0.0626	0.0413

Minimum eigenvalue statistic = 10.6017

Critical Values # of endogenous regressors: 2
Ho: Instruments are weak # of excluded instruments: 2

	5%	10%	20%	30%
2SLS relative bias	(not available)			
	10%	15%	20%	25%
2SLS Size of nominal 5% Wald test	7.03	4.58	3.95	3.63
LIML Size of nominal 5% Wald test	7.03	4.58	3.95	3.63

Test 3: Test for Underidentification, Weak Identification and Overidentification

```
IV (2SLS) estimation
--------------------

Estimates efficient for homoskedasticity only
Statistics consistent for homoskedasticity only

                                                      Number of obs =     1264
                                                      F( 29,  1234) =     1.16
                                                      Prob > F      =   0.2517
Total (centered) SS     =  52869.74925                Centered R2   =  -1.6563
Total (uncentered) SS   =  288483.3444                Uncentered R2 =   0.5132
Residual SS             =   140437.605                Root MSE      =    10.54
```

lTFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	26.85522	7.239877	3.71	0.000	12.66532	41.04511
Exports	-.4637272	.2173533	-2.13	0.033	-.8897318	-.0377227
Agefirm	.0009212	.0013575	0.68	0.497	-.0017395	.0035819
firmsize	-1.261916	.6038471	-2.09	0.037	-2.445434	-.0783971
RnD	-1.261427	1.040657	-1.21	0.225	-3.301077	.7782235
Govt	-6.883761	3.254303	-2.12	0.034	-13.26208	-.5054439
Other	.8285759	1.861155	0.45	0.656	-2.819221	4.476373
Food	2.885936	1.19238	2.42	0.016	.548913	5.222958
Textiles	1.781279	2.226015	0.80	0.424	-2.581631	6.144188
Garments	-1.302451	2.481135	-0.52	0.600	-6.165386	3.560484
Leather	.0477991	4.703433	0.01	0.992	-9.17076	9.266358
Wood	-3.029525	3.446785	-0.88	0.379	-9.7851	3.726051
Retail	-.0399467	1.219503	-0.03	0.974	-2.430128	2.350234
PPRMedia	.7373486	2.808733	0.26	0.793	-4.767667	6.242364
IT	-5.219279	4.68147	-1.11	0.265	-14.39479	3.956233
Chemicals	-1.40766	1.894608	-0.74	0.457	-5.121024	2.305704
PlastRubb	-9.51341	3.274094	-2.91	0.004	-15.93052	-3.096304
NonMetMin	.0047881	4.069408	0.00	0.999	-7.971105	7.980681
BasicMet	-2.956506	4.304964	-0.69	0.492	-11.39408	5.481069
MachEq	-.3956157	3.031774	-0.13	0.896	-6.337784	5.546552
TransMach	1.585053	3.140144	0.50	0.614	-4.569516	7.739622
Furniture	4.883963	2.76165	1.77	0.077	-.528772	10.2967
ServicesMV	.948786	2.360822	0.40	0.688	-3.67834	5.575912
Wholesale	1.790984	1.943909	0.92	0.357	-2.019007	5.600974
HotRes	.2574449	1.595875	0.16	0.872	-2.870412	3.385302
Transport	-.5309716	1.99928	-0.27	0.791	-4.449489	3.387546
Electronics	2.541788	6.200137	0.41	0.682	-9.610256	14.69383
Construction	6.829624	5.170971	1.32	0.187	-3.305293	16.96454
FabMet	1.347887	2.56118	0.53	0.599	-3.671934	6.367708
_cons	5.48135	8.8498	0.62	0.536	-11.86394	22.82664

```
Underidentification test (Anderson canon. corr. LM statistic):          21.352
                                                   Chi-sq(1) P-val =    0.0000
------------------------------------------------------------------------------
Weak identification test (Cragg-Donald Wald F statistic):               10.602
Stock-Yogo weak ID test critical values: 10% maximal IV size              7.03
                                         15% maximal IV size              4.58
                                         20% maximal IV size              3.95
                                         25% maximal IV size              3.63
Source: Stock-Yogo (2005).  Reproduced by permission.
------------------------------------------------------------------------------
Sargan statistic (overidentification test of all instruments):           0.000
                                                (equation exactly identified)
------------------------------------------------------------------------------
Instrumented:         Foreign Exports
Included instruments: Agefirm firmsize RnD Govt Other Food Textiles Garments
                      Leather Wood Retail PPRMedia IT Chemicals PlastRubb
                      NonMetMin BasicMet MachEq TransMach Furniture ServicesMV
                      Wholesale HotRes Transport Electronics Construction FabMet
Excluded instruments: LSALES CAPUTIL
------------------------------------------------------------------------------
```

