Foreign Ownership and Productivity in Ethiopia’s Manufacturing Sector

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ABSTRACT

FOREIGN OWNERSHIP AND PRODUCTIVITY IN ETHIOPIA’S MANUFACTURING SECTOR

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The purpose of this study is to measure productivity and to examine the relationship between foreign ownership and multifactor productivity in Ethiopian manufacturing establishments. To empirically test whether there is a relationship between foreign ownership and productivity, fixed effect and probit regressions are estimated using firm-level data on large and medium scale manufacturing firms in Ethiopia from 1996-2010. The study also examines whether foreign-owned firms target productive firms. First, we find significant dispersion in productivity. Second, the effect of foreign ownership on productivity is mixed with positive effects for the textile, leather and footwear, and paper and printing subsectors; negative effect for the wood subsector; and no effect of foreign ownership on productivity in the entire manufacturing industry. Third, we find that foreign-owned firms target more productive firms. We discuss the implications of these results for Ethiopia’s industrial development policy and foreign capital investment in the manufacturing industry.
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Chapter 1

Introduction

1.1. Motivation

There has been persistent stagnation in the manufacturing sector for Sub-Saharan Africa (Sonobe et al, 2009). Economic growth in Africa’s manufacturing sector has been constrained by issues ranging from high transaction costs because of imperfect information, infrastructural limitations, to highly risky business environments (Collier and Gunning, 1999). Growth in productivity in the manufacturing industry is important as it fosters modernization and job creation (UNDP, 2017). Industrial development strategies are needed to ensure that the manufacturing industry drives productivity growth and sustains structural transformation in the economy. Foreign ownership is identified as a key facilitator for industrial development in the manufacturing industry (UNDP, 2017). Foreign ownership has become increasingly common among developing economies as a result of globalization and promoting economic growth (Blomstrom and Kokko, 1998). Endogenous economic growth theories suggest that foreign ownership may contribute to industrial development efforts through their transfer of modern technologies, improved managerial procedures, employment creation, enhancement of production efficiency, and increasing competition in the domestic market (Mengistu and Adams, 2007; Romer, 1986, 1990). The objective of this thesis is to examine the link between foreign ownership and productivity in Ethiopia. Ethiopia is one of the sub-Saharan countries with limited inflows of foreign direct investment. Average net inflows of FDI as a percent of gross domestic product (GDP) in 2016 was 5.46 percent, up from 0.26 percent in 1996- indicating a 20 percent growth in net inflows of FDI as a percentage of GDP between 1996 and 2016 (World Development Indicators, 2018). Although
the contribution of FDI to GDP grew over time, the magnitude of the inflows each year have been significantly less than 7 percent. Productivity gaps between developing countries such as Ethiopia, and developed countries are quite large. For example, Mcmillan et al (2014) found that as at 2005 average labour productivity in the U.S manufacturing industry was over 30 times the average labour productivity in Ethiopia’s manufacturing industry. One effective tool used to close productivity gaps is the entry of foreign-owned firms through inward foreign direct investment. When foreign-owned firms do not fully internalize the benefits of their productivity, spillovers or externalities such as knowledge externalities generated from the presence of foreign firms raise the level of human capital in the domestic market, and thus increases the productivity of domestic firms in the host country (Jarvocik, 2004). Foreign-owned firms are also said to be larger in size, more innovative and tend to use more advanced management practices which contribute to an industry’s productivity growth over time (Harris, 1999). Thus, when comparing domestic firms to foreign-owned firms based on firm attributes, the general consensus in the FDI literature is that foreign-owned firms are more productive than domestic firms because they use more advanced technology and managerial practices than their domestic counterparts.

Fons-Rosen et al (2014) argue that foreign-owned firms are more productive because they tend to target more productive firms in the domestic market. To diversify any potential business risks, financial investors will opt for high performing firms through mergers and acquisition investments (Fons-Rosen et al, 2014). This is because information on “unobservable variables” such as managerial expertise cannot be easily accessed by financial investors, thus foreign-owned firms would target or “cherry-pick” (i.e., selecting best performing firms) high productivity firms (Fons-Rosen et al, 2014; Harris and Robinson, 2002). The empirical finance literature however, argues otherwise. Fukao et al (2006) argue that firms tend to target small underperforming firms, with a
higher liability to asset ratio. Most firms target low productivity firms because of their growth potential, and because they can be purchased at extremely discounted prices (Fons-Rosen et al, 2014). The second objective of this thesis is to examine whether firms target productive firms.

Despite the general consensus on the positive contribution of firms to productivity growth, the empirical evidence is mixed, which begs the question of whether firms actually influence productivity, or they target productive firms in an industry. For example, Batool et al (2009) analyze Pakistan’s food, tobacco and business sector, and find that foreign ownership at the sector level improved productivity by 13.8 percent. Batool et al (2009) also find that improvements can be associated with the advanced capital, management and technology that foreign investment brings along. Aitken and Harrison (1999) however, find that foreign ownership negatively impacts the productivity of domestic firms in the same subsector of the Venezuelan manufacturing industry. They attribute this negative impact to the fact that firms tend to target more productive sectors and invest in more productive firms. Ruane and Ugur (2010) examined the Irish manufacturing industry and found no evidence of productivity increase or spillovers resulting from the presence of firms. On the other hand, Baldwin and Hanel (2003, p.319) assert that firms in the manufacturing sector have a higher multifactor productivity because they target more productive and knowledge-intensive sectors, in order to exploit local sources of technology and scientific research. Helpman et al (2004) also suggest that increased productivity in the manufacturing sector may be associated with the possibility that firms are more concentrated in productive sectors.

In the manufacturing sector of developing economies, less research has been carried out on the link between foreign ownership and multi-factor productivity. There are some exceptions to this. For example, Blomstrom (1986) examine foreign investment and productive efficiency in the
Mexican manufacturing industry, and find foreign ownership is positively correlated with structural efficiency in the industry. Suyanto and Salim (2010) find negative technology spillovers from foreign-owned firms in Indonesia’s food processing sector. They show that the technology gap between domestic and foreign firms is relatively large. In Ethiopia, studies that examine multifactor productivity in the manufacturing industry using firm-level data focus on exports (e.g., Bigsten and Gebreeyesus, 2009), imports (e.g., Abreha, 2014), firm turnover (e.g., Gebreyesus, 2008), firm growth, firm size and firm age (e.g., Bigsten and Gebreyesus, 2007). To the best of my knowledge, there are no studies on the effect of foreign ownership on multifactor productivity in the Ethiopian manufacturing industry at the establishment level. Examining productivity at an establishment level is important in analyzing long-run economic growth in the manufacturing industry, because it is difficult to measure these outcomes with aggregated data (Syverson, 2011). Thus, this study will fill this gap in the literature by addressing the following: 1) Does foreign ownership influence multifactor productivity level in the Ethiopian manufacturing industry? 2) Do foreign-owned firms target productive firms in the Ethiopian manufacturing industry?

I use establishment-level survey data of large and medium firms to examine the relationship between foreign ownership and productivity in the Ethiopian manufacturing industry. First, I estimate multifactor productivity using the Levinsohn and Petrin (2003) approach. Second, I use a Fixed Effects model to examine the relationship between foreign ownership and productivity. Third, using a panel Probit model, I examine whether firms target more productive firms. Fourth, I compare the results from multifactor productivity with results from labour productivity. Finally, I examine the relationship between foreign ownership and productivity by subsectors.
The results of this thesis provide mixed evidence on the relationship between foreign ownership and productivity. In the overall manufacturing industry, the results suggest that firms do not have an effect on multifactor productivity. In other words, the presence of firms does not influence multifactor productivity of the entire manufacturing industry. This could mean that firms are situated in smaller subsectors such that their productivity as a whole may not be sufficient to influence the productivity of the manufacturing industry. Subsectors such as textiles and leather and footwear reveal that firms increase multifactor productivity. However, foreign ownership in the wood subsector had a negative effect on multifactor productivity. Also, the results show that foreign-owned firms target productive firms, although with very minimal probability. This suggests that the more productive a manufacturing firm is, the higher the probability that such productivity is associated with a firm.

1.2. Purpose and Objectives

The purpose of this study is to examine the direct impact of foreign ownership (i.e., the presence of foreign-owned firms) on multifactor productivity in the Ethiopian manufacturing industry. The specific objectives of this study are as follows:

- To estimate a productivity index
- To examine the relationship between foreign ownership and the level of productivity
- To examine whether foreign-owned firms target productive firms

1.3. Outline of Thesis

This section outlines how the thesis will be organized. Chapter 2 will highlight the overview of the Ethiopian economy, GDP trend in Ethiopia, FDI net inflows in Ethiopia, background on the
Ethiopian manufacturing industry, the contribution of the manufacturing industry to GDP, its sector composition and ownership structure, and challenges in the manufacturing industry.

Chapter 3 will introduce the literature review surrounding the theory on foreign direct investment, the OLI (ownership, location and internalization) framework on foreign direct investment, foreign ownership, exports versus foreign ownership, foreign ownership in the manufacturing industry, benefits of foreign ownership to domestic firms, foreign ownership in the Ethiopian manufacturing industry, foreign ownership in developing economies, the concept of productivity, and any gaps in the literature.

Chapter 4 will design the theoretical framework surrounding the concept of the production function, multifactor productivity, as well as the link between foreign ownership and multifactor productivity.

Chapter 5 will discuss the different productivity estimation techniques, and the Levinsohn and Petrin model used to examine the relationship between foreign ownership and multifactor productivity on the level form. It will also demonstrate how the Probit model is used to determine whether foreign-owned firms target productive firms in the food manufacturing sector. Chapter 6 will describe the data to be used for the analysis and discuss why firm-level data is important for the analysis.

Chapter 7 will discuss the results of the empirical analysis and Chapter 8 will summarize findings, policy implications of the study, and future research.
Chapter 2

Industry Background

2.1. Ethiopian Economy- Overview

According to the World Bank Group, Ethiopia is the second most populous country in Africa and one of the least developed countries in sub-Saharan Africa, with a population of about 102 million in 2016. The International Monetary Fund (IMF) also forecasts Ethiopia as the fastest growing economy in sub-Saharan Africa. Gross Domestic Product (GDP) in figure 2.1 has followed a steady increasing trend, however, between 1996 and 1999 GDP dropped by 9.9%. By 2000, GDP increased to $8.24 billion, which continued on an increasing path from $32.44 billion in 2009 to $80.56 billion in 2017 (World Development Indicators, 2018). The country maintained a steady double-digit growth rate in GDP since 2004 due to the different investment strategies implemented by the government on infrastructural development. Also, this growth in GDP can be attributed to favourable agro-climatic conditions, high coffee prices, growth in the construction sector, and foreign direct investment (Altenburg, 2010). Also, figure 2.2 displays the average net inflows of FDI as a percent of gross domestic product (GDP). In 2016, the contribution of FDI to GDP was 5.46 percent, up from 0.26 percent in 1996- indicating a 20 percent growth in net inflows of FDI as a percentage of GDP between 1996 and 2016 (World Development Indicators, 2018). Although the contribution of FDI to GDP grew over time, the magnitude of the inflows each year have been significantly less than 7 percent.
The agricultural sector contributed to the majority of the economic growth and played a role towards the government’s poverty alleviation and strategy (Lie and Mesfin, 2018). Despite all indications of economic growth, poverty is still a big issue in Ethiopia. Lie and Mesfin (2018) add
that poverty is more significant in rural areas while the central and urban areas experience more economic growth. About 80% of the population in the rural area are small farmers who face a great deal of land scarcity and drought due to the economy’s dependence on rainfed agriculture, while the rest of the population seek employment in the industrial and service sectors (Lie and Mesfin, 2018). Ethiopia’s economy is largely driven by rainfed agriculture, and despite a few challenges it encounters such as irregular rainfalls, increasing soil erosion, drought and tropical diseases in some areas, most regions in Ethiopia have substantial agricultural potential and relatively high availability of water (Altenburg, 2010). About three-quarters of Ethiopia’s exports are primary agricultural commodities such as coffee, oilseeds, gold, pulses and live animals, with coffee, tea and spices accounting for 33.6% of total exports while oil seeds accounted for 15.6% of total exports in 2017\(^1\). Major export destinations include China, Saudi Arabia, Germany, USA, Netherlands, Djibouti and Somalia- with China being Ethiopia’s biggest trade partner (Lie and Mesfin, 2018).

To emphasize the role of the agricultural sector for improving food security, and long-term economic growth, the Ethiopian government established the Agricultural Development-Led Industrialization (ADLI) strategy in 1992. This strategy was designed to take advantage of the country’s abundant resources of land and labour, based on its labour-intensive smallholder farming structure, to encourage the use of modern agricultural technologies and significantly increase agricultural productivity. Under the ADLI strategy, major interventions such as fertilizers, improved seeds and extension services were provided to small farmers which increased growth in the agricultural sector (Shiferaw, 2017). Although agriculture is a vital sector for the economy,

the government is committed to transforming its agricultural-based economy into a manufacturing hub, through its five-year Growth and Transformation Plan (GTP) strategy, in order to make Ethiopia a middle-income country by 2025 (Lie and Mesfin, 2018).

The first Growth and Transformation Plan (GTP I) commenced in 2010 and was designed for a five-year period- 2010 to 2015. Though agriculture still maintained its place as a major source of economic growth through this program, a lot more emphasis was placed on promoting the manufacturing sector, infrastructure development and creating favourable conditions for the industrial sector to contribute significantly to the economy (Ferede and Kebede, 2015). GTP I also recognizes the value of small and microenterprises for industrialization, employment opportunities and strengthening rural-urban and urban-urban economic links by expanding production of electricity, transportation and irrigation capacities (Ferede and Kebede, 2015). A few of the industries identified under the GTP I for growth and industrialization include textiles, leather and leather products, agro-processing, pharmaceutical, chemical, and the metals and engineering industry (Ferede and Kebede, 2015). The GTP I development strategy also targeted the large and medium scale manufacturing industries to expand the development of industrial parks, in order to address any restrictions domestic and foreign investors face relating to production and logistics that disrupt their productivity and competitiveness (NPC, 2016). The manufacturing sector experienced an average growth of 14.6%, real GDP grew at an average rate of 10.1% coupled with investment growth and employment generation, which improved living standards of Ethiopians during the implementation period. A few challenges, however, were still encountered, such as inflation in the first two years of the GTP I, inadequate supply of quality infrastructures, and insufficient foreign financial resources to implement development projects (NPC, 2016). Thus, to address these challenges detected during the implementation of GTP I, the second five-year
Growth and Transformation Plan (GTP II) was launched by building upon the achievements of the GTP I.

The GTP II (2015/16 to 2019/2020) strengthens and scales up the targets of the GTP I by giving major attention to the quality, competitiveness and productivity of the manufacturing sector. Thus, by using quota and tariff-free trade opportunities, the objective of the GTP II is to develop its manufacturing sector, increase its exports and enable its manufacturing subsectors compete in the global market (NPC, 2016). Also, through the GTP II, the Ethiopian government creates links between domestic and firms to promote technology and knowledge transfer, to accelerate the structural transformation of the economy (NPC, 2016). Therefore, to address the challenges that hinder growth in the manufacturing sector, the government uses the GTP II to provide adequate policy support and transparent incentive schemes to increase the participation of investors in the sector, and thus speed up the structural transformation of the manufacturing sector (NPC, 2016).

2.2. Ethiopian Manufacturing Sector

Ethiopia has an agrarian economy with a small industrial sector. The industrial sector consists of the manufacturing, mining, construction, electricity, water and gas sectors with the manufacturing sector accounting for 70% of the industrial sector (World Development Indicators, 2018). In terms of employment in 2013, the manufacturing sector provided employment to about 173,000 people, with the food and beverage sector accounting for 38% of employment in the industry (AACCSA, 2015). However, its contribution of the manufacturing industry to Ethiopia’s GDP over time has been significantly minimal- 3.7 percent in 2013.
Table 2.2 displays the average contribution of the manufacturing industry to GDP from 1996 to 2017. There was a rapid increase in the average contribution from 5.2% in 1996 to 7.3% in 1997 and followed a fluctuating trend path to 5.6% in 2017 (World Development Indicators, 2018). Despite the impressive growth in the country’s GDP over time, the manufacturing sector lost its momentum for the past two decades, demonstrating an average growth of 7.2% between 1996 and 2017. This low contribution of the manufacturing sector to the economy’s GDP is a big indicator of Ethiopia’s underdeveloped manufacturing base and constitutes a major concern for the Ethiopian government (Shiferaw, 2017). Although, there was a growth in the share of manufacturing by 10.8% during the implementation of GTP I, between 2010 and 2015. Shiferaw (2017) adds that one of the goals of the GTP II is to increase the manufacturing sector’s share of GDP to 15%. Productivity in the manufacturing sector still lags behind its global competitors and thus, the main objective behind industrial development under the GTP II is to ensure the manufacturing sector becomes the main driver of growth that stimulates productivity and structural transformation of the economy, creates employment opportunities, increases export earnings, and provides a medium for technological transfer (UNDP, 2017).
The UNDP (2017) also highlights the development of industrial parks for small and medium-scale firms as a means of attracting foreign direct investment in key manufacturing subsectors, which could also result in technology spillovers to domestic firms, diversify exports and generate more employment. The Industrial Parks Development Corporation (IPDC) implemented this strategy by providing land, pre-built and well-equipped workshops with global standards of quality of service, labour security and environmental safety (UNDP, 2017). One major industrial park in the manufacturing sector is the Hawassa Industrial Park - the largest industrial park in sub-Saharan Africa- located close to Addis Ababa, built in 2016 and focuses on the export of textiles and garments$^2$. The Kilinto Industrial Park located in the south of Addis Ababa is also a major destination for manufacturers particularly in the pharmaceuticals, wood, furniture, electronics and

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agro-processing sector, who export and serve the domestic market\(^3\). By investing heavily in industrial parks, the directions of the GTP II in developing the manufacturing sector aims at increasing the competitiveness and productivity in industrial firms, increasing foreign direct investment and technological capabilities, as well as promoting exports of manufactured products (Lie and Mesfin, 2018).

2.2.1. Sector Composition

The manufacturing sector comprises of eight broad subsectors- food and beverage products, textile and apparel products, leather and leather products, wood and pulp products, chemical and chemical products, rubber and plastic products, other non-metallic mineral products, and metal and engineering products industries (AACCSCA, 2015). The food and beverage, textile and apparel sectors sector source their inputs locally, while the chemical and metal depend on imported inputs. During the GTP I period, the food and beverage sector, textile and apparel, leather products and chemical industries were classified as top priority sectors because they use labour-intensive techniques for production, source local agricultural inputs for food processing, contribute to technology transfer, and are highly export-oriented (Mitiku and Raju, 2015). Also, during this period, the food and beverage sector and the leather products sectors demonstrated high performance in the export market. In other words, the transformation plan’s objective to promote the manufacturing sector increased export opportunities and opened new export destinations, through export duty elimination and provision of industrial finance (Mitiku and Raju, 2015).

2.2.2. Ownership Structure

The scale of Ethiopia’s manufacturing sector depends on the ownership structure. Firms in the manufacturing sector are dominated by either the government (state) or by private owners, i.e., individuals, groups and institutions (Mitiku and Raju, 2015). According to Altenburg (2010, p.9), a huge majority of Ethiopian manufacturing sectors are micro and small, that are mainly based on entrepreneurship. The state-owned industries are usually on a large scale while the private ones are mostly small to medium-sized. On a firm-level, most of the firms in the manufacturing sector produce multiple goods and are mostly private, hence a large number of privately-owned firms in the sector (Shiferaw, 2017). About 78.8 percent of firms in the manufacturing sector in 2013 were private, 3.4 percent were state-owned, 4.2 percent were both private and state-owned, while the remaining 13.6 percent were joint ventures or cooperatives (AACC Saudia Arabia, 2015, p.69). Foreign investment in the Ethiopian manufacturing sector in 2013 was significantly low at 9.5 percent, with its highest level of investment of 17.4 percent in the textile and apparel products sector (AACC Saudia Arabia, 2015, p.69). The large proportion of multi-products firms in the Ethiopian manufacturing sector exist because successful micro and small firm entrepreneurs prefer to diversify their products, rather than growing and developing their expertise (Altenburg, 2010). As a result, micro and small firms hardly scale up to medium-sized, which reflects the absence of advanced and efficient managerial skills in the sector (Altenburg, 2010).

2.2.3. Challenges in the Manufacturing Industry

Although Ethiopia has been experiencing some economic growth in recent years, due to increased industrial activity and investment in infrastructure and manufacturing, its manufacturing sector still faces some significant challenges. Although the GTPs were designed to develop and sustain the labour-intensive sectors that are linked to the rest of the economy, productivity performance
of the manufacturing industry remained unsatisfactory. Some challenges the manufacturing sector faces include: low capacity utilization in the industry, shortage of skilled labour, poor infrastructure, lack of research and development in manufacturing, high transportation costs and poor tariff laws protecting domestic firms (AACCSA, 2015). To effectively compete in global markets, Ethiopian firms need to improve access to new technologies, managerial practices, and continuously upgrade their technical skills in the labour market. Shiferaw (2017) also argues that the challenge with the Ethiopian manufacturing sector is not just kick-starting growth in the sector, but sustaining growth momentum in a country where the economy is highly dependent on rain-fed agriculture. To sustain rapid growth in the manufacturing industry, major domestic structural changes need to be adopted by transforming low-productivity activities in agriculture and skill-intensive sectors, to more innovative and knowledge-intensive procedures (Altenburg, 2010).

Abreha (2014) identified foreign ownership as an important channel for international knowledge spillovers and emphasized how developing countries like Ethiopia, can also benefit from knowledge transfers and R&D investments from firms. However, the magnitude of the R&D spillovers depends on the manufacturing sector’s production structure and the capacity of the country to absorb any new form of innovation (Abreha, 2014). Although technology spillovers may be realized with the entrance of firms, there is also a probability of a worker and technology mismatch due to a scarcity in high-skilled workers (Acemoglu and Zilibotti, 2001). Therefore, the effect of the presence of firms on the productivity of the Ethiopian manufacturing sector depends on its capacity to absorb technology, which is measured by the level of its skilled labour (Augier et al., 2013). Below, I discuss three major challenges that the Ethiopian manufacturing sector faces.
Poor Innovation and Technology

The growth of the Ethiopian manufacturing industry is constrained by the lack of advanced technology, and inadequate technical and managerial skills (AfBD, 2014). Baldwin et al (1999) affirm that new technology brings about a quality improvement in firm operations— from processing to packaging. Shiferaw (2017) also argues that economic prosperity is linked to newly manufactured products and their export market. The higher the innovative content of the newly manufactured products, the faster the growth in income per capita (Shiferaw, 2017). However, technological progress in the Ethiopian manufacturing sector is remarkably low and ranks poorly on international technology and innovation indices, such as the Innovation Capability Index (Haile et al, 2017). Talegeta (2014) gathered that the major barriers to technological advancement in the Ethiopian manufacturing industry include: firm size, inadequate R&D tools, high cost of innovation, lack of skilled personnel, and inadequate policies and regulation. As competition in the global markets increases, it is crucial for firms in the Ethiopian manufacturing industry to increase their innovative capacity in order to improve the quality of food products and efficiency in the production process.

Shortage of Highly Skilled Labour

To better exploit the advantages of advanced technology and adapt existing technology to match domestic conditions, highly skilled human capital should be employed in the Ethiopian manufacturing sector (Haile et al, 2017). In other words, highly skilled labour is needed to effectively implement new and advanced technologies and support the production of high-quality products. The small and micro sectors may not contribute significantly to GDP, but they are run by their owners and tend to employ a larger share of semi-skilled workers than medium and large manufacturing (Abegaz, 2013). According to World Bank (2015), “Ethiopia has not made
significant progress in pulling labor out of agriculture into more productive and industrial jobs with three-quarters of all workers still employed in agriculture”. To effectively restructure the economy and push it towards generating well-paid employment, labour needs to be reallocated from less productive agriculture to more productive manufacturing activities (World Bank, 2015). Thus, to accelerate growth in the manufacturing sector, Ethiopia launched an Industrial Park Development program in 2014 designed to attract FDI in the labour-intensive manufacturing sector (World Bank, 2015). Through this program, Ethiopia can use its agricultural base to attract tradable manufacturing activities that capture large numbers of young and semi-skilled labour force.

Inadequate Infrastructure

The level of resources in the Ethiopian manufacturing sector is quite limited, and it prevents accumulation of capital for industrial development (Abegaz, 2013). For instance, the structural link between agricultural suppliers and the manufacturing sector is weak, causing manufacturers to deal with the constraints such as foreign exchange constraints, involved in importing raw inputs and machinery (UNDP, 2017). In sectors where Ethiopia should have a competitive edge in production, there is a high level of dependence on imported raw materials due to the poor quality of locally produced goods and reliance on seasonal supplies (UNDP, 2017). Also, industries such as electrical and electronics, metal processing and chemical industries that create inter-industry linkages and are highly dependent on their technological capabilities are lacking in the Ethiopian manufacturing sector (Abegaz, 2013). The major issue with low production capacity is poor infrastructure such as shortage of electricity, outdated technology and transportation problems.

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4 An Industrial Park is a part of a city designated for industrial use only. It may contain factories, oil refineries, and warehouses. See https://www.investopedia.com/terms/i/industrial-park.asp
Thus, the physical constraints and the poor state of infrastructure have led to inefficiency and a weak performance in the manufacturing industry (Abegaz, 2013).

2.3. Productivity Concept

Productivity is defined as “the ratio of a volume measure of output to a volume measure of input use” (OECD, 2001, p.11). It measures how efficiently inputs of production such as labour and capital, are used to produce a given level of output. Also, productivity is an essential measure of economic growth, performance and competitiveness, and thus provides information on how well a country is performing (OECD, 2001). The commonly used measures of productivity are labour productivity and multifactor productivity.

Fare et al (2001) define labour productivity as output per hours worked, whereby labour input is the number of paid or unpaid hours worked. However, Felipe (1999) added that the Solow growth model refutes the use of single-factor productivity measures because there is a limited level to the application of labour inputs. Single factor productivity measures such as labour productivity levels are affected by the excluded inputs (Syverson, 2011). Fare et al (2001) argue that labour productivity is an inadequate measure of productivity because it is not feasible in accounting for how much capital each worker uses in production. It disregards contributions from non-labour inputs and restricts the depth of the analysis, resulting in misleading estimates of productivity performance. Syverson (2011) also adds that the labour productivity levels of two different producers may vary even if they have the same production technology. The law of diminishing returns restricts the input growth process, rendering the use of labour inputs as an inefficient measure for productivity (Felipe, 1999). As a result, a productivity concept that is not based on how much observable inputs are used is preferred (Syverson, 2011). This measure is referred to as
total factor productivity or multifactor productivity, which is based on a residual. Syverson (2011) defines multifactor productivity as the "variation in output that cannot be explained based on observable inputs" (p. 330).

Furthermore, the residual term in the regression analysis accounts for any growth in multifactor productivity that cannot be captured by the intermediate inputs (OECD, 2001). According to the OECD (2001), multifactor productivity also measures the total efficiency of labour, capital, and other intermediate inputs used in production. Estimates of multifactor productivity are important in the analysis because they assess the productive capacity and growth opportunities in an economy (OECD, 2001). In addition, changes in multifactor productivity account for any difference in organizational or management practices, spillovers from factors of production, firm cost and scale effects, as well as measurement errors (OECD, 2001).

2.4. **Determinants of Productivity Growth in the Manufacturing Industry**

Firm productivity in the manufacturing industry is a key indicator of their ability to operate and compete in domestic and global markets, thereby contributing to long-term economic growth and improving standard of living. Productivity growth also depends on the industry’s competitiveness relative to other manufacturing industries in the economy and internationally. Harris (1999) identifies technological progress as a key determinant of productivity growth and adds that multifactor productivity growth in an economy is stimulated by technological knowledge. By expanding investment in machinery and equipment, Harris (1999) adds that new technological ideas gradually diffuse into the economy, causing countries to experience significant productivity growth rates.
Other determinants of productivity growth are investment in the education of workers and accumulation of human capital, exports and foreign investment (Harris, 1999). Adoption of human capital facilitates growth in productivity through knowledge spillovers, with Hamid and Pichler (2009) defining human capital as fundamental for growth and continuous development. Thus, Hamid and Pichler (2009) conclude that more resources should be allocated to educating and training its labour force, for knowledge spillovers among workers and easy application of new technology. Foreign direct investment and exports are known as channels for global trade and gains in productivity for the domestic market (Keller and Yeaple, 2009; Piedrahita, 2016). Fuglie et al (2012) highlight that the need for output market exposure has introduced inflows of foreign direct investment, which has generated productivity growth in recent times. Foreign affiliates with firm-specific knowledge bring about productivity growth through knowledge spillovers that take place provincially or in the industry (Keller and Yeaple, 2009). Harris (1999) strengthen this claim by stating that the entrance of foreign-owned firms accelerates quicker transmission of productivity ideas, through the introduction of foreign capital, proprietary technology, trademarks and highly skilled employees.

2.5. Chapter Summary

This chapter discusses the Ethiopian economy, its manufacturing sector- sector composition and ownership structure, and the challenges the manufacturing sector faces. It also discusses the productivity concept and determinants of productivity growth in the manufacturing industry. The Ethiopian economy is largely agrarian, with an increasing GDP trend due to its favourable agro-climatic conditions and the government’s implementation of different investment strategies on infrastructural development. Though agriculture is a vital source of economic growth, the Ethiopian government is committed to using its Growth and Transformation Plan in transforming
the economy into a manufacturing hub and a middle-income country by 2025. Although the second Growth and Transformation Plan (GTP II) was designed in 2015 to improve the competitiveness and productivity of the manufacturing industry and speed up the structural transformation of the industry, the manufacturing industry still faces significant issues hindering its growth. A few of the challenges it faces include poor innovation and technology, shortage of highly skilled labour and inadequate infrastructure. These challenges have hindered its productivity over the years and have caused the manufacturing industry to continuously lag behind its global competitors. To move Ethiopia’s manufacturing industry forward, introducing effective management of resources, new technology and innovation and providing firms with incentives to upgrade their production processes can increase competitiveness in the industry. Since foreign-owned firms are known to possess advanced technology and practice effective managerial processes, it is imperative for Ethiopia’s manufacturing sector to allow entrance of foreign-owned firms in order to improve scale and productivity in the industry.
Chapter 3

Literature Review

3.1. Theory on Foreign Direct Investment

According to OECD (2008), foreign direct investment (FDI) is defined as an investment with “the objective of establishing a lasting interest by a resident enterprise in one economy (direct investor), in an enterprise (direct investment enterprise) that is resident in an economy other than that of the direct investor” (p.48). The “lasting interest” signifies a long-term relationship between the investor and the investment enterprise, with a magnitude of influence on the administration of the enterprise. Put differently, foreign direct investment is a form of investment in which a non-resident company or individual shows business interest in a given country, by establishing business operations in that country either by ownership of a subsidiary or acquiring controlling interest in an existing foreign company.