APPENDIX C: Correlation Matrix

	Agefirm	firmsize	RnD	Govt	Other	Domestic	LSALES	CAPUTIL	Food	Textiles	Garments	Leather	Wood	Retail
Agefirm	1.0000													
firmsize	-0.0633	1.0000												
RnD	-0.1737	0.0424	1.0000											
Govt	0.1376	0.0666	-0.0457	1.0000										
Other	0.1245	-0.0274	-0.1645	0.2046	1.0000									
Domestic	-0.0353	-0.1026	-0.0176	-0.1127	-0.1855	1.0000								
LSALES	0.0144	0.6496	-0.0851	0.0839	0.0181	-0.1327	1.0000							
CAPUTIL	-0.0464	0.2254	-0.1001	-0.0217	0.0149	0.0001	0.1774	1.0000						
Food	-0.1739	0.0412	1.0000	-0.0451	-0.1633	-0.0176	-0.0861	-0.0999	1.0000					
Textiles	-0.1741	0.0413	1.0000	-0.0458	-0.1645	-0.0172	-0.0861	-0.1000	1.0000	1.0000				
Garments	-0.1741	0.0413	1.0000	-0.0459	-0.1645	-0.0173	-0.0862	-0.1001	1.0000	1.0000	1.0000			
Leather	-0.1740	0.0413	1.0000	-0.0456	-0.1644	-0.0173	-0.0861	-0.1002	1.0000	1.0000	1.0000	1.0000		
Wood	-0.1740	0.0412	1.0000	-0.0459	-0.1644	-0.0173	-0.0863	-0.1002	1.0000	1.0000	1.0000	1.0000	1.0000	
Retail	-0.1739	0.0402	1.0000	-0.0461	-0.1650	-0.0169	-0.0867	-0.1005	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
PPRMedia	-0.1741	0.0411	1.0000	-0.0459	-0.1645	-0.0172	-0.0862	-0.1000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
IT	-0.1740	0.0412	1.0000	-0.0458	-0.1644	-0.0172	-0.0862	-0.1002	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Chemicals	-0.1742	0.0415	1.0000	-0.0459	-0.1646	-0.0172	-0.0858	-0.1001	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
PlastRubb	-0.1740	0.0413	1.0000	-0.0459	-0.1644	-0.0173	-0.0861	-0.1003	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
NonMetMin	-0.1741	0.0413	1.0000	-0.0459	-0.1644	-0.0172	-0.0861	-0.1001	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
BasicMet	-0.1740	0.0413	1.0000	-0.0458	-0.1644	-0.0173	-0.0860	-0.1002	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
MachEq	-0.1741	0.0413	1.0000	-0.0459	-0.1645	-0.0172	-0.0862	-0.1001	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
TransMach	-0.1741	0.0412	1.0000	-0.0459	-0.1643	-0.0172	-0.0861	-0.1002	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Furniture	-0.1739	0.0413	1.0000	-0.0459	-0.1645	-0.0172	-0.0862	-0.1001	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ServicesMV	-0.1740	0.0411	1.0000	-0.0458	-0.1646	-0.0171	-0.0862	-0.1002	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Wholesale	-0.1740	0.0411	1.0000	-0.0459	-0.1643	-0.0173	-0.0861	-0.1003	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
HotRes	-0.1738	0.0412	1.0000	-0.0460	-0.1647	-0.0172	-0.0866	-0.1003	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Transport	-0.1742	0.0414	1.0000	-0.0458	-0.1643	-0.0174	-0.0861	-0.1001	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Electronics	-0.1739	0.0413	1.0000	-0.0458	-0.1644	-0.0172	-0.0861	-0.1002	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Construction	-0.1740	0.0412	1.0000	-0.0458	-0.1644	-0.0172	-0.0861	-0.1002	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
FabMet	-0.1739	0.0413	1.0000	-0.0459	-0.1643	-0.0172	-0.0860	-0.1001	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Paper	-0.1740	0.0413	1.0000	-0.0458	-0.1644	-0.0173	-0.0861	-0.1001	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
FOODLSALES	-0.1712	0.1303	0.9846	-0.0336	-0.1593	-0.0389	0.0341	-0.0593	0.9847	0.9846	0.9846	0.9846	0.9846	0.9846
PLASTRUBBL~S	-0.1713	0.1301	0.9847	-0.0346	-0.1604	-0.0384	0.0335	-0.0597	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847
FURNLSALES	-0.1712	0.1300	0.9847	-0.0346	-0.1605	-0.0383	0.0334	-0.0596	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847
TEXTLSALES	-0.1715	0.1301	0.9847	-0.0345	-0.1605	-0.0384	0.0335	-0.0594	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847
GARMENTLSA~S	-0.1714	0.1301	0.9847	-0.0346	-0.1605	-0.0384	0.0334	-0.0596	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847