Direct ownership of the FDI “includes branches of a parent investor or subsidiaries- defined as incorporated firms with more than 50 percent owned by the direct investor- and associates, defined as incorporated firms owned 10-50 percent” (Lipsey, 2008, p.7). The position of FDI flows into an economy can be inward or outward- with inward FDI flows signifying foreign capital investment in Ethiopia’s domestic market made by non-Ethiopians, while outward FDI are investments made by Ethiopians in a foreign country or business (OECD, 2008). Through inward FDI, Audet and Gagne (2010) assert that productivity spills over from the foreign-owned firms to domestic firms, leading to productivity growth in the given sector.
Alfaro and Chauvin (2016) postulate that a country’s higher participation in FDI flows demonstrates push and pull factors. The push factors that draw foreign firms to invest in a country include cheaper transportation costs, cheaper agricultural input choices, and economic growth opportunities (Alfaro and Chauvin, 2016). On the pull side, the government encourages the presence of FDI using incentives and policies, because they see FDI as a channel through which foreign capital, advanced technology and management practices penetrates their economy to make them globally competitive (Alfaro and Chauvin, 2016). Furthermore, Henderson et al (1996) highlights the different paths through which foreign direct investment flows to a country such as: licensing production to the foreign firm, franchising of foreign firm using firm’s trademark, joint venture with a partner, acquiring minor controlling interest in a firm and obtaining full ownership of the foreign enterprise.

Herrmann and Lipsey (2003) also state that “foreign direct investment is about foreign ownership, and in particular, concentrated ownership, i.e. foreign investors take a controlling stake” (p. 269). There are a large number of studies that examine the impact of general foreign direct investment in different sectors of an economy, but Herrmann and Lipsey (2003) argue that the foreign ownership aspect of foreign direct investment is taken for granted. For the purpose of this study, I will focus on the ownership form of foreign direct investment.

3.1.1. The OLI Framework on Foreign Direct Investment

The ownership, location and internalization (OLI) framework to foreign direct investment (FDI) was first designed by Dunning (1977), to provide a clear analysis of FDI. Dunning (1977) uses the OLI framework to describe three conditions a firm must realize before setting up its multinational production facility. First, the ownership advantage addresses the firm-specific assets that allow a
foreign-owned firm to handle the costs of operating in a different country. Markusen (2009) adds that foreign-owned firms control advanced production processes, trademarks, research and development intensity, quality products, or managerial structures that give it an edge over domestic firms in the market. Neary (2009) also adds that only the most productive firms venture into foreign direct investment regardless of the high fixed costs involved, medium productivity firms focus on exporting, while low productivity firms concentrate only on producing in their home country. This heterogeneity in productivity can be explained by a foreign-owned firm’s investment in research and development for its processes and products (Neary, 2009).

Second, the location advantage addresses the purpose of the firm’s foreign direct investment to either serve the domestic market or to export from its home country (Markusen, 2009). If the foreign-owned firm’s purpose is to serve the domestic market by increasing market access to consumers, then this form of FDI is called the horizontal FDI (Neary, 2009). Brainard (1997) describes the rationale behind the horizontal FDI as the “proximity-concentration trade-off” whereby a firm gains proximity advantage by constructing a firm in the host country and saves on trade costs (e.g., tariffs or transportation costs that makes exporting expensive), but loses the rewards from concentrating on firm production in its home country. On the other hand, an FDI where the firm intends to capture lower input and trade costs to move intermediate and final goods to and from the host country is called vertical FDI (Neary, 2009). Vertical FDI allows firms to use the host country as their exporting platform (Markusen, 2009).

The third condition in the OLI framework is the internalization advantage. In this case, a firm must have a motive for possessing a production facility rather than contracting a local firm to produce on their behalf (Markusen, 2009). For product differentiation and trade, Neary (2009) adds that
highly productive firms demonstrate internalization (e.g., the supplier becomes an employee), while less productive firms display distant trading relationship whereby the supplier remains a contractor. Thus, internalization seeks to secure knowledge-based assets and to avoid loss of its value through imitation and other channels of agent exploitation.

3.1.2. Foreign Ownership

Foreign ownership, as defined by Vaughn (1995), is “the ownership of assets by a foreign firm for the purpose of “controlling” the use of those assets”. This ownership is said to be a direct foreign investment when the foreign-owned firm owns at least 10 percent of the domestic operations (Vaughn, 1995). However, these foreign-owned firms usually hold 100 percent claim on their subsidiaries. Babu and Sekhar (2015) define foreign direct investment as capital inflows from the foreign country to the host country with the goal of enhancing the production capacity of the host economy. Due to the slow growth in domestic markets, most firms explore international markets to capitalize on their firm-specific advantages and benefit from their production and marketing skills. Anwar and Nguyen (2011) encourage nations to attract more foreign investment because it has the potential to improve economic growth on the national level. For instance, Krstevska and Petrovska (2012) examine the interaction between foreign ownership and exports and find that export-oriented foreign firms positively influence the trade balance of the economy.

There is a common belief that the presence of foreign-owned firms generates externalities such as technology transfer. Aitken and Harrison (1999) assert that some countries respond to the externalities belief by offering incentives such as a subsidy for firm constructions or lower income taxes, to foreign-owned firms. The provision of firm construction subsidies is justified by the notion that domestic firms may benefit from the circulation of new processes used in creating new
products, designed by foreign-owned firms (Aitken and Harrison, 1999). Krstevska and Petrovska (2012) highlight the direct and indirect mediums through which foreign-owned firms implement advanced technological procedures and generate growth in the host economy. Firstly, a foreign-owned firm can directly increase economic growth by introducing a new technological process for producing capital goods, which increases the capital stock in the host economy, and subsequently leading to long-run growth in the economic state. Secondly, the promotion of knowledge diffusion through the transfer of managerial expertise is an indirect mechanism through which economic growth and technological improvements emerge (Krstevska and Petrovska, 2012). Haddad and Harrison (1993) describe these managerial skills as an intangible asset that foreign-owned firms hold and cannot be sold easily.

3.1.3. Exports versus Foreign Ownership

Foreign ownership and exports are two channels by which firms can serve foreign buyers and increase the country’s access to international trade opportunities and sustained economic growth (Helpman et al., 2004). Firms can either choose to export their domestically-produced commodities or they can serve the host market using its subsidiaries through a form of inward foreign direct investment (FDI). However, is it more beneficial for the host country to allow the entrance of foreign-owned firms or to encourage only distant trading instead? Girma et al. (2004) point out that most firms avoid export markets because of the sunk or entry costs involved such as the cost of market research and product modification, or transport costs and tariffs. Nonetheless, the few firms that choose to export gain better market exposure by learning from buyers and competing with other firms to raise their productivity (Girma et al., 2004). However, Helpman et al. (2004) state that only the productive group of firms would engage in exporting and the most productive ones out of the group would go further in establishing quartiles of productivity in the host country.
through foreign ownership. Alternatively, Jongwanich and Kohpaiboon (2008) add that since foreign-owned firms are highly experienced with international markets and thus have quicker access to market information than domestic firms, their presence could potentially improve the host country’s export performance. Also, foreign-owned firms tend to possess information relating to advanced technologies and management practices that would be unavailable under exporting (Jongwanich and Kohpaiboon, 2008). Thus, through imitation and labour turnovers, domestic firms can benefit a lot more from the presence of foreign-owned firms than through exporting.

3.2. Foreign Ownership in the Manufacturing Industry

According to Harris and Robinson (2003), a growing share of foreign ownership in the manufacturing sector has more advantages that outweigh the disadvantages (e.g., loss of control of integral components of production) associated with foreign ownership. Nonetheless, a foreign-owned firm undertakes investment abroad if they possess some form of distinctive resource or attributes such as product and process technology or advanced management skills, that can help them stay profitable in the host country. Also, “For direct investment to thrive there must be some imperfection in markets for goods or factors, including among the latter technology, or some interference in competition by the government or by firms, which separates markets” (Kindleberger, 1969, p. 13). Chen (2000) also highlights that foreign-owned firms anticipate locational advantages in order to respond swiftly to change in consumer preferences in the foreign market. Production efficiency is assumed to be greater with the entry of foreign-owned firms and their presence leads to two effects- direct and indirect effects- discussed below.

The manufacturing industry directly experiences an overall increase in productivity and performance levels, through competition that stimulates domestic firms to adopt the superior
practices of foreign firms (Harris and Robinson, 2003). Domestic firms, however, indirectly experience an increase in productivity through knowledge spillovers (Harris and Robinson, 2003). Blomstrom and Kokko (1998) also argue that the presence of foreign-owned firms interrupts the existing market equilibrium and forces domestic firms to actively protect their market share and profit, which is likely to result in productivity spillovers to the domestic firm. Gorg and Greenway (2004) add that the rationale behind allowing foreign ownership in the manufacturing sector is that domestic firms benefit and the entire industry experiences productivity through the following mechanisms: R&D spillovers, market competition, imitation and skill acquisition. Another key form of spillover mentioned in the productivity literature includes firm agglomeration. I will discuss these spillover mechanisms later in the literature.

3.3. Benefits of Foreign Ownership to Domestic Firms

When foreign-owned firms do not completely internalize their productivity, spillovers from the presence of foreign-owned firms in the industry raises the productivity of domestic firms. Spillovers are defined as productivity improvements resulting from knowledge transfer from the foreign-owned firm to the domestic firm- which includes technology diffusion and transfer of knowledge from managerial and organizational practices related to production (Farole and Winkler, 2012). These productivity spillovers can be intentional or unintentional and assume that foreign-owned firms enjoy innovative and technological advantages, and thus have higher levels of productivity (Farole and Winkler, 2012). Audet and Gagne (2010) assert that any resulting positive spillovers from firms can either be horizontal (intra-industry) or vertical (inter-industry) spillovers. Intra-industry or horizontal spillovers takes place within firms in the same industry and are benefits to domestic firms when they compete with foreign-owned firms within their sector (Anaya, 2013; Audet and Gagne, 2010). However, inter-industry or vertical spillovers take place
between firms across industries—usually from foreign-owned firms to suppliers—and occur in the production process between different industries (Anaya, 2013; Audet and Gagne, 2010). The different mechanisms through which horizontal and vertical spillovers occur are discussed below:

3.3.1. Research and Development Spillovers

Most foreign-owned firms are affiliated with and also control the majority of the world’s private research and development, and modern technology contributions. The few countries that manage the world’s technology and R&D contributions are the United States, Netherlands, Japan, Switzerland, Germany, and the U.K, of which Blomstrom and Kokko (1997) point out that they all account for approximately four-fifths of the world’s stock of foreign investment. Theoretically, it is safe to conclude that foreign-owned firms are important sources of new technology in the host country by reason of their proprietary technology. Research and development spillovers to domestic firms occur either by imitation, reverse engineering or by recruiting workers from the foreign firm (Wei and Liu, 2006). Absorbing and adapting any new technology from foreign-owned firms requires well-trained and highly competent workers (Djankov and Hoekman, 2000). When technology knowledge leaks out from foreign affiliates, domestic firms are likely to use such information to their advantage, which leads to an increase in the domestic firm’s productivity. Blomstrom and Kokko (1998) explain this spillover process by indicating that foreign-owned firms train new employees on how to use new technologies, and then with labour turnovers, domestic firms hire these employees with special skill sets to improve their productivity levels. Djankov and Hoekman (2000) examined foreign-owned firms in Czech manufacturing sector and found that they reduce the cost of learning new techniques because they possess quality systems that help them easily implement techniques to ensure food products meet given specifications. However, the manufacturing sector in the host country will only undergo a rise in productivity if they are
research intensive and if the technology spillover is large enough (Sjoholm, 1999). Sjoholm (1999) also adds that the wider the technology gap, the higher the potential for technology imitation. If the industry is dominated by domestic firms, then there is a higher potential for technology spillovers from foreign firms (Sjoholm, 1999).

3.3.2. Market Competition Spillovers

Harris and Robinson (2003) postulate that market competition is one of the outcomes of intra-industry spillovers from foreign-owned to domestic firms in the food manufacturing sector. They also argue that foreign ownership should be highly encouraged because foreign firms stimulate a healthy competition that could raise the productivity of the food industry. As a result of this increase in market competition, domestic firms are motivated to improve their market share by upgrading their technology or imitating foreign firm’s products (Harris and Robinson, 2003). Although the general consensus in the literature on spillovers is that the existence of foreign ownership benefits the host country, there are contrasting results. For instance, Aitken and Harrison (1999, p.606) argue that the presence of foreign-owned firms may disrupt the market by stealing market share, thus negatively impacting the performance of the domestic firm. Nonetheless, Haddad and Harrison (1993) conclude that competition from foreign ownership is not just about stimulating technology transfers but also motivating existing firms towards their best production possibility frontier.

3.3.3. Imitation and Skill Acquisition Spillovers

Imitation involves the adaptation of modern production processes and management techniques. However, the extent of imitation also depends on the complexity of the procedures involved. Gorg and Greenaway (2004) assert that domestic firms can emulate basic production procedures, as well as innovative management and administrative techniques. Thus, any upgrade to innovative
production processes attained through imitation, could lead to spillovers with productivity benefits for domestic firms. Although foreign-owned firms demand highly skilled labour and tend to invest heavily in training employees, it is difficult to prevent employee mobility to other domestic firms (Gorg and Greenaway, 2004). There are two mechanisms Gorg and Greenaway (2004) highlight as mediums through which productivity spillovers from workers occur: First, spillovers to corresponding workers; and second, knowledge transfer from workers hired from foreign-owned firms. When domestic firms exhibit low levels of product innovation, they are more inclined to employ labour from their rival foreign-owned firms to stimulate innovative activity (Gorg and Greenaway, 2004).

3.3.4. Firm Agglomeration Spillovers

The theory behind agglomeration is based on the need for production flexibility and limiting production to the local environs alone (Driffield and Munday, 2000). When production firms “agglomerate” or are located close to each other they benefit from a reduction in the cost of production and gains in efficiency resulting from their close proximity (Hailu and Deaton, 2016). Furthermore, agglomeration benefits arise when firms are situated close to a diverse set of workers or consumers and competing for multiple suppliers providing cheaper intermediate inputs (Greenstone et al, 2010). With increased access to suppliers and customers, and a higher chance of knowledge spillovers, Hailu and Deaton (2016) add that firms clustered together can experience improved productivity levels. Since most firms and workers are drawn to areas that are concentrated with other firms and workers, firms will be more productive on average because they are situated in a larger market with a high supply of unemployed workers (Greenstone et al, 2010). In addition, location advantages could be continuous when growth in the sector makes the location more attractive, resulting in the set-up of specialized supporting infrastructure in the industry.
(Driffield and Munday, 2000). Consequently, foreign-owned firms are more inclined to build their facilities in the host country in order to benefit from the agglomeration economies.