	PPRMedia	IT	Chemic~s	PlastR~b	NonMet~n	BasicMet	MachEq	TransM~h	Furnit~e	Servic~V	Wholes~e	HotRes	Transp~t	Electr~s
PPRMedia	1.0000													
IT	1.0000	1.0000												
Chemicals	1.0000	1.0000	1.0000											
PlastRubb	1.0000	1.0000	1.0000	1.0000										
NonMetMin	1.0000	1.0000	1.0000	1.0000	1.0000									
BasicMet	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000								
MachEq	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000							
TransMach	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000						
Furniture	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000					
ServicesMV	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000				
Wholesale	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000			
HotRes	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		
Transport	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
Electronics	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Construction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
FabMet	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Paper	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
FOODLSALES	0.9846	0.9846	0.9846	0.9846	0.9846	0.9846	0.9846	0.9846	0.9846	0.9846	0.9846	0.9846	0.9846	0.9846
PLASTRUBBL~S	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847
FURNLSALES	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847
TEXTLSALES	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847
GARMENTLSA~S	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847	0.9847

	Constr~n	FabMet	Paper	FOODLS~S	PLASTR~S	FURNLS~S	TEXTLS~S	GARMEN~S
Construction	1.0000							
FabMet	1.0000	1.0000						
Paper	1.0000	1.0000	1.0000					
FOODLSALES	0.9846	0.9846	0.9846	1.0000				
PLASTRUBBL~S	0.9847	0.9847	0.9847	1.0000	1.0000			
FURNLSALES	0.9847	0.9847	0.9847	1.0000	1.0000	1.0000		
TEXTLSALES	0.9847	0.9847	0.9847	1.0000	1.0000	1.0000	1.0000	
GARMENTLSA~S	0.9847	0.9847	0.9847	1.0000	1.0000	1.0000	1.0000	1.0000

.

APPENDIX D: Two Stage Least Squares (2SLS) Instrumental Variable Regressions – Model 1

Regression 1

Instrumental variables (2SLS) regression

Number of obs =	1370
Wald chi2(7) =	13.04
Prob > chi2 =	0.0712
R-squared =	.
Root MSE =	11.323

lTFP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	38.02402	11.6031	3.28	0.001	15.28237	60.76567
Exports	-.2875145	.218544	-1.32	0.188	-.7158529	.1408239
Agefirm	-.0001941	.0013923	-0.14	0.889	-.002923	.0025348
firmsize	-1.424406	.6426001	-2.22	0.027	-2.683879	-.1649335
RnD	-.006543	.0060083	-1.09	0.276	-.0183191	.0052331
Domestic	28.2488	8.770148	3.22	0.001	11.05962	45.43797
Other	9.076875	3.818454	2.38	0.017	1.592843	16.56091
_cons	-29.75327	9.53098	-3.12	0.002	-48.43365	-11.07289

Regression 2

```
Instrumental variables (2SLS) regression            Number of obs =    1370
                                                    Wald chi2(28) =   36.74
                                                    Prob > chi2   =  0.1247
                                                    R-squared     =       .
                                                    Root MSE      =  11.558
```

lTFP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	39.64281	12.51835	3.17	0.002	15.10729	64.17832
Exports	-.3375245	.2257932	-1.49	0.135	-.780071	.105022
Agefirm	-.0003462	.0014565	-0.24	0.812	-.003201	.0025085
firmsize	-1.327663	.6769171	-1.96	0.050	-2.654396	-.0009293
Domestic	29.52995	9.48486	3.11	0.002	10.93996	48.11993
Other	8.565554	4.063204	2.11	0.035	.6018218	16.52929
Food	2.682159	1.514152	1.77	0.076	-.2855246	5.649842
Textiles	.5977228	3.72744	0.16	0.873	-6.707926	7.903371
Garments	1.103795	1.463328	0.75	0.451	-1.764276	3.971866
Leather	-1.217242	2.794093	-0.44	0.663	-6.693565	4.25908
Wood	-2.201764	4.49472	-0.49	0.624	-11.01125	6.607725
PPRMedia	1.37885	1.741398	0.79	0.428	-2.034228	4.791929
Chemicals	-1.425451	2.317011	-0.62	0.538	-5.966709	3.115808
PlastRubb	-8.935378	5.730907	-1.56	0.119	-20.16775	2.296995
NonMetMin	-2.694469	2.866227	-0.94	0.347	-8.312171	2.923232
BasicMet	-2.042539	7.944793	-0.26	0.797	-17.61405	13.52897
FabMet	-1.015652	4.041305	-0.25	0.802	-8.936464	6.90516
MachEq	.2621203	1.809212	0.14	0.885	-3.283871	3.808111
Electronics	3.177968	2.340055	1.36	0.174	-1.408455	7.764391
TransMach	-.7676233	3.458422	-0.22	0.824	-7.546005	6.010759
Furniture	4.441099	2.603475	1.71	0.088	-.6616185	9.543817
Construction	7.436134	5.612016	1.33	0.185	-3.563215	18.43548
ServicesMV	-2.161998	3.612071	-0.60	0.549	-9.241526	4.917531
Wholesale	4.264836	2.102707	2.03	0.043	.143605	8.386066
Retail	.7258057	1.364388	0.53	0.595	-1.948346	3.399957
HotRes	1.21985	1.753532	0.70	0.487	-2.217009	4.656709
Transport	2.135121	2.654495	0.80	0.421	-3.067594	7.337835
IT	-6.961892	6.503257	-1.07	0.284	-19.70804	5.784256
_cons	-29.99707	10.70181	-2.80	0.005	-50.97223	-9.021905

```
Instrumented:  Foreign Exports
Instruments:   Agefirm firmsize Domestic Other Food Textiles Garments
               Leather Wood PPRMedia Chemicals PlastRubb NonMetMin BasicMet
               FabMet MachEq Electronics TransMach Furniture Construction
               ServicesMV Wholesale Retail HotRes Transport IT LSALES
               CAPUTIL

.
```