3.4. Foreign Ownership in the Ethiopian Manufacturing Industry

The productivity gap between developed and developing countries is quite large, such that, underdeveloped economies have a larger gap. Mcmillan et al (2014) examined productivity growth in Africa and found that labour productivity in the US manufacturing sector as of 2005, was nearly thirty times that of Ethiopia’s sector. This productivity gap is larger in underdeveloped economies due to allocative inefficiencies that negatively affect the overall labour productivity (Mcmillan et al, 2014). One approach to closing this gap in productivity is to permit the entrance of foreign direct investment in the sector (Griffith et al, 2004). Also, “For direct investment to thrive there must be some imperfection in markets for goods or factors, including among the latter technology, or some interference in competition by the government or by firms, which separates markets” (Kindleberger, 1969, p. 13). Foreign-owned firms undertake investment abroad if they possess some form of distinctive resource or attributes such as product and process technology or advanced management skills, that can help them stay profitable in the host country. Helpman et al (2004) state that only the most productive firms serve the domestic market and undertake FDI in the host country. Therefore, countries use policies and incentives such as lower tax rates, financial incentives and subsidized infrastructural services to attract firms.

The Ethiopian manufacturing sector draws foreign ownership mainly from the United States, India, China, Saudi Arabia, and some European Union (EU) countries such as Netherlands, Germany, and Sweden. These foreign investors tend to focus a lot more on the agricultural sector including horticulture, floriculture, meat and biofuels (Altenburg, 2010). Since Ethiopia is an agrarian
economy, there is a lot of arable land with a sufficient amount of rainfall throughout the year which makes the agricultural sector viable for investors. However, the Ethiopian government formulated a second Growth Transformation Plan (GTP II) to not only increase production and employment in the manufacturing sector through the Industrial Park program, but also enhance the productivity and competitiveness of the sector. Priority has been given to the manufacturing sector because it experiences a low level of investment in infrastructure, employment and significantly low rate of development of small and micro firms (NPC, 2016). As a result, the Ethiopian economy has faced a slow pace in transition from agriculture to manufacturing.

Foreign ownership in the manufacturing sector of developed countries have shown that improving the sector is essential for maintaining its technological capacity, industrial capability, improving income and multifactor productivity of the overall economy (NPC, 2016). Thus, to facilitate the productive capacity of the manufacturing sector and accelerate its growth, foreign ownership is highly critical (NPC, 2016). Domestic firms have limited capacity to reach the intended goals for the manufacturing sector, thus increasing FDI inflows in key investment areas is essential for industrial development and strengthening business partnerships with strategic countries (NPC, 2016). By building industrial parks, a link between domestic and firms is created to expedite knowledge and technology transfer, advanced managerial skills, and stimulate competition in the manufacturing sector in order for it to be globally competitive (NPC, 2016).

3.5. **Foreign Ownership in Developing Economies**

Globalization in the manufacturing sector today implies that there is an international market for manufactured products and services- It opens a channel through which firms can set up their business in a given country and increase the competition in the market. Through foreign
ownership, developing economies can experience growth in employment, access to global markets, efficient management procedures and transfer of modern technologies (Anyanwu, 2012). Endogenous growth models also suggest that technology is a factor of production, and foreign ownership linked with technology transfer can lead to growth in the host economy (Mengistu and Adams, 2007). When firms bring new ideas and invest in manufacturing infrastructure, they help narrow the “idea gaps” and technical gaps between developed and developing economies (Mengistu and Adams, 2007). By reducing these knowledge and technical gaps, the absorptive capacity of developing economies increases. This suggests that the effect of foreign ownership in a developing economy depends on the economy’s conditions or absorptive capacity in terms of financial development, technology levels, and human capacity (Mengistu and Adams, 2007). Sanchez-Sellero et al (2014) define absorptive capacity as the ability of domestic firms to evaluate, assimilate and apply knowledge obtained from its foreign competitors. Put differently, a domestic firm can only fully take advantage of productivity spillovers from firms if they have the capacity to absorb them- which also depends on their technological abilities (Sanchez-Sellero et al, 2014). Sanchez-Sellero et al (2014) highlight a few factors that determine the absorptive capacity of domestic firms from the presence of foreign firms, which include the existing technology gap, R&D activities, market concentration and quality of human capital. The intensity of R&D activities and technological gaps influence how well domestic firms absorb spillovers from foreign ownership. Wang and Blomstrom (1992) argue that a larger technological gap benefits domestic firms, while Blalock and Gerter (2009) argue that domestic firms may not absorb positive spillovers from foreign ownership because the technology gap between domestic and foreign firms is either too large or too small.
3.6. Gaps to be Addressed

This thesis will address the below gaps in the literature: (1) The direct relationship between productivity in manufacturing and foreign ownership; (2) The relationship between productive firms and foreign-owned firms in the industry.
Chapter 4

Theoretical Framework

4.1. Production Function

Goods are produced by converting primary and intermediate input resources such as labour, energy, capital and raw materials into the finished output. Marsden et al (1972) define the production function as a mathematical construction of a well-defined production technology. The production function describes the relationship between the quantity of inputs used in production and the quantity of output. (OECD, 2001). Marsden et al (1972, p.280) describe the production function as a function that gives the “maximal output obtainable from a given set of inputs”. Thus, given a level of technical knowledge, the production function establishes the maximum possible output level a firm can obtain using its factors of production (Aigner and Chu, 1968). The production function is given as:

\[ Y_t = A_t F(K_t, L_t, E_t, M_t) \]  \hspace{1cm} (4.1)

where, \( A_t \) represents a residual that measures technical progress or technological change and other productivity growth factors that cannot be explained by labour and capital used (Solow, 1957), and the firm’s output level produced at a given time \( (Y_t) \) is a function of factors of production- i.e., capital or machinery \( (K_t) \), labour input \( (L_t) \), raw materials \( (M_t) \), and energy input \( (E_t) \). Therefore, any shifts in the production function resulting from improved managerial skills or advances in technology is captured by \( A_t \).
4.2. Foreign-Owned Firms and the Production Frontier

In microeconomic theory, a production function is defined in terms of the maximum output that can be produced from a specified set of inputs, given the existing technology available to the firms involved. A production set is the set of all combinations of inputs and outputs that are technologically feasible to produce, and consists of all points between the production frontier $0F'_0$ in figure 4.1 (Battese, 1992; Coelli et al, 2005). A production frontier describes the maximum potential output of an efficient firm that can be obtained given the input levels. $0F'_0$ and $0F'_1$ in figure 4.1. below illustrates the production frontier for a firm with two different technologies. In figure 4.1, the ray through the origin measures productivity at a given data point. The slope of the ray is $y/x$ and it measures productivity (Coelli et al, 2005). Productivity is at its maximum at the point where the ray through the origin is tangent to the production function, which is also the point of optimal scale efficiency. Production plans at any point other than the tangency point entails lower productivity.

*Figure 4.1. Technical Change in Two Time Periods*
Figure 4.1 also demonstrates how productivity improves when a firm introduces advanced technology. Jorgenson and Griliches (1967) associate a shift in the production function to advances in technology. Thus, in figure 4.1, if a foreign firm introduces better technology and has better managerial efficiency, the production frontier shifts upward. Foreign-owned firms tend to invest a lot more in research and development, innovation, and technology (Markusen, 2009). With the introduction of advanced technology in a foreign-owned firm in the first period, their production frontier shifts upward from $0F_0'$ to $0F_1'$. As a result, foreign-owned firms demonstrate a higher level of productivity in period 1 because they have better technology, and thus they produce more in period 1 with their given level of inputs compared to period 0. The ray from the origin tilts in response to the production function shift from $0F_0'$ to $0F_1'$, and indicates that productivity increases with technical changes in a foreign-owned firm.
Chapter 5

Empirical Analysis

This chapter discusses the concept of multifactor productivity and the empirical strategy used to estimate multifactor productivity in the manufacturing sector. The second section of this chapter estimates the relationship between foreign ownership and productivity in the manufacturing sector.

5.1. Empirical Strategy and Measurement

To measure multifactor productivity, one can choose between different econometric techniques designed for estimating the production function. Wolff (2013) classifies these techniques as either parametric, semi-parametric and nonparametric. The parametric method includes the Stochastic Frontier Analysis, the semi-parametric method includes the Olley and Pakes (1996) and Levinsohn and Petrin (2003) approaches, while the nonparametric method includes the Index Number, and Data Envelopment Analysis approaches (Bartelsman and Doms, 2000, p.7). Using the Index Number technique to estimate productivity is quite difficult, especially when deciding what kind of index works best and what prices (or output shares) are used to evaluate the different levels of output produced (Bartelsman and Doms, 2000). If output growth is faster than input growth, then there is a growth in multifactor productivity (Jorgenson and Griliches, 1967). However, measuring only multifactor productivity growth is not sufficient as it is difficult to verify the source of growth. Thus, the index number approach may not provide an accurate measure of multifactor productivity (Bartelsman and Doms, 2000). Although the Data Envelopment Analysis approach requires only the total amount of inputs and output, it is not a preferred method because it is deterministic, and its estimates are highly susceptible to outliers and measurement errors (Hossain et al, 2012). Thus, Hossain et al (2012) argue that the Stochastic Frontier Analysis (SFA) is a better approach because
it accounts for stochastic noise in the data. Kim and Han (2001) add that SFA permits decomposition of multifactor productivity growth into four essential parts: technical progress, technical efficiency, allocative efficiency, and scale effects. The stochastic frontier approach also accounts for firm heterogeneity by capturing firms that are technically inefficient, permitting measurement of heterogeneity from unobservable factors such as advanced managerial skills (Yasar and Paul, 2009). However, Yasar and Paul (2009) add that the SFA approach does not account for endogeneity in the independent variables which may be difficult to estimate using the maximum likelihood method. Also, the SFA approach may not be able to account for unobserved heterogeneity among firms, depending on the firm’s characteristics (Yasar and Paul, 2009).

Olley and Pakes (1996) apply a semi-parametric estimation procedure where the investment input is used as a proxy to account for unobserved heterogeneity and tackle any endogeneity in firms. However, the investment proxy tends to hold zero observations for some firms and for some years, which can be problematic in estimation. This is problematic because it implies losing all observations with zero-investment values, which could also be a significant loss in observations since a large sample of firms within an industry do not report positive investment each year (Beveren, 2012). Ignoring observations with zero investment values means ignoring a lot of data, which results in an estimation efficiency issue. Levinsohn and Petrin (2003) extend the Olley and Pakes (1996) method by using intermediate inputs such as materials rather than investment, as a proxy for unobserved heterogeneity such as productivity (Wolffe, 2013). This achieves greater precision than the Olley and Pakes (1996) approach because the materials input is more flexible, and firms typically report a positive use of materials every year (Beveren, 2012). Thus, it is easier to retain most observations in a dataset for a more efficient estimation when using the Levinsohn and Petrin (2003) approach.
Standard production function estimation techniques such as the Ordinary Least Squares (OLS), may prove inadequate because they do not control for unobservable productivity shocks that may be associated with input choices (He et al., 2017). As a result, selection bias and endogeneity or simultaneity problems arise- a correlation between any unobserved productivity shocks and input choices- leading to biased productivity estimates (Beveren, 2012; Breunig and Wong, 2004). According to Benfratello and Razzolini (2008), the OLS method assumes orthogonality between the explanatory variables and the time-invariant firm-specific fixed effects, which is not feasible in the production function. Input choices are usually determined by a firm’s decisions, which are based on their productivity levels (Benfratello and Razzolini, 2008). Thus, the input choices are selected to maximize profit and therefore will depend on any unobservable and observable productivity shocks present in the error term (Benfratello and Razzolini, 2008). Therefore, using the OLS estimation approach to estimate productivity will result in endogeneity or simultaneity bias in the regression estimates.

A large literature has developed on the methods for estimating the production function in the presence of simultaneity between input and output choices, and errors of measurement (e.g., Olley and Pakes 1996; Levinsohn and Petrin 2003; Wooldridge 2009; Gandhi, Navarro, and Rivers 2016; Ackerberg et al., 2015). Olley and Pakes (1996) and Levinsohn and Petrin (2003) developed a semi-parametric technique that deals with the simultaneity and selection bias. As mentioned earlier, Olley and Pakes (1996, hereafter OP) suggested using a firm’s investment decision as a proxy to control for unobserved productivity shocks while Levinsohn and Petrin (2003, hereafter LP) propose using intermediate inputs such as materials and energy as a proxy instead. The purpose of both approaches is that input choices can be inverted to allow one “observe” the unobservable productivity shocks, under certain assumptions (Ackerberg et al., 2015). Beveren
(2012) argues that the OP method implies that only firms with positive investment can be used for analysis, and if only a few firms demonstrate positive investment flows, there could be a potential loss in efficiency across firms. On the other hand, the LP method is a bit advantageous since firms tend to disclose yearly positive usage of materials and energy and are less likely to contain zero observations on the firm level, which makes them an optimal proxy variable. The materials proxy input is flexible and can further be expressed as a function of capital and productivity, thus reflecting more information on firm multifactor productivity and producing more consistent and unbiased estimates (Petrin et al, 2004). Ackerberg et al (2015, hereafter ACF) examines both LP and OP methodologies, and find evidence of identification or collinearity problems in the first stages of the estimation procedure. In the first stage of estimation, collinearity issues arise as both the OP and LP methodologies focus on estimating the labour coefficient, and further estimate the capital coefficient in the second stage. Thus, ACF tackles the collinearity problems arising in the first stage of the OP and LP methodology by estimating all input coefficients in the second stage of the estimation procedure instead.

As previously mentioned, the ACF approach addresses the multicollinearity and identification issues with the labour variable, that arise with the OP and LP methodologies. ACF adds that productivity is a complex function which may not be well estimated by the first-order Markov process rather, a second-order Markov process. In the first stage of estimation, the collinearity between labour and the polynomial in investment and capital (OP approach) and the collinearity between labour and the polynomial in materials and capital (for LP approach), leads to an unidentified labour coefficient (Beveren, 2012). The LP approach selects the labour input before materials input which means selection of materials depends on the choice labour input, and consequently prevents the identification of labour coefficient in the first stage of estimation.
(Beveren, 2012). For labour to be identified in the first stage, the data used has to possess some variation that does not depend on the materials input. Without data variation, the labour coefficient becomes perfectly collinear in the first stage and will not be identified. ACF thus suggests a procedure where the first stage is used to net out the error term, while labour and all other input coefficients are derived in the second stage.

For this study, I will use the LP approach to estimate multifactor productivity in the Ethiopian manufacturing industry, because it allows the use of observable firm attributes as a proxy to control for unobservable shocks in productivity that vary with time. Finally, the LP method unlike the OP method, does not discard any unobservable firm-specific shocks affecting the intermediate input, since the intermediate and labour inputs are stable inputs that only impact current profits (Ackerberg et al, 2015). Thus, there is no need for the intermediate inputs to depend on these shocks. In the next section, I will discuss multifactor productivity and how to estimate firm multifactor productivity using the Levinsohn and Petrin approach.

5.2. **Multifactor Productivity**

Multifactor productivity is defined as “a ratio of a volume measure of output to a volume measure of input use” (OECD, 2001, p.11). It measures how efficiently inputs are used for production. One of the objectives of measuring multifactor productivity is to easily capture a firm’s technological progress when it converts its resources to outputs. In addition, it can further be decomposed to provide changes in efficiency, economies of scale, and capacity utilization (OECD, 2001). It is an essential tool for examining growth in productivity over time and estimating its contribution to future economic growth. OECD (2001) highlights that multifactor productivity uses two types of output measures such as gross output and value-added measures. The gross output measure
accounts for both primary (i.e., capital and labour) and intermediate inputs (i.e., materials and energy), while the value-added measure of productivity accounts only for the primary input usage (OECD, 2001).