Regression 3

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 39.04
Prob > chi2 = 0.0000
R-squared = .
Root MSE = 9.4032

lTFP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	27.24261	11.92506	2.28	0.022	3.869918	50.6153
Exports	-.3625561	.1940143	-1.87	0.062	-.7428172	.017705
Agefirm	-.0002268	.0011927	-0.19	0.849	-.0025645	.0021108
firmsize	-1.326454	.5597814	-2.37	0.018	-2.423606	-.229303
Domestic	20.42735	8.860006	2.31	0.021	3.062059	37.79264
Other	7.690994	3.229471	2.38	0.017	1.361347	14.02064
Food	-.1000548	.0381873	-2.62	0.009	-.1749004	-.0252091
FOODLSALES	.0054122	.0022842	2.37	0.018	.0009352	.0098892
_cons	-18.27171	10.716	-1.71	0.088	-39.27468	2.731251

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other Food FOODLSALES LSALES CAPUTIL

Regression 4

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 38.90
Prob > chi2 = 0.0000
R-squared = .
Root MSE = 9.4188

lTFP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	27.33242	11.92991	2.29	0.022	3.950225	50.71462
Exports	-.3628124	.1942644	-1.87	0.062	-.7435636	.0179387
Agefirm	-.0002297	.0011943	-0.19	0.847	-.0025705	.0021111
firmsize	-1.326278	.5602914	-2.37	0.018	-2.424429	-.2281269
Domestic	20.49027	8.864568	2.31	0.021	3.116035	37.8645
Other	7.695848	3.234604	2.38	0.017	1.35614	14.03556
PlastRubb	-.0996132	.038217	-2.61	0.009	-.1745171	-.0247092
PLASTRUBBLSALES	.0053803	.002287	2.35	0.019	.0008979	.0098626
_cons	-18.32503	10.71638	-1.71	0.087	-39.32876	2.678696

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other PlastRubb PLASTRUBBLSALES LSALES CAPUTIL

Regression 5

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 38.98
Prob > chi2 = 0.0000
R-squared = .
Root MSE = 9.4129

lTFP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	27.2977	11.91244	2.29	0.022	3.949748	50.64565
Exports	-.3628354	.1941886	-1.87	0.062	-.7434381	.0177673
Agefirm	-.0002283	.0011937	-0.19	0.848	-.0025678	.0021113
firmsize	-1.326683	.5601233	-2.37	0.018	-2.424505	-.2288618
Domestic	20.46628	8.851892	2.31	0.021	3.116895	37.81567
Other	7.693407	3.232075	2.38	0.017	1.358656	14.02816
Furniture	-.0999214	.0381212	-2.62	0.009	-.1746377	-.0252051
FURNLSALES	.0054012	.0022806	2.37	0.018	.0009314	.0098711
_cons	-18.29972	10.70422	-1.71	0.087	-39.2796	2.680168

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other Furniture FURNLSALES LSALES CAPUTIL

.

Regression 6

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 38.99
Prob > chi2 = 0.0000
R-squared = .
Root MSE = 9.4095

lTFP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	27.27787	11.90437	2.29	0.022	3.945738	50.61
Exports	-.3628659	.1941356	-1.87	0.062	-.7433646	.0176329
Agefirm	-.0002278	.0011933	-0.19	0.849	-.0025667	.0021111
firmsize	-1.326585	.5599754	-2.37	0.018	-2.424116	-.229053
Domestic	20.45165	8.846033	2.31	0.021	3.113743	37.78956
Other	7.69117	3.230835	2.38	0.017	1.358849	14.02349
Wholesale	-.1000383	.0381029	-2.63	0.009	-.1747185	-.025358
WHOLELSALES	.0054088	.0022795	2.37	0.018	.0009409	.0098766
_cons	-18.28335	10.70137	-1.71	0.088	-39.25766	2.690949

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other Wholesale WHOLELSALES LSALES CAPUTIL

APPENDIX E: Two Stage Least Squares (2SLS) Instrumental Variable Regressions – Model 2

Regression 1

Instrumental variables (2SLS) regression

Number of obs	= 1370
Wald chi2(7)	= 24.84
Prob > chi2	= 0.0008
R-squared	= .
Root MSE	= 10.649

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	42.95421	10.15675	4.23	0.000	23.04733	62.86108
Exports	.0795755	.1987304	0.40	0.689	-.3099289	.4690799
Agefirm	.0001981	.0011933	0.17	0.868	-.0021407	.0025369
firmsize	-1.916418	.5583276	-3.43	0.001	-3.01072	-.8221157
RnD	-.0026089	.0057012	-0.46	0.647	-.0137831	.0085654
Domestic	31.63808	7.86336	4.02	0.000	16.22618	47.04999
Other	5.649178	3.701501	1.53	0.127	-1.60563	12.90399
_cons	-20.16131	8.949333	-2.25	0.024	-37.70168	-2.620938

Instrumented: Foreign Exports
Instruments: Agefirm firmsize RnD Domestic Other LSALES CAPUTIL

Regression 2

```
Instrumental variables (2SLS) regression          Number of obs =    1370
                                                  Wald chi2(28) =   31.63
                                                  Prob > chi2   =  0.2898
                                                  R-squared     =       .
                                                  Root MSE      =  10.841
```

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	44.56584	10.952	4.07	0.000	23.10032	66.03135
Exports	.0747745	.206505	0.36	0.717	-.3299679	.479517
Agefirm	.0000359	.0012357	0.03	0.977	-.002386	.0024577
firmsize	-1.850301	.5919046	-3.13	0.002	-3.010412	-.6901892
Domestic	32.87561	8.480375	3.88	0.000	16.25438	49.49684
Other	5.71544	3.950321	1.45	0.148	-2.027048	13.45793
Food	1.221834	1.33324	0.92	0.359	-1.391268	3.834936
Textiles	-2.546786	3.242207	-0.79	0.432	-8.901394	3.807823
Garments	2.35109	1.264988	1.86	0.063	-.1282414	4.830421
Leather	-5.080009	7.251154	-0.70	0.484	-19.29201	9.131991
Wood	-3.086646	4.142046	-0.75	0.456	-11.20491	5.031615
Retail	2.077093	1.129666	1.84	0.066	-.1370111	4.291197
PPRMedia	-1.147239	2.962103	-0.39	0.699	-6.952855	4.658377
IT	-3.695293	6.426303	-0.58	0.565	-16.29062	8.90003
Chemicals	-.4412504	2.135015	-0.21	0.836	-4.625803	3.743303
PlastRubb	-9.714608	5.418981	-1.79	0.073	-20.33562	.9063993
NonMetMin	2.322808	1.879513	1.24	0.217	-1.36097	6.006587
BasicMet	-2.54586	6.23835	-0.41	0.683	-14.7728	9.681082
MachEq	4.097726	1.350774	3.03	0.002	1.450258	6.745194
TransMach	-.1191993	3.068387	-0.04	0.969	-6.133127	5.894728
Furniture	4.120042	1.236801	3.33	0.001	1.695957	6.544128
ServicesMV	-5.767813	3.210432	-1.80	0.072	-12.06014	.5245181
Wholesale	4.083117	1.704482	2.40	0.017	.7423935	7.423841
HotRes	2.128415	1.526044	1.39	0.163	-.8625758	5.119407
Transport	2.924215	2.777239	1.05	0.292	-2.519073	8.367503
Electronics	6.51292	2.40034	2.71	0.007	1.808339	11.2175
Construction	5.063338	1.435297	3.53	0.000	2.250208	7.876468
FabMet	-2.752702	3.683827	-0.75	0.455	-9.972871	4.467467
_cons	-22.17738	9.837785	-2.25	0.024	-41.45908	-2.895671

```
Instrumented:  Foreign Exports
Instruments:   Agefirm firmsize Domestic Other Food Textiles Garments
               Leather Wood Retail PPRMedia IT Chemicals PlastRubb NonMetMin
               BasicMet MachEq TransMach Furniture ServicesMV Wholesale
               HotRes Transport Electronics Construction FabMet LSALES
               CAPUTIL
```