With the value-added approach, Gullickson (1995, p.17) states that “intermediate inputs are excluded from consideration in the value-added model on the basis of the assumption that they are insignificant to the analysis of productivity growth”. In addition, Cobbold (2003) critiques the value-added approach as being conceptually flawed which may result in misleading productivity estimates or biased productivity growth trend in the industry. Thus, the value-added concept of output is not considered an appropriate output measure for multifactor productivity. The gross output measure, however, is considered more comprehensive because it includes all intermediate inputs and associates its usage to industry productivity growth (Cobbold, 2003). Jorgenson and Stiroh (2001, p.53) also add that “by correctly accounting for the quantity and quality of intermediate inputs, the gross output concept allows aggregate TFP gains to be correctly allocated among industries”. Finally, the gross output approach clearly indicates any form of technological changes from research and development or learning-by-doing, that is not attached to a given input used in production (Cobbold, 2003). Thus, the gross output approach in measuring multifactor productivity is generally preferred in the literature and will be used in this study.

Jorgenson and Griliches (1967) add that multifactor productivity is accurately measured when the production function shows constant returns to scale. With constant returns to scale production function, changes in multifactor productivity are associated with shifts in the production function. Abramovitz (1962, p.764) defines these changes in multifactor productivity as “… the effect of costless advances in applied technology, managerial efficiency, and industrial organization
(“cost”- the employment of scarce resources with alternative uses- is, after all, the touchstone of an “input”) …”. Thus, to estimate multifactor productivity, the Cobb-Douglas functional form of production function will be applied, because it is commonly used in the productivity literature and it assumes constant elasticity of substitution or returns to scale. Thus, it will yield transparent estimates of production. It is given by:

\[ Y_{lt} = e^{\beta_0} L_{lt}^{\beta_l} K_{lt}^{\beta_k} M_{lt}^{\beta_m} e^{u_{lt}} \]  

(5.1)

where \( Y_{lt} \) is the output of the firm or firm \( i \) at time \( t \), \( L_{lt} \) is the labour input, \( K_{lt} \) is the capital input, \( u_{lt} \) is the error term which includes advanced managerial skills and any measurement error, while \( \beta_0, \beta_k, \beta_l \) and \( \beta_m \) are parameters to be estimated. Taking logs of equation (5.1) will result in:

\[ y_{lt} = \beta_0 + \beta_l l_{lt} + \beta_k k_{lt} + \beta_m m_{lt} + u_{lt} \]  

(5.2)

where \( y_{lt} = \log(Y_{lt}), l_{lt} = \log(L_{lt}), k_{lt} = \log(K_{lt}), m_{lt} = \log(M_{lt}) \). In the next section, I will discuss the empirical approach used in this study.

5.2.1. Productivity Estimation - Levinsohn and Petrin Approach

As earlier highlighted, the OP approach tackles the endogeneity problem resulting from the correlation between input factors and the productivity term, by replacing the latter term with observables such as level of investment, that carries information on firm productivity. The LP methodology takes a similar approach to solving the endogeneity problem with the production function by improving the OP approach and using intermediate inputs rather than investment as a proxy variable for productivity. The identification of this proxy depends on the below assumptions:

1. **Proxy variable**: Firms examine their level of productivity and modify their level of intermediate inputs such as materials, \( m_{lt} \), relative to the demand function \( m_{lt} = m_t(\omega_{lt}, k_{lt}) \),
where $\omega_{it}$ represents a firm’s productivity at time $t$, and $k_{it}$ represents firm capital stock at a given time.

2. **Strict monotonicity:** The materials input, $m_{it} = m_t(k_{it}, \omega_{it})$, is strictly monotonic in productivity, $\omega_{it}$, i.e., the intermediate input variable is monotonically increasing function of productivity, to easily invert the intermediate input demand function.

3. **Unobservable scalar:** Productivity, $\omega_{it}$, is the only unobserved state variable at the firm level in $m_{it} = m_t(\omega_{it}, k_{it})$.

4. **Implications of Input choices:** Labour input $l_{it}$ is assumed to “static”, i.e., labour input demand in a given period has no implications on future profits. Although this is not a necessary condition, labour input in the previous period ($l_{t-1}$), should be included in the intermediate input demand function.

5. **Timing of Input choices:** The level of capital stock is chosen in time $t - 1$, while the labour and intermediate inputs are decided in time $t$, when the firm’s productivity is observed. This is expressed as:

$$l_{it}, m_{it} \in \Omega_t \quad l_{it}, m_{it} \ni \Omega_{t-1}$$

$$k_{it} \in \Omega_t \quad k_{it} \in \Omega_{t-1}$$

where $\Omega_t$ is the information set at time $t$. The mechanism of the LP approach is defined with a production function as follows:

$$Y_{it} = F(K_{it}, L_{it}, M_{it}, \omega_{it}) \quad (5.3)$$

where $Y_{it}$ measures output and $\omega_{it}$ measures productivity for firm $i$ at time $t$. On the other hand, $K_{it}$ represents the state variable called capital input, while $L_{it}, M_{it}$ represent the free variables—labour and materials, respectively. The production function is approximated with a Cobb-Douglas technology functional form as:
\[ y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + u_{it} \] (5.4)

The \( u_{it} \) is the error term which represents “innovation” in productivity, that can be split into two components \( \omega_{it} \) and \( \eta_{it} \)- with the former representing shocks in productivity, and the latter is the true error term that contains unobserved shocks and any measurement errors that do not influence a firm’s decisions. Therefore, the innovation in productivity is expressed as:

\[ u_{it} = \omega_{it} + \eta_{it} \] (5.5)

Substituting equation (5.5) into (5.4) results in:

\[ y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \omega_{it} + \eta_{it} \] (5.6)

Next, the LP methodology defines a demand function for intermediate input i.e., materials, as a function of current productivity and capital:

\[ m_{it} = m_t(\omega_{it}, k_{it}) \] (5.7)

The monotonicity condition allows equation (5.7) to be inverted such that productivity is defined as a function of materials and capital input, as seen in equation (5.8) below:

\[ \omega_{it} = \omega_{it}(m_{it}, k_{it}) \] (5.8)

According to the OP approach, productivity in the next period is expected to follow a first order Markov process:

\[ \omega_{it} = E[\omega_{it} | \omega_{it-1}] + \xi_{it} \] (5.9)

which implies that current productivity is dependent on past productivity and an innovation in productivity term, \( \xi_{it} \). Next, substituting (5.8) into (5.6) results in the below:

\[ y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \omega_{it}(m_{it}, k_{it}) + \eta_{it} \] (5.10)

Next, LP defines a function of materials and capital inputs as \( \varphi_{it}(m_{it}, K_{it}) \) such that:

\[ \varphi_{it}(m_{it}, K_{it}) = \beta_0 + \beta_k k_{it} + \beta_m m_{it} + \omega_{it}(m_{it}, k_{it}) \] (5.11)
Substituting equation (5.11) in (5.10) yields:

$$y_{it} = \beta_l l_{it} + \varphi_{it}(m_{it}, k_{it}) + \eta_{it}$$ (5.12)

where LP defines equation (5.12) as a first stage estimator that is linear in labour input, $l_{it}$ and non-parametric in $\varphi_{it}$. The LP approach also estimates equation (5.12) using a no-intercept OLS method by approximating the non-parametric component $\varphi_{it}$, with a third order polynomial in $m_{it}$ and $k_{it}$. Next, expectations of equation (5.12) is taken conditional on materials and capital inputs, given as:

$$E[y_{it} | m_{it}, k_{it}] = \beta_l E[l_{it} | m_{it}, k_{it}] + \varphi_{it}(m_{it}, K_{it})$$ (5.13)

where expectations of $\eta_{it}$ is zero and expectations of the non-parametric term given $m_{it}$ and $k_{it}$, yields $\varphi_{it}(m_{it}, K_{it})$. To obtain a consistent estimate for $\beta_l$, equation (5.13) is subtracted from (5.12) resulting in:

$$y_{it} - E[y_{it} | m_{it}, k_{it}] = \beta_l (l_{it} - E[l_{it} | m_{it}, k_{it}]) + \eta_{it}$$ (5.14)

To estimate the coefficient of the capital input, $\beta_k$, the OP approach assumes that current productivity, $\omega_{it}$, adopts a first-order Markov process as illustrated in equation (5.9), and Levinsohn and Petrin (2003, p.321) further state that “capital does not immediately respond to $\xi_{it}$, the innovations in productivity over last period’s expectation”. Thus $\xi_{it}$ is given by:

$$\xi_{it} = \omega_{it} - E[\omega_{it} | \omega_{it-1}]$$ (5.15)

Next, the LP approach defines output net of labour’s contribution using equation (5.10) such that:

$$y_{it}^{*} = \beta_0 + \beta_k k_{it} + E[\omega_{it} | \omega_{it-1}] + \eta_{it}^{*}$$ (5.16)

where $y_{it}^{*} = y_{it} - \beta_l l_{it} - \beta_m m_{it}$, and $\eta_{it}^{*} = \xi_{it} + \eta_{it}$. Since $\eta_{it}$ and $\xi_{it}$ are uncorrelated with capital input $k_{it}$, therefore, equation (5.16) yields a consistent estimate for $\beta_k$. Furthermore, the
LP method estimates multifactor productivity (the difference between actual and predicted output) such that:

\[
\begin{align*}
\hat{\omega}_{it} &= y_{it} - (\beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \eta_{it}) \\
MFP_{it} &= \exp(\hat{\omega}_{it})
\end{align*}
\] (5.17) (5.18)

Next, I will estimate the relationship between productivity and foreign ownership.

### 5.2.2. Productivity and Foreign Ownership

To examine the relationship between productivity and foreign ownership, I ask two questions: (1) Do foreign-owned firms have higher productivity? (2) Do foreign-owned firms target more productive firms? To address the first research question, I follow Batool (2009), Bresnahan et al (2013) and Fons-Rosen et al (2014). The relationship between the level of productivity and foreign ownership is examined by estimating the following equation using the fixed effects approach:

\[
\log(\omega_{it}) = \beta_0 + \beta_1 FO_{it} + \beta_3 X_{it} + \delta_s + \delta_t + u_{it}
\] (5.19)

where \(\omega_{it}\) is the multifactor productivity, \(FO_{it}\) is a binary variable that represents foreign ownership, \(X_{it}\) represent attributes of a firm in a given time period, \(\delta_s\) are two-digit sector fixed-effects dummies; \(\delta_t\) are year fixed-effects dummies, \(\beta's\) are parameters to be estimated. \(u_{it}\) is the error term that includes management differences, measurement errors, and any variation in external factors that may affect multifactor productivity. The input choices initially used to determine productivity were not included because they were already controlled for, and thus the equation above permits for separate productivity effects from foreign ownership. The error term can be expressed as: \(u_{it} = \alpha_t + \varepsilon_{it}\), where \(\alpha_t\) is the unobserved time-invariant firm-specific shocks in all periods but constant over time, and \(\varepsilon_{it}\) refers to white noise. Due to the presence of
unobserved time-invariant effects that may be correlated with the explanatory variables, the OLS approach for estimation may not be efficient because it would lead to biased and inconsistent estimates (Benfratello and Razzolini, 2008). Thus, the fixed effects approach is used because it controls for all unobserved time-invariant differences, by removing the effect of the time-invariant characteristics in order to better evaluate the net effect of the covariates on the outcome variable.

To address the second research question, a panel probit model is used to estimate the link between foreign ownership and multifactor productivity obtained earlier. Following Fons-Rosen et al. (2014), equation (5.20) below examines whether foreign-owned firms target productive firms based on their productivity and firm characteristics in the previous period, given by:

\[
FO_{lt} = \beta_0 + \beta_1 \omega_{lt-1} + \beta_2 X_{lt-1} + \delta_s + \delta_t + \epsilon_{lt} \tag{5.20}
\]

where \(FO_{lt}\) is a binary variable that equals one if a firm is owned by a foreign firm and zero otherwise; \(\omega_{lt-1}\) is a measure of firm level multifactor productivity lagged one period; \(X_{lt-1}\) represents firm level characteristics in the previous period (e.g., firm size, age, skilled workers); \(\delta_s\) are two-digit sector fixed-effects dummies; \(\delta_t\) are year fixed-effects dummies; \(\beta'\)s are parameters to be estimated; and \(\epsilon_{lt}\) represents the error term. The fixed effect dummies cancel out those firm attributes that do not vary over time.
Chapter 6

Data and Variable Definitions

This chapter describes the data used for the study, the importance of firm-level productivity measures and the definition of variables used in analysing the manufacturing sector.

6.1. Data

I use annual firm-level longitudinal data on manufacturing establishments, obtained from the Survey of Large and Medium Scale Manufacturing and Electricity Industries with over ten employees, collected by the Ethiopian Central Statistical Agency (CSA). The unbalanced panel data for this study covers periods 1996 to 2010. The survey includes information on private, public and foreign manufacturing firms in Ethiopia. Also, information on total sales, the value of production, capital investment, number of employees by gender, production and non-production workers, wages and salaries by gender, ownership by gender, education, taxes, a variety of inputs used and other related information at the firm-level were provided. Although the survey does not provide information on whether firms have global operations or a firm’s country of origin, it provides information on capital investment by ownership and sex. Thus, foreign ownership in a firm is determined by summing share of initial and current paid-up capital investment by non-Ethiopians. The dataset also includes location indicators for the different regions with manufacturing industries. Industries covered include food, beverage and tobacco, textiles, wearing apparel, leather and footwear, wood, paper and printing services, chemicals, rubber and plastics, non-metals, metals and other industries, where other industries include general purpose machinery, furniture manufacturing, and vehicle parts manufacturing.
In constructing the final sample used for this study, the years 2011 to 2014 were excluded because information on raw materials in the dataset was not reported for this time period. Firms with less than ten employees were excluded from the study since the survey covers manufacturing firms with at least 10 employees. Firms that report negative or zero inputs and outputs were also excluded from the study. The total number of establishments including foreign firms (based on capital investment by non-Ethiopians) from 1996 to 2010, are provided in the Appendix (Table A.1). Data on the manufacturing industry’s subsectors is organized according to the International Standard Industrial Classification (ISIC)- a standard United Nations industry classification System- that groups together activities that share a common process in producing goods or services and use similar technologies.

In the absence of the 2-digit ISIC industry-level price deflators for deflating inputs and output, a GDP implicit price deflator obtained from the World Development Indicators database is used to deflate nominal variables such as output, capital, energy, materials and paid-up capital investment. In this study, the three inputs used for productivity analysis are capital, labour and intermediate inputs where intermediate inputs include energy and raw materials inputs.

6.2. Importance of Establishment-Level Productivity Measurements

Doms and Jensen (1998) argue that firm or establishment-level data is preferred because it reveals substantial heterogeneity between domestic and foreign-owned firms within the manufacturing industry and allows one control for firm-specific characteristics such as size, age, industry and location. As the average productivity of each firm increases, this, in turn, increases the aggregate industry productivity level and thus enlightens us on the direction of the overall food industry productivity. Aggregate level data, however, allows one address broad inquiries such as “which
industries are performing well in terms of productivity growth?” (Mai and Warmke, 2012, pg. 3), and allow for global comparisons of productivity and evaluation of policies over time. However, Syverson (2011) adds that aggregate productivity still depends on firm-level choices such as research and development contributions, Scarpetta et al (2002) adds that aggregate productivity combines different firm-level factors such as productivity growth of existing firms, entry of highly productive firms and the exit of less productive firms in the industry. In summary, aggregate-level productivity measures only supplement the information about the existence or non-existence of productivity growth, while firm-level productivity measures allow for a more in-depth statistical testing and control of surrounding factors that may be omitted on the aggregate level (Mai and Warmke, 2012). This equips one with a more refined understanding of the micro-level drivers of productivity growth in the industry.