Regression 3

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 30.98
Prob > chi2 = 0.0001
R-squared = .
Root MSE = 9.9405

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	40.0891	11.02323	3.64	0.000	18.48396	61.69425
Exports	.0599569	.1910149	0.31	0.754	-.3144255	.4343393
Agefirm	.0001922	.0011125	0.17	0.863	-.0019882	.0023727
firmsize	-1.891755	.5195839	-3.64	0.000	-2.91012	-.8733889
Domestic	29.56078	8.378973	3.53	0.000	13.13829	45.98327
Other	5.284047	3.519922	1.50	0.133	-1.614873	12.18297
Retail	-.0274783	.0417732	-0.66	0.511	-.1093523	.0543957
RETAILSALES	.0014452	.0025683	0.56	0.574	-.0035886	.006479
_cons	-17.12738	10.35253	-1.65	0.098	-37.41798	3.163211

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other Retail RETAILSALES LSALES CAPUTIL

Regression 4

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 30.91
Prob > chi2 = 0.0001
R-squared = .
Root MSE = 9.9533

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	40.14135	11.03234	3.64	0.000	18.51835	61.76434
Exports	.0598543	.1912208	0.31	0.754	-.3149315	.4346402
Agefirm	.0001893	.0011141	0.17	0.865	-.0019942	.0023728
firmsize	-1.890965	.5201241	-3.64	0.000	-2.910389	-.8715401
Domestic	29.59729	8.386038	3.53	0.000	13.16095	46.03362
Other	5.286928	3.523787	1.50	0.134	-1.619567	12.19342
PlastRubb	-.0270911	.0418246	-0.65	0.517	-.1090657	.0548836
PLASTRUBBLSALES	.0014169	.002572	0.55	0.582	-.0036241	.0064579
_cons	-17.15965	10.35823	-1.66	0.098	-37.4614	3.142099

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other PlastRubb PLASTRUBBLSALES LSALES CAPUTIL

.

Regression 5

Instrumental variables (2SLS) regression

Number of obs	= 1370
Wald chi2(8)	= 30.99
Prob > chi2	= 0.0001
R-squared	= .
Root MSE	= 9.9414

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	40.09285	11.01075	3.64	0.000	18.51218	61.67352
Exports	.0597625	.1910322	0.31	0.754	-.3146538	.4341787
Agefirm	.0001911	.0011127	0.17	0.864	-.0019898	.0023719
firmsize	-1.891427	.519605	-3.64	0.000	-2.909834	-.8730199
Domestic	29.56325	8.370254	3.53	0.000	13.15785	45.96865
Other	5.283541	3.519427	1.50	0.133	-1.614409	12.18149
Furniture	-.0275215	.0417451	-0.66	0.510	-.1093404	.0542974
FURNLSALES	.001446	.0025669	0.56	0.573	-.003585	.006477
_cons	-17.12134	10.34363	-1.66	0.098	-37.39449	3.151809

Instrumented: Foreign Exports

Instruments: Agefirm firmsize Domestic Other Furniture FURNLSALES LSALES CAPUTIL

Regression 6

Instrumental variables (2SLS) regression

Number of obs	= 1370
Wald chi2(8)	= 31.03
Prob > chi2	= 0.0001
R-squared	= .
Root MSE	= 9.9359

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	40.0708	11.00369	3.64	0.000	18.50396	61.63765
Exports	.0596778	.1909263	0.31	0.755	-.3145308	.4338864
Agefirm	.0001915	.0011121	0.17	0.863	-.0019882	.0023712
firmsize	-1.891449	.5193262	-3.64	0.000	-2.90931	-.8735882
Domestic	29.54738	8.365128	3.53	0.000	13.15203	45.94273
Other	5.281435	3.517773	1.50	0.133	-1.613273	12.17614
Wholesale	-.027704	.0417159	-0.66	0.507	-.1094657	.0540578
WHOLELSALES	.0014576	.0025651	0.57	0.570	-.0035699	.0064851
_cons	-17.10135	10.3395	-1.65	0.098	-37.36639	3.163699

Instrumented: Foreign Exports

Instruments: Agefirm firmsize Domestic Other Wholesale WHOLELSALES LSALES CAPUTIL

Regression 7

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 30.98
Prob > chi2 = 0.0001
R-squared = .
Root MSE = 9.9436

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	40.10198	11.01446	3.64	0.000	18.51402	61.68993
Exports	.0597967	.1910655	0.31	0.754	-.3146847	.4342781
Agefirm	.0001908	.001113	0.17	0.864	-.0019907	.0023722
firmsize	-1.891363	.5197122	-3.64	0.000	-2.909981	-.8727462
Domestic	29.56975	8.372864	3.53	0.000	13.15924	45.98027
Other	5.284291	3.520248	1.50	0.133	-1.615269	12.18385
Garments	-.0274386	.0417655	-0.66	0.511	-.1092975	.0544203
GARMLSALES	.0014406	.0025682	0.56	0.575	-.003593	.0064742
_cons	-17.12943	10.34654	-1.66	0.098	-37.40827	3.149405

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other Garments GARMLSALES LSALES CAPUTIL

Regression 8

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 30.90
Prob > chi2 = 0.0001
R-squared = .
Root MSE = 9.9526

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	40.13856	11.03097	3.64	0.000	18.51825	61.75887
Exports	.0598477	.1911936	0.31	0.754	-.3148849	.4345803
Agefirm	.0001892	.0011142	0.17	0.865	-.0019945	.002373
firmsize	-1.890923	.5200338	-3.64	0.000	-2.91017	-.8716752
Domestic	29.59535	8.384973	3.53	0.000	13.16111	46.0296
Other	5.286324	3.523456	1.50	0.134	-1.619523	12.19217
ServicesMV	-.0271085	.0418148	-0.65	0.517	-.1090641	.0548471
SERMVLSALES	.0014177	.0025715	0.55	0.581	-.0036222	.0064577
_cons	-17.1571	10.35569	-1.66	0.098	-37.45387	3.139682

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other ServicesMV SERMVLSALES LSALES CAPUTIL

Regression 9

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 30.98
Prob > chi2 = 0.0001
R-squared = .
Root MSE = 9.9426

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	40.09775	11.01167	3.64	0.000	18.51527	61.68022
Exports	.0597815	.1910376	0.31	0.754	-.3146454	.4342083
Agefirm	.0001909	.0011129	0.17	0.864	-.0019904	.0023721
firmsize	-1.891391	.5196603	-3.64	0.000	-2.909907	-.8728756
Domestic	29.56672	8.370975	3.53	0.000	13.15991	45.97353
Other	5.283938	3.519827	1.50	0.133	-1.614796	12.18267
MachEq	-.02748	.0417456	-0.66	0.510	-.1092999	.05434
MACHEQLSALES	.0014432	.002567	0.56	0.574	-.003588	.0064745
_cons	-17.12568	10.34347	-1.66	0.098	-37.39851	3.147144

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other MachEq MACHEQLSALES LSALES CAPUTIL

.

Regression 10

Instrumental variables (2SLS) regression

Number of obs = 1370
Wald chi2(8) = 30.99
Prob > chi2 = 0.0001
R-squared = .
Root MSE = 9.9406

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	40.08981	11.00894	3.64	0.000	18.51268	61.66693
Exports	.0597107	.1910111	0.31	0.755	-.3146642	.4340856
Agefirm	.0001906	.0011126	0.17	0.864	-.0019901	.0023714
firmsize	-1.891246	.5195331	-3.64	0.000	-2.909513	-.8729803
Domestic	29.56085	8.368854	3.53	0.000	13.15819	45.9635
Other	5.282737	3.519045	1.50	0.133	-1.614464	12.17994
Electronics	-.0275456	.0417376	-0.66	0.509	-.1093498	.0542585
ELECLSALES	.0014467	.0025666	0.56	0.573	-.0035837	.0064771
_cons	-17.11637	10.34195	-1.66	0.098	-37.38622	3.153477

Instrumented: Foreign Exports
Instruments: Agefirm firmsize Domestic Other Electronics ELECLSALES LSALES CAPUTIL

Regression 11

```
Instrumental variables (2SLS) regression               Number of obs =    1370
                                                       Wald chi2(8)  =   30.97
                                                       Prob > chi2   =  0.0001
                                                       R-squared     =       .
                                                       Root MSE      =  9.9435
```

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	40.10153	11.01242	3.64	0.000	18.51758	61.68549
Exports	.0597755	.1910559	0.31	0.754	-.3146871	.4342381
Agefirm	.0001907	.001113	0.17	0.864	-.0019907	.0023721
firmsize	-1.891358	.5196902	-3.64	0.000	-2.909932	-.8727844
Domestic	29.56936	8.371491	3.53	0.000	13.16153	45.97718
Other	5.28415	3.520092	1.50	0.133	-1.615103	12.1834
Construction	-.0274527	.0417444	-0.66	0.511	-.1092703	.0543648
CONLSALES	.0014412	.002567	0.56	0.574	-.00359	.0064724
_cons	-17.12804	10.34359	-1.66	0.098	-37.40111	3.145024

```
Instrumented:  Foreign Exports
Instruments:   Agefirm firmsize Domestic Other Construction CONLSALES LSALES
               CAPUTIL
```