6.3. Variable Definitions

6.3.1. Manufacturing Output

Output in the manufacturing sector is measured using either the gross output or value-added approach. The gross output measure of productivity is defined as “the value of sales and net additions to inventories without, however, allowing for purchases of intermediate inputs.” (OECD, 2001, p. 24). The value-added measure is, therefore, obtained by deducting intermediate inputs from gross output (OECD, 2001, p. 24). The value-added measure is a measure that conceptually links industry-level MFP to aggregate MFP growth. However, its estimates tend to be misleading and excludes intermediate inputs from consideration, which makes mismeasurement of growth trends highly possible (Cobbold, 2003). The gross output measure is favoured in productivity literature because it provides a complete picture of the production process by reflecting the use of both primary and intermediate inputs, which are known to contribute to industry productivity.
growth (Cobbold, 2003). Bailey (1986) recommends using gross output measure for firm level data since there are no intra-industry sales at the firm level, and it provides a theoretical measure of output. Bailey (1986, p.191) also highlights that the value-added approach has an advantage over the gross output approach, because of a possibility of double counting of inputs such as materials, using the gross output approach. Double counting is prevented under the value-added concept since the value-added concept does not account for intermediate inputs (Bailey, 1986). For this study, estimates from both value-added and gross output measures of multifactor productivity are used and compared.

6.3.2. Manufacturing Inputs

1. **Capital:** A number of studies have measured capital input using a firm’s level of fixed assets. For instance, Hossain and Karunaratne (2004) define capital input as total fixed assets aggregated from book values of machinery, land, building, tools and office equipment in the manufacturing sector for Bangladesh. Hailu and Tanaka (2015) measure capital input in the Ethiopian manufacturing sector as the net value of fixed assets at the end of the survey year. Thus, similar to existing literature, this study will define capital input as the total value of fixed assets by year-end, aggregated from the book value of dwelling houses, non-residential buildings, other construction works, machinery and equipment, vehicles and other office fixtures.

2. **Labour:** This is measured either by total hours worked or total number of workers at the end of the fiscal year. Camus (2007) states that information on hours worked provides the most appropriate measure of the volume of labour input, because it accounts for differences in employees’ working pattern, and differentiates between hours worked by full-time or part-time employees. However, it is difficult to measure the quality of hours worked, which makes
number of hours worked inadequate for estimation purposes (Camus, 2007). In contrast, the total number of workers is easier to measure and is the most common measure of labour input (Camus, 2007). Similar to Hailu and Tanaka (2015), this study measures labour input as the total number of workers, which is the sum of permanent and temporary workers.

3. **Energy**: This is defined as the cost of fuel and lubricating oil, electricity, wood, charcoal and water consumed.

4. **Materials**: This is measured as the total cost of raw materials used, which includes the value of local and imported raw materials.

5. **Foreign Ownership**: The share of foreign capital investment is used as a proxy for foreign-owned firms in the industry. It is measured as the ratio of total initial and current paid-up capital by non-Ethiopians to the total initial and current paid-up capital by private Ethiopians, non-Ethiopians, and the public sector. A foreign binary variable is also defined for the probit model which takes a value of 1 if the firm is foreign, i.e., foreign paid-up capital is greater than zero, and 0, otherwise.

6. **Size**: Baldwin and Sabourin (1998) highlight that measuring firm size is important because 98 percent of larger firms tend to adopt advanced technology than small or medium-sized firms. Baldwin and Sabourin (1998) further add that larger firms that adopt more technology experience higher improvements in productivity. A number of studies measure firm size using total employment level such as Li et al (2009) and thus firm size in this study is defined total number of employees in the firm.

7. **Age**: This has been defined in existing literature as the number of years since the commencement of the firm, or the number of years of establishment up to the end of the survey year (Majumdar, 1997; Li et al, 2009). Similar to existing literature, firm age is defined as
number of years since firm was established and is computed as current year minus the year if firm’s establishment.

8. **Skill:** This is a proxy for high-skilled workers using employee wages and salaries. The survey of Large and Medium Scale Manufacturing provides information on production and non-production workers, where Berman *et al* (1994) define production workers as those involved in direct labour such as fabricating, processing, assembling, and other manufacturing, while non-production workers signify workers above foreman level engaging in activities such as, supervision, sales, professional, technological and administrative work. Therefore, skill in this study is measured as the ratio of the wages of non-production workers to the total wages of all employees.

9. **Addis:** This is a proxy variable for location of firms. It is a binary variable that takes a value of 1 if firms are located in Addis Ababa, and 0 otherwise. This variable is used to control for region fixed effects.
Chapter 7

Results and Discussion

This chapter provides the results of the production function estimates using the Levinsohn and Petrin approach. Section 7.1 provides descriptive statistics for all inputs and output variables, as well as the share of foreign capital investment in Ethiopia’s manufacturing sector. Section 7.2 explains the multifactor productivity estimates from the Ordinary Least Squares, Fixed Effects and Levinsohn and Petrin approaches. It also provides robustness checks using a value-added method of productivity estimation and labour productivity. These productivity estimates obtained are used to examine the relationship between foreign ownership and productivity.

7.1. Descriptive Statistics

Table 7.1 below provides descriptive statistics at the firm-level, based on firm characteristics and firm input and output measures. The foreign capital variable represents the total paid-up capital (only values greater than zero) invested by non-Ethiopians in the manufacturing industry. On average, foreign firms invest about 21.9 million Birr of capital, a maximum of 888 million Birr and a minimum of 4,015 Birr of capital in the manufacturing industry. Table 7.1 also contains a few firm characteristics such as firm size, age and skill, that are informative of the type of firms in the manufacturing sector. Size captures the size of a firm, proxied by the total number of employees in a firm. It indicates that the average number of employees in a firm is 114, and over 7000 employees at maximum. The average age of firms in the industry is 14, with the oldest firm operating for about 91 years while the average share of skilled workers in a firm is about 36.9%.
Table 7.1. Summary Statistics of the Manufacturing Sector from 1996 to 2010

<table>
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<tr>
<th>Variables</th>
<th>Obs.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Firm Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size (employees)</td>
<td>11,738</td>
<td>114</td>
<td>303.024</td>
<td>10</td>
<td>7909</td>
</tr>
<tr>
<td>Age (years)</td>
<td>11,738</td>
<td>15</td>
<td>15.164</td>
<td>1</td>
<td>91</td>
</tr>
<tr>
<td>Skill (%)</td>
<td>11,702</td>
<td>0.369</td>
<td>0.231</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Foreign Capital (Birr, ‘000)</td>
<td>637</td>
<td>21,900</td>
<td>62,300</td>
<td>4.015</td>
<td>888,000</td>
</tr>
<tr>
<td><strong>Firm Inputs and Outputs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital (Birr, ‘000)</td>
<td>11,738</td>
<td>5977.697</td>
<td>25,900</td>
<td>0.114</td>
<td>787,000</td>
</tr>
<tr>
<td>Labour (employees)</td>
<td>11,738</td>
<td>114</td>
<td>292.985</td>
<td>10</td>
<td>7909</td>
</tr>
<tr>
<td>Energy (Birr, ‘000)</td>
<td>11,738</td>
<td>675.177</td>
<td>6,594.632</td>
<td>0.105</td>
<td>238,000</td>
</tr>
<tr>
<td>Materials (Birr, ‘000)</td>
<td>11,738</td>
<td>5272.627</td>
<td>15,700</td>
<td>0.112</td>
<td>549,000</td>
</tr>
<tr>
<td>Sales Revenue (Birr, ‘000)</td>
<td>11,738</td>
<td>11,300</td>
<td>38,500</td>
<td>0.876</td>
<td>708,000</td>
</tr>
</tbody>
</table>

Source: Author’s calculations using data from the Central Statistical Agency (CSA) of Ethiopia. Size represents the total number of employees, age represents the number of years the firm has been in operation, skill represents share of skilled workers in the manufacturing sector using wages of skilled workers as a proxy, while foreign capital is the level of foreign capital investment in the manufacturing industry. Foreign capital, capital, energy, materials and sales revenue are expressed in thousands (’000) of Ethiopian Birr. Similar to size, labour represents the total number of employees.

Figure 7.1 illustrates the average percentage share of input expenditure in the manufacturing industry between 1996 and 2010. Capital stock expenditure has the highest trend, starting off at 37.8% in 1996 and steadily increasing to about 57% in 2003, and slowly declines thereafter to about 49% by 2010. When cost of capital declines over time, manufacturing firms become more capital intensive because capital is cheaper and substitutes for labour (Piedrahita, 2016). The share of expenditure on labour in figure 7.1 was estimated using the total wages of employees in the sample. Labour expenditure was quite low at 6.9% in 1996 and 5.1% by 2010, indicating an overall decline in wages by 26 percent. This decline in wages could be attributed to low productivity in the manufacturing industry which leads to a potentially lower scope for wage growth. Energy costs include cost of fuel and lubricating oil, electricity, wood and charcoal, and water consumed. The trend in energy expenditure was similar to that of labour, contributing 4.6% of total input expenditure in 1996 and a minimal increase to 5.6% by 2010.
The Ethiopian government’s investment in hydroelectric power firms has maintained low electricity costs, although there are still frequent power outages—which can be attributed to power transmission problems (Shiferaw, 2017). Raw material expenses in figure 7.1 are based on both locally sourced and imported raw materials, which decreased on average by 36 percent between 1996 and 2003, which could be attributed to a high number of firms sourcing their raw material locally. This results in a reduction in cost of transportation and stock management for firms and less constraints from foreign exchange rates (Alemu and Zerihun, 2001). However, after 2003, share of materials expenditure increased by 52 percent on average between 2003 and 2010.

Figure 7.2 illustrates the average foreign capital investment in the subsectors of the manufacturing industry, in the 90’s and in the 00’s. In 1996, the food manufacturing, chemicals and rubber sectors had zero foreign investment, while all other sectors experienced very minimal level of investment as well, apart from the non-metals sector that received almost 700,000 Birr in foreign investment.
By 1999 (the end of the 90’s) in figure 7.2, foreign investment in the manufacturing industry increased, with the food manufacturing sector receiving over 1.5 million Birr of foreign investment on average, followed by the paper and print sector receiving over 700,000 Birr, and leather and footwear with over 300,000 Birr in foreign investment. By 2000, all subsectors apart from the wood manufacturing subsector in the industry, received some level of foreign capital investment, with the textile sector receiving over 3.2 million Birr on average. By 2010, all subsectors received a significant level of foreign capital investment with the wearing apparel sector receiving the highest level of foreign investment of over 4 million Birr on average. The increase in foreign investment in these sectors over time could be attributed to trade liberalization and the elimination of restrictions on private investments. Between 1993 and 2003, a trade reform was designed to dismantle trade restrictions by reducing custom tariffs from 230% to 35% (Haile et al, 2013). Also, to increase foreign investment and encourage the entrance of foreign knowledge and technology in 2003, the Ethiopian government further reduced taxes and charges on salaries of foreign workers.
(Haile et al, 2013). Also, increase in foreign investment in the textiles and wearing apparel sectors in 2000 and 2010 respectively can be attributed to Ethiopia’s five-year growth and transformation plan, which featured the development of its apparel sector and introduced the textile development institute to help develop and improve the necessary human capital (Mihretu and Llobet, 2017, p.9). The Ethiopian Investment Commission also lists the textile and wearing apparel sectors as strategic sectors for foreign investment because it offers relative proximity to international export markets, tax free access to the U.S and European Union (EU) markets, and cheap labour costs with highly productive workers than those in Vietnam, using similar technology (EIC, 2018). Thus, foreign investors from India, China and Turkey seeking alternative production bases for export to the United States and the EU, increase their level of investment in Ethiopia’s textile and garment manufacturing subsectors (Mihretu and Llobet, 2017, p.9).

**Figure 7.3. Foreign Intensity in the Manufacturing Industry**

![Foreign Intensity in the Manufacturing Industry](image)

*Source: Author’s calculation using data from the Central Statistical Agency (CSA) of Ethiopia from 1996 to 2010. Foreign intensity is measured by a ratio of foreign paid-up capital to total paid-up capital.*

Figure 7.3 above illustrates the foreign intensity of the manufacturing sector from 1996 to 2010. Foreign intensity is measured as a share of foreign capital investment in the sector, which increased
on average by 41.4% over the time period. This increase in foreign intensity is as a result of foreign investors taking advantage of Ethiopia’s cheap cost of inputs of production, as well as their smooth regulatory policies on foreign investment, and a growing domestic market (Shiferaw, 2017). Although, the level of foreign intensity each year is still quite minimal. In the 1990’s, the intensity of foreign ownership increased by 13.8% on average from 1996 to 1999 and followed an increasing trend till its peak in 2005. The jump in foreign intensity between 2003 and 2005 can be attributed to the rising influx of foreign investment from emerging economies such as China, India and Turkey (Turi, 2015). A significant number of Chinese investors have decided to increase their capital investment in Ethiopia by setting up an industrial zone (Turi, 2015). For instance, the Bole Lemi industrial park partly funded by the World Bank Group in Addis Ababa, is a major industrial zone with factory sites and basic amenities, which is attractive to foreign firms that may not be acquainted with the business practices and local system (Shiferaw, 2017). To attract more foreign investors, the government has also provided tax exemption policies and generous credit schemes, duty-free importation of raw materials, equipment and machinery for manufacturers (AACC, 2015).

7.2. Productivity Estimates

Tables A.4 and A.5 in the appendix present the results of the production function using ordinary least squares and fixed effects estimation methods respectively. Table 7.2 below presents the results of the production function using the Levinsohn and Petrin approaches. Table A.4 provides parameter estimates from the OLS regression, which are generally positive and statistically significant for the manufacturing sector and all other subsectors. All inputs are statistically significant in the manufacturing industry, with materials input indicating the largest value of significance. For the manufacturing industry in Table A.4, a one percent increase in materials
would increase output levels by 0.565% on average. The elasticity for labour input is statistically significant and increases output levels by 0.304% following a one percent increase in labour. Capital input elasticity was the lowest in the manufacturing industry, indicating that a one percent increase in capital will increase output by only 0.072%, while a one percent increase in energy will increase output by 0.130% on average. The trend variable that captures output changes with time, was not statistically significant in the overall manufacturing industry.

Next, I discuss the output elasticity estimates in the manufacturing subsectors in Table A.4. The output elasticities for materials are significant across all sectors, a larger elasticity (i.e., 0.694) for food manufacturing, followed by an elasticity of 0.617 for the leather and footwear sector. Output elasticity for labour is also statistically significant for all subsectors except for the textile manufacturing sector. The metal sector had the highest elasticity for labour input with a value of 0.694, while the food manufacturing had the lowest elasticity value of 0.238. This shows that labour input contributes significantly to productivity, and thus the metals manufacturing sector is heavily dependent on its level of labour or is more labour-intensive. On the other hand, the lower labour elasticity value in the food manufacturing sector indicates that the food manufacturing sector is less responsive to changes in accumulation of workers compared to other sectors. This could be as a result of the food manufacturing sector using more capital-intensive machinery and less labour. The elasticity of output with respect to capital is largest, positive and statistically significant for the paper and printing sector in comparison to other sectors. This implies that productivity in this sector is more responsive to the level of capital employed. Thus, it can be inferred that increase in productivity in the paper and printing sector is due to an increase in capital employed per worker or the use of more capital-intensive technologies or machinery in the sector. Finally, the trend variable was positive and significant for textiles and wearing apparel subsectors,
which not only implies an increase in output with time for these sectors but is also an indicator of continuous overall technological progress.

The ordinary least squares (OLS) approach provides a standard measure of estimating the production function. The assumptions of the OLS approach requires that input choices in the production function are determined exogenously, however, input choices are not selected independently but are determined by the choices of a firm (Marschak and Andrews, 1944). Thus, there may be a relationship between the level of inputs used and any unobservable productivity shocks present in the error term, which leads to endogeneity issues. Since the OLS regression estimates suffer endogeneity or simultaneity bias, the fixed effects estimation approach provides a conventional method for eliminating endogeneity in the input variables (Marschak and Andrews, 1944).

Table A.5 provides the regression results using the fixed effects estimation method. The coefficients for capital in the manufacturing industry and across all sectors appear to be generally lower than those of the OLS estimation. For instance, the capital estimate for the manufacturing industry dropped and turned negative for the chemical subsector. This is consistent with Beveren (2012) that specifies that the fixed effects estimation approach “often leads to unreasonably low estimates of the capital coefficient” (p.106). A negative value for the capital coefficient implies that increasing the level of capital decreases output levels, which violates the monotonicity condition that specifies capital as an increasing function of productivity (Beveren, 2012). In addition, the fixed effects approach assumes that any unobserved shocks in productivity are fixed and time-invariant (Beveren, 2012). Thus, it assumes that input endogeneity issues are only caused by time-invariant unobservables, and inputs are not selected based on a firm’s level of productivity.
which is not feasible. Therefore, fixed effects estimation is not sufficient. Finally, the Levinsohn and Petrin method is adopted in estimating productivity because it addresses the endogeneity issue by using intermediate inputs such as materials and energy as a proxy to control for unobservable shocks in productivity over time.
Table 7.2. Levinsohn and Petrin Estimates

<table>
<thead>
<tr>
<th></th>
<th>All Sectors</th>
<th>Food Manufacturing</th>
<th>Textiles</th>
<th>Wearing Apparel</th>
<th>Leather and Footwear</th>
<th>Wood</th>
<th>Paper and Printing</th>
<th>Chemicals</th>
<th>Rubber and Plastics</th>
<th>Non-Metals</th>
<th>Metals</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>0.0459***</td>
<td>0.0442*</td>
<td>0.0536</td>
<td>0.0862</td>
<td>0.192**</td>
<td>0.0659</td>
<td>0.0370</td>
<td>-0.0168</td>
<td>0.0338</td>
<td>0.0763</td>
<td>0.121</td>
<td>-0.0317</td>
</tr>
<tr>
<td></td>
<td>(3.03)</td>
<td>(1.84)</td>
<td>(0.90)</td>
<td>(1.06)</td>
<td>(2.05)</td>
<td>(0.90)</td>
<td>(0.69)</td>
<td>(-0.33)</td>
<td>(0.36)</td>
<td>(1.20)</td>
<td>(1.63)</td>
<td>(-0.64)</td>
</tr>
<tr>
<td>Labour</td>
<td>0.269***</td>
<td>0.203***</td>
<td>0.0109</td>
<td>0.302***</td>
<td>0.231***</td>
<td>0.382***</td>
<td>0.231***</td>
<td>0.281***</td>
<td>0.250***</td>
<td>0.306***</td>
<td>0.673***</td>
<td>0.365***</td>
</tr>
<tr>
<td></td>
<td>(13.24)</td>
<td>(5.86)</td>
<td>(0.24)</td>
<td>(3.24)</td>
<td>(4.57)</td>
<td>(2.85)</td>
<td>(4.66)</td>
<td>(3.17)</td>
<td>(3.48)</td>
<td>(3.53)</td>
<td>(7.08)</td>
<td>(6.92)</td>
</tr>
<tr>
<td>Energy</td>
<td>0.124***</td>
<td>0.142***</td>
<td>0.218***</td>
<td>-3.43E-4</td>
<td>0.0620*</td>
<td>0.137</td>
<td>0.110***</td>
<td>0.115***</td>
<td>0.100**</td>
<td>0.238***</td>
<td>0.0189</td>
<td>0.0471</td>
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<tr>
<td></td>
<td>(11.01)</td>
<td>(6.91)</td>
<td>(3.91)</td>
<td>(-0.01)</td>
<td>(1.84)</td>
<td>(1.50)</td>
<td>(3.08)</td>
<td>(2.20)</td>
<td>(1.99)</td>
<td>(8.41)</td>
<td>(0.39)</td>
<td>(1.64)</td>
</tr>
<tr>
<td>Material</td>
<td>0.498***</td>
<td>0.598***</td>
<td>0.505***</td>
<td>0.359***</td>
<td>0.511***</td>
<td>0.498***</td>
<td>0.508***</td>
<td>0.323***</td>
<td>0.504***</td>
<td>0.443***</td>
<td>0.517***</td>
<td>0.556***</td>
</tr>
<tr>
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<td>435</td>
<td>325</td>
<td>747</td>
<td>215</td>
<td>898</td>
<td>614</td>
<td>612</td>
<td>1283</td>
<td>753</td>
<td>1566</td>
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<tr>
<td>Dispersion</td>
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<td>141</td>
<td>37</td>
<td>9</td>
<td>60</td>
<td>6</td>
<td>37</td>
<td>40</td>
<td>64</td>
<td>25</td>
<td>92</td>
<td>69</td>
</tr>
<tr>
<td>Total No of Firms</td>
<td>3282</td>
<td>862</td>
<td>86</td>
<td>81</td>
<td>195</td>
<td>78</td>
<td>170</td>
<td>130</td>
<td>168</td>
<td>647</td>
<td>287</td>
<td>578</td>
</tr>
</tbody>
</table>

Note: t statistics in parentheses, *** Significant at 1% significance level, ** Significant at 5% significance level, * Significant at 10% significance level. Productivity dispersion ratio estimates are based on a 90-10 percentile range. The estimation model follows a log-log functional form.
Table 7.2 provides estimates of the production function using the Levinsohn and Petrin approach. All elasticities for inputs are positive and statistically significant for the overall manufacturing industry. The output elasticity with respect to material has the largest value and contributes the most to productivity, implying that the manufacturing industry is heavily dependent on the level of materials input. A one percent increase in materials will increase output levels in the manufacturing industry by 0.498% on average. Output elasticity with respect to labour is the second largest contributor to productivity, and it shows that a one percent increase in labour input will increase output levels in the manufacturing industry by 0.269% on average. Capital input elasticity was lowest in the manufacturing industry, indicating that a one percent increase in capital will increase output by only 0.046%, while a one percent increase in energy will increase output by 0.130% on average. Thus, the results of the Levinsohn and Petrin approach reveal that productivity in the manufacturing industry depends a lot more on its level of raw materials than its capital input.

Next, I discuss the output elasticities of the subsectors in Table 7.2. The output elasticity with respect to materials is also positive and statistically significant for all subsectors, showing that all subsectors are heavily dependent on materials input. The output elasticity with respect to capital, however, is only statistically significant in the food manufacturing and leather and footwear subsectors, implying that these sectors are capital-intensive. The insignificant output elasticities with respect to capital in all other subsectors imply that these subsectors are unresponsive to changes in capital accumulation, which could be attributed to their heavy dependence on older techniques of production. Labour elasticity is positive and statically significant for all subsectors except textiles manufacturing subsector, implying that increasing the number of workers in these sectors will increase their productivity. Thus, higher employment levels are needed in these sectors.
to increase production and enhance economic growth. Finally, output elasticity with respect to energy is largest for the non-metals sector indicating that a one percent increase in energy inputs increases productivity by 0.238%. This shows that compared to other subsectors, the non-metals sector consumes a lot more energy to increase its productivity.

The productivity dispersion estimate in the manufacturing industry in Table 7.2 are based on a 90th-10th percentile ratio. It is computed by taking a ratio of logged multifactor productivity of firms in the 90th percentile to multifactor productivity of firms in the 10th percentile, and then take exponentials of the ratio (Piedrahita, 2016). This multifactor productivity ratio expresses how much firms in the top 10% of the productivity distribution are more productive than those in the bottom 10% (Piedrahita, 2016). Syverson (2004) found that within subindustries in the U.S manufacturing sector, the ratio of the logged TFP between an industry’s 90th and 10th percentile firms is 0.651. “This corresponds to a TFP ratio of $e^{0.651} = 1.92$, which implies that firms at the 90th percentile of the productivity distribution makes almost twice as much as output with the same measured input as the 10th percentile firm” (Syverson 2011, p.326). In Table 7.2, firms in the top 10% of the manufacturing sector are over 6 times more productive than the bottom 10%. This means that firms in the top 10% are substantially more productive than others in the bottom 10%, and Bartelsman and Doms (2000) suggest that productivity differences can be attributed to differences in technology used by firms in the manufacturing industry. Bartelsman and Doms (2000) also suggests that quality of workforce, ownership, regulatory environment and international exposure are factors that can explain the productivity distribution amongst firms in the industry.
The productivity dispersion estimates in Table 7.2 are discussed as follows. The rubber and plastics sector exhibit the highest level of productivity dispersion such that, firms in the top 10% of the rubber and plastics manufacturing sector are 11 times more productive than the bottom 10%. Syverson (2004) uses product substitutability in the output market to explain persistent productivity dispersion across industries. When consumers can easily substitute products between producers, high-cost or inefficient producers lose profits, and therefore high-substitutability industries have lower productivity dispersion (Syverson, 2004). However, when product substitutability is low, inefficient producers can still operate profitably and industries face higher productivity dispersion (Syverson, 2004). Syverson (2011) on the other hand, asserts that the variation in productivity dispersion can also be attributed to managerial skills, varying firm investments in information technology and R&D, and a firm’s innovative efforts.

7.3. Productivity Measure Robustness Checks

To confirm the validity of the regression results of the Levinsohn and Petrin approach, a robustness check is carried out by estimating the Levinsohn and Petrin production function using an alternative measure of multifactor productivity - the value-added approach. The value-added approach excludes intermediate inputs used in production, such as materials and energy, and thus takes the form of a capital-labour measure of multifactor productivity. Although the value-added approach does not measure technological change or efficiency improvements in the industry, it measures changes in an industry’s contribution to aggregate income (Cobbold, 2003).

Table 7.3 below displays the results from the value-added based Levinsohn and Petrin estimation. The output elasticities for labour are much higher than estimates in the gross output approach with values ranging from 0.32% in textile manufacturing to 0.75% in metals manufacturing. Similarly,
output elasticities for capital are also high with values ranging from 0.01% in leather and footwear to 0.21% in metals manufacturing. These differences in estimates between value-added and gross output are expected because the two approaches measure the level of multifactor productivity differently. Gandhi et al (2016) also add that value-added estimates tend to overstate the capital intensity of technology compared to the gross output measure. The value-added approach assumes that technological change in the industry only operates on capital and labour inputs, and assumes all other inputs are in fixed proportions. Thus, a value-added output concept will reflect a heavy dependence on the number of workers and level of capital employed in the industry. However, the value-added output concept may overstate the output levels of materials-intensive sectors and may lead to misleading inferences (Gandhi et al, 2016). The productivity dispersion estimates are significantly larger with the value-added output approach compared to the productivity dispersion estimates under the gross output approach. According to Gandhi et al (2016), value-added approach suggests a larger level of heterogeneity in productivity across industries and firms within an industry, while the smaller dispersion ratios under the gross output approach provide a more remarkable degree of stability across industries.

7.4. Foreign Ownership and Productivity

7.4.1. Does Foreign Ownership Increase Productivity?

Table 7.4 presents the estimates of the relationship between foreign ownership and multifactor productivity. Similar to Haskel et al (2007), the relationship between foreign ownership and productivity of firms is examined using a fixed effects model, where the variable foreign captures the presence of foreign firms in the industry.
Table 7.3. Levinsohn and Petrin Estimates - Value Added Approach

<table>
<thead>
<tr>
<th></th>
<th>All Sectors</th>
<th>Food Manufacturing</th>
<th>Textiles</th>
<th>Wearing Apparel</th>
<th>Leather and Footwear</th>
<th>Wood</th>
<th>Paper and Printing</th>
<th>Chemicals</th>
<th>Rubber and Plastics</th>
<th>Non-Metals</th>
<th>Metals</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>0.572***</td>
<td>0.498***</td>
<td>0.622***</td>
<td>0.399***</td>
<td>0.559***</td>
<td>0.699***</td>
<td>0.607***</td>
<td>0.432***</td>
<td>0.347***</td>
<td>0.787***</td>
<td>0.826***</td>
<td>0.608***</td>
</tr>
<tr>
<td></td>
<td>(17.88)</td>
<td>(13.16)</td>
<td>(12.92)</td>
<td>(3.80)</td>
<td>(7.93)</td>
<td>(5.27)</td>
<td>(8.38)</td>
<td>(3.96)</td>
<td>(3.84)</td>
<td>(8.71)</td>
<td>(8.13)</td>
<td>(9.16)</td>
</tr>
<tr>
<td>Capital</td>
<td>0.123***</td>
<td>0.0944***</td>
<td>0.159***</td>
<td>0.211**</td>
<td>-0.106</td>
<td>0.0950</td>
<td>0.0795</td>
<td>0.0847</td>
<td>-0.105</td>
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<td>0.0598</td>
<td>0.0686</td>
</tr>
<tr>
<td></td>
<td>(5.09)</td>
<td>(3.64)</td>
<td>(3.29)</td>
<td>(2.00)</td>
<td>(-0.57)</td>
<td>(0.81)</td>
<td>(1.26)</td>
<td>(0.89)</td>
<td>(-0.64)</td>
<td>(0.01)</td>
<td>(0.48)</td>
<td>(1.10)</td>
</tr>
<tr>
<td>Observations</td>
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<td>2629</td>
<td>2743</td>
<td>296</td>
<td>662</td>
<td>196</td>
<td>836</td>
<td>557</td>
<td>534</td>
<td>1122</td>
<td>666</td>
<td>1447</td>
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<tr>
<td>No of Foreign Firms</td>
<td>580</td>
<td>141</td>
<td>37</td>
<td>9</td>
<td>60</td>
<td>6</td>
<td>37</td>
<td>40</td>
<td>64</td>
<td>25</td>
<td>92</td>
<td>69</td>
</tr>
<tr>
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<td>862</td>
<td>86</td>
<td>81</td>
<td>195</td>
<td>78</td>
<td>170</td>
<td>130</td>
<td>168</td>
<td>647</td>
<td>287</td>
<td>578</td>
</tr>
</tbody>
</table>

Note: t statistics in parentheses, *** Significant at 1% significance level, ** Significant at 5% significance level, * Significant at 10% significance level. Productivity dispersion ratio estimates are based on a 90-10 percentile range. The estimation model follows a log-log functional form.
Table 7.4. Foreign Ownership and Multifactor Productivity in Manufacturing and its Subsector from 1996 - 2010

<table>
<thead>
<tr>
<th></th>
<th>All Sectors</th>
<th>Food Manufacturing</th>
<th>Textiles</th>
<th>Wearing Apparel</th>
<th>Leather and Footwear</th>
<th>Wood</th>
<th>Paper and Printing</th>
<th>Chemicals</th>
<th>Rubber and Plastics</th>
<th>Non-Metals</th>
<th>Metals</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign</td>
<td>0.0928</td>
<td>-0.0288</td>
<td>0.369*</td>
<td>-0.790</td>
<td>0.269***</td>
<td>-0.411***</td>
<td>0.336***</td>
<td>0.0893</td>
<td>0.0171</td>
<td>-0.0622</td>
<td>0.167</td>
<td>0.0642</td>
</tr>
<tr>
<td></td>
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Table 7.4. Foreign Ownership and Multifactor Productivity in Manufacturing and its Subsector from 1996 – 2010 (cont’d)

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<td>Total No of Firms</td>
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<td>647</td>
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<td>578</td>
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</table>

Note: t statistics in parentheses, *** Significant at 1% significance level, ** Significant at 5% significance level, * Significant at 10% significance level. Robust standard errors. Model is of a log-linear functional form, where the dependent variable is in log form while the independent variables are in level form.
By controlling for industry fixed effects in Table 7.4, Baldwin and Gu (2005) assert that differences in productivity that may reflect the concentration of foreign-owned firms in more productive sectors, are controlled for. Table 7.4. shows unexpected results and fails to detect any statistically significant correlation between the explanatory variables and productivity of the overall manufacturing industry. The results imply that foreign ownership, size, age, skill, location and trend are not correlated with the productivity of firms in the manufacturing industry. Although the results are unexpected, their statistical insignificance could be attributed to survey errors from the Ethiopian CSA in reporting values of input and output in the dataset.