APPENDIX F: General Method of Moments (GMM) Instrumental Variable Regression – Model 1

```
Instrumental variables (GMM) regression               Number of obs =    1370
                                                       Wald chi2(7)  =   13.04
                                                       Prob > chi2   =  0.0712
                                                       R-squared     =       .
GMM weight matrix: Robust                              Root MSE      =  11.323
```

lTFP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	38.02402	11.6031	3.28	0.001	15.28237	60.76567
Exports	-.2875145	.218544	-1.32	0.188	-.7158529	.1408239
Agefirm	-.0001941	.0013923	-0.14	0.889	-.002923	.0025348
firmsize	-1.424406	.6426001	-2.22	0.027	-2.683879	-.1649335
RnD	-.006543	.0060083	-1.09	0.276	-.0183191	.0052331
Domestic	28.2488	8.770148	3.22	0.001	11.05962	45.43797
Other	9.076875	3.818454	2.38	0.017	1.592843	16.56091
_cons	-29.75327	9.53098	-3.12	0.002	-48.43365	-11.07289

Instrumented: Foreign Exports
Instruments: Agefirm firmsize RnD Domestic Other LSALES CAPUTIL

APPENDIX G: Limited Information Maximum Likelihood (LIML) Instrumental Variable Regression – Model 1

```
Instrumental variables (LIML) regression              Number of obs =     1370
                                                      Wald chi2(7)  =    13.04
                                                      Prob > chi2   =   0.0712
                                                      R-squared     =        .
                                                      Root MSE      =   11.323
```

lTFP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	38.02402	11.6031	3.28	0.001	15.28237	60.76567
Exports	-.2875145	.218544	-1.32	0.188	-.7158529	.1408239
Agefirm	-.0001941	.0013923	-0.14	0.889	-.002923	.0025348
firmsize	-1.424406	.6426001	-2.22	0.027	-2.683879	-.1649335
RnD	-.006543	.0060083	-1.09	0.276	-.0183191	.0052331
Domestic	28.2488	8.770148	3.22	0.001	11.05962	45.43797
Other	9.076875	3.818454	2.38	0.017	1.592843	16.56091
_cons	-29.75327	9.53098	-3.12	0.002	-48.43365	-11.07289

Instrumented: Foreign Exports
Instruments: Agefirm firmsize RnD Domestic Other LSALES CAPUTIL

APPENDIX H: General Method of Moments (GMM) Instrumental Variable Regression – Model 2

```
Instrumental variables (GMM) regression                Number of obs =     1370
                                                       Wald chi2(7)  =    24.84
                                                       Prob > chi2   =   0.0008
                                                       R-squared     =        .
GMM weight matrix: Robust                              Root MSE      =   10.649
```

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	42.95421	10.15675	4.23	0.000	23.04733	62.86108
Exports	.0795755	.1987304	0.40	0.689	-.3099289	.4690799
Agefirm	.0001981	.0011933	0.17	0.868	-.0021407	.0025369
firmsize	-1.916418	.5583276	-3.43	0.001	-3.01072	-.8221157
RnD	-.0026089	.0057012	-0.46	0.647	-.0137831	.0085654
Domestic	31.63808	7.86336	4.02	0.000	16.22618	47.04999
Other	5.649178	3.701501	1.53	0.127	-1.60563	12.90399
_cons	-20.16131	8.949333	-2.25	0.024	-37.70168	-2.620938

```
Instrumented:  Foreign Exports
Instruments:   Agefirm firmsize RnD Domestic Other LSALES CAPUTIL
```

APPENDIX I: Limited Information Maximum Likelihood (LIML) Instrumental Variable Regression – Model 2

Instrumental variables (LIML) regression

Number of obs = 1370
Wald chi2(7) = 24.84
Prob > chi2 = 0.0008
R-squared = .
Root MSE = 10.649

LLP	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Foreign	42.95421	10.15675	4.23	0.000	23.04733	62.86108
Exports	.0795755	.1987304	0.40	0.689	-.3099289	.4690799
Agefirm	.0001981	.0011933	0.17	0.868	-.0021407	.0025369
firmsize	-1.916418	.5583276	-3.43	0.001	-3.01072	-.8221157
RnD	-.0026089	.0057012	-0.46	0.647	-.0137831	.0085654
Domestic	31.63808	7.86336	4.02	0.000	16.22618	47.04999
Other	5.649178	3.701501	1.53	0.127	-1.60563	12.90399
_cons	-20.16131	8.949333	-2.25	0.024	-37.70168	-2.620938

Instrumented: Foreign Exports
Instruments: Agefirm firmsize RnD Domestic Other LSALES CAPUTIL

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