Contrary to the general consensus in the literature that asserts that foreign ownership increases productivity (Batool et al, 2009; Javorcik, 2004; Haskel et al, 2007), the results in Table 7.4 show that foreign ownership has no correlation with productivity in the overall manufacturing industry. However, the results are consistent with the findings of Benfratello and Sembenelli (2006), Aitken and Harrison (1999) and Patibandla and Sanyal (2005) who provide empirical evidence to prove that foreign ownership does not impact productivity. This could be as a result of the low level of foreign capital investment in the manufacturing industry. Shiferaw (2017) attributes this weak foreign investment levels to poor infrastructures such as frequent power interruptions and shallow research and development activities. The results could also be attributed to the fact that there are a few foreign-owned firms in Ethiopia’s manufacturing industry, whose impact cannot be fully observed in the entire industry.

Next, I discuss productivity in the subsectors in Table 7.4. The effect of foreign ownership is positive and statistically significant in the textiles, leather and footwear, and paper and paper printing subsectors, by indicating that a one unit increase in foreign ownership increases
productivity by 36.9%, 26.9% and 33.6% on average, respectively. This could be as a result of the influx of foreign companies from China, India, Turkey and Japan who want to take advantage of the cheap cost of labour in the textile, leather products and shoe industry (Hailu and Tanaka, 2015). Foreign firms in these industries form clusters through which they can easily access local suppliers and customers, increasing the chances of technology spillovers from foreign-owned firms to the industry, thereby improving productivity levels in the subsector. Foreign ownership in the wood subsector, however, is negative and statistically significant. This indicates that the presence of foreign-owned firms in the Ethiopian wood subsector decreases productivity by 41.1% on average.

Firm size in Table 7.4 is measured by the total number of employees in the industry, is not statistically significant in the subsectors except in the food manufacturing and textiles sectors. An increase in firm size increases productivity in the textiles sector by 0.034% on average. This is consistent with Biesebroeck (2005) who finds that firm size is positively correlated with productivity in African manufacturing industries. They find that large firms introduce new technology, tend to hire more workers regularly and produce a lot more output than smaller firms. On the other hand, increasing firm size reduces productivity in the food manufacturing sector by 0.037% on average. Diaz and Sanchez (2008, p.322) find that “small and medium-sized firms seem to be more efficient than large firms are”, which is explained by how large firms tend to be in managerial control and organization. Smaller firms tend to have more flexible and non-hierarchical structures, while larger firms tend to face possible bureaucratic frictions that may negatively affect the productivity in a firm (Diaz and Sanchez, 2008).

Firm age which is measured by the number of years since a firm was established, is positive and significant in the leather and footwear sector while its quadratic term is not statistically significant.
This implies that older firms are more productive and face an increase in productivity by 3.11% on average. For the wood subsector, firm age has a nonlinear effect on productivity - negative but increasing at the margin. Biesebroeck (2005) suggests that younger firms tend to be smaller and marginally less productive, but as they get older, they undertake new investments, participate in global markets and achieve economies of scale, which increases productivity.

The coefficient of skill in Table 7.4 measures the share of skilled non-production workers in the manufacturing industry, which is not statistically significant in the subsectors, suggesting that the level of skilled workers do not contribute to productivity in the manufacturing industry. However, in the leather and footwear sector, a one unit increase in the share of skilled workers increases productivity by 41.6% on average. This finding is consistent with Meschi et al (2011) findings that suggest firms with highly skilled workers are more productive because technology-related variables such as research and development expenditure and technological transfer are positively and significantly associated with skill upgrading. Vivarelli (2014) also states that “new technologies require suitable skills to be implemented effectively and efficiently” (p.138).

Addis takes the value of one if the firm is located in the capital city, Addis Ababa, and zero otherwise. The coefficient for Addis is expected to capture the difference across firms with better access to infrastructure and larger markets for raw materials, output and skilled labour. However, the coefficient on the variable Addis in Table 7.4 is not statistically significant in all subsectors, which means location does not contribute to the productivity of firms. This also means there is no productivity difference between firms located in the capital city and any other city in Ethiopia. On the other hand, the coefficient estimate of Addis in the leather and footwear sector was negative. This signifies that as leather firms move operations to the capital city, their productivity declines.
by 38.4% on average. This could be attributed to an oversaturation of firms in the capital city reducing the availability of skilled labour and raw materials in the sector. Thus, a firm may be more productive if located elsewhere. Finally, the coefficient on trend which captures productivity changes over time is only statistically significant in the leather and footwear and wood subsectors. Although, the coefficients are negative and indicate that multifactor productivity declines over time by 4.2% and 3.9% on average, in the leather and footwear and wood subsectors respectively.
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<th>Food Manufacturing</th>
<th>Textiles</th>
<th>Wearing Apparel</th>
<th>Leather and Footwear</th>
<th>Wood</th>
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Table 7.5. Foreign Ownership and Labour Productivity in Manufacturing and its Subsector from 1996 – 2010 (cont’d)

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</table>

Note: t statistics in parentheses, *** Significant at 1% significance level, ** Significant at 5% significance level, * Significant at 10% significance level. Robust standard errors. Model is of a log-linear functional form, where the dependent variable is in log form while the independent variables are in level form.
Table 7.5 provides the regression estimates of the relationship between foreign ownership and labour productivity in the manufacturing industry and its subsectors from 1996 to 2010. Labour productivity is measured by output or total sales per employee. Total sales is adjusted for any price movements using a GDP implicit price deflator, while labour is the total number of temporary and permanent employees. The effect of foreign ownership on labour productivity is positive and statistically significant in the overall manufacturing industry. Put differently, foreign ownership increases labour productivity in the overall manufacturing industry by 20.8% on average. This is consistent with Ruane and Ugur (2010) and Griffith et al (2004) who find that the presence of foreign-owned firms leads to higher labour productivity in the industry. Griffith et al (2004) attribute this positive relationship to foreign firms selecting or “cherry picking” high productivity establishments for investments. The positive effect of foreign ownership on labour productivity can also be explained by the superior technological assets and managerial competencies that foreign firms bring to the host economy, which results in technology transfers and know-hows to workers in the manufacturing industry. Thus, employing high skilled workers and training newly employed workers with new technology, improves labour productivity in the industry. All other subsectors show no statistical significance with foreign ownership and labour productivity, except, the leather and footwear subsector. The effect of foreign ownership in the leather and footwear sector increases labour productivity by 37.1% on average.

Firm size is also statistically significant in determining labour productivity in the overall manufacturing industry, however, it is negative. The results show that increasing firm size decreases labour productivity by 0.059%. This is consistent with Diaz and Sanchez (2008) and Majumdar (1997) who explain that larger firms may face difficulty in monitoring, lack of motivation from workers or bureaucratic conflicts, which results in a negative relationship between...
firm size and labour productivity. A larger firm size in the food manufacturing, leather and footwear, and rubber and plastics subsectors decrease labour productivity by 0.094%, 0.22% and 0.26% on average respectively. Firm age is not statistically significant in the overall manufacturing industry however, it is positively correlated to labour productivity in the leather and footwear sector but negatively correlated with labour productivity in the wood subsector. Increasing the share of skilled workers in the manufacturing industry increases labour productivity by 16.6% on average. This implies that the higher the share of skilled workers in a firm, the more labour productive the firm becomes. The share of skilled workers is only statistically significant in the leather and footwear subsector and shows that a one unit increase in skilled workers increases labour productivity by 64.1% on average. The results in table 7.5 also show that labour productivity is not dependent on a firm’s operating in the capital city -Addis Ababa. However, firms in the wearing apparel sector operating in Addis Ababa are positively correlated with labour productivity. The trend in labour productivity of the overall manufacturing industry was negative and statistically significant, indicating that labour productivity decreases by approximately 2% on average over time.

7.4.2. Do Foreign-Owned Firms Target Productive Firms?

Table 7.6 below presents the regression results of the panel probit model estimation of the correlation between foreign ownership and productivity, where foreign ownership is a binary dependent variable that takes on a value of one for foreign-owned firm or zero for the domestic firm.
<table>
<thead>
<tr>
<th></th>
<th>Coefficient Estimates (1)</th>
<th>Average Marginal Effect (2)</th>
<th>Coefficient Estimates (3)</th>
<th>Average Marginal Effect (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multifactor Productivity</td>
<td>0.305**</td>
<td>0.0153**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(2.26)</td>
<td>(2.25)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Labour Productivity</td>
<td>-</td>
<td>-</td>
<td>0.146**</td>
<td>0.00727**</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>(2.19)</td>
<td>(2.16)</td>
</tr>
<tr>
<td>Size</td>
<td>0.000177</td>
<td>0.00000888</td>
<td>0.000239</td>
<td>0.0000119</td>
</tr>
<tr>
<td></td>
<td>(0.89)</td>
<td>(0.89)</td>
<td>(1.21)</td>
<td>(1.20)</td>
</tr>
<tr>
<td>Age</td>
<td>0.0107</td>
<td>0.000538</td>
<td>0.0119</td>
<td>0.000591</td>
</tr>
<tr>
<td></td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.91)</td>
<td>(0.90)</td>
</tr>
<tr>
<td>Age squared</td>
<td>0.0000424</td>
<td>0.00000212</td>
<td>0.0000294</td>
<td>0.00000146</td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.22)</td>
<td>(0.15)</td>
<td>(0.15)</td>
</tr>
<tr>
<td>Skill (share of)</td>
<td>0.244</td>
<td>0.0122</td>
<td>0.245</td>
<td>0.0122</td>
</tr>
<tr>
<td></td>
<td>(0.91)</td>
<td>(0.91)</td>
<td>(0.92)</td>
<td>(0.92)</td>
</tr>
<tr>
<td>Addis</td>
<td>0.475**</td>
<td>0.0238**</td>
<td>0.489**</td>
<td>0.0244**</td>
</tr>
<tr>
<td></td>
<td>(2.23)</td>
<td>(2.25)</td>
<td>(2.26)</td>
<td>(2.29)</td>
</tr>
<tr>
<td>Trend</td>
<td>0.0453***</td>
<td>0.00227***</td>
<td>0.0471***</td>
<td>0.00235***</td>
</tr>
<tr>
<td></td>
<td>(2.93)</td>
<td>(2.99)</td>
<td>(3.00)</td>
<td>(3.07)</td>
</tr>
<tr>
<td>Constant</td>
<td>-6.136***</td>
<td>-</td>
<td>-6.297***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(-7.90)</td>
<td>-</td>
<td>(-7.47)</td>
<td>-</td>
</tr>
<tr>
<td>Observations</td>
<td>5850</td>
<td>5850</td>
<td>5850</td>
<td>5850</td>
</tr>
<tr>
<td>Industry Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>No of Foreign Firms</td>
<td>580</td>
<td>580</td>
<td>580</td>
<td>580</td>
</tr>
<tr>
<td>Total No of Firms</td>
<td>3282</td>
<td>3282</td>
<td>3282</td>
<td>3282</td>
</tr>
</tbody>
</table>

t-statistics in parentheses: *** Significant at 1% significance level, ** Significant at 5% significance level, * Significant at 10% significance level. Robust standard errors. The dependent variable is a foreign ownership variable that encompasses foreign-owned firms. Column 1 and 3 report the coefficients of the xtprob regressions while, Columns 2 and 4 report the average marginal effects from the xtprob regressions. Multifactor productivity and labour productivity are expressed in logarithm form, while the control variables are in linear form.

The values of multifactor and labour productivity variables in Table 7.6 are lagged and log transformed, while the rest of the control variables are in level form. Fons-Rosen et al (2014) suggest that foreign-owned firms target more productive domestic firms, and they estimate this form of selection by using alternative firm characteristics that could influence a foreign-owned
firm’s investment decision, such as productivity in the previous period. Thus, similar to Fons-Rosen et al (2014) and Arnold and Javorcik (2009), I use one lag of productivity to estimate whether foreign-owned firms target productive firms. Columns (1) and (3) represent the panel probit regression results while columns (2) and (4) represent the average marginal effects.

Table 7.6 displays the results of the panel probit regression and the average marginal effects for the relationship between foreign ownership and productivity. The model is estimated using one lag of multifactor productivity and labour productivity. The control variables for firm characteristics are also lagged once. The average marginal effect of a one-year lag of multifactor productivity in column (2) suggests that a 10% productivity increase in a firm in the previous period, increases the probability that a foreign firm would target it by 0.15 percentage points. This implies that a firm with higher productivity in the previous period is more likely to be targeted by a foreign-owned firm. This positive correlation between foreign ownership and productivity is consistent with Fons-Rosen et al (2014), Guadalupe et al, (2012) and Fukao et al (2014) who conclude that foreign-owned firms tend to “cherry-pick” or invest in productive firms. Fons-Rosen et al (2014) also add that foreign-owned firms tend to invest in high productivity firms but do not increase the productivity of the acquired firms in the sector.

Firm characteristics such as size, age and skill were not statistically significant in the results, which suggests that foreign-owned firms do not consider these factors when targeting productive firms in the Ethiopian manufacturing industry. Location of firms, however, is statistically significant in the results. The average marginal effects suggest that firms located in Addis Ababa, the capital city, are more likely to be targeted by foreign-owned firms. Finally, the average marginal effects of the trend variable indicate that over time, only a few firms in the manufacturing industry are
likely to be foreign-owned. The average marginal effects using lagged labour productivity are displayed in column (4) of Table 7.6. Similar to column (2), labour productivity is also statistically significant. The coefficient on lagged labour productivity indicates that a 10% labour productivity increase in a firm a year ago, increases the probability that a foreign firm would target it by 0.073 percentage points. This implies that foreign-owned firms are more likely to target labour productive firms. Thus, when the industry faces a 10 percent increase in productivity in the previous period, there is a very small chance – less than 1% probability- that such productivity improvements can be attributed to foreign firms. Addis and trend variables are also statistically significant, suggesting that a firm located in Addis Ababa, is more likely to be targeted by a foreign-owned firm and over time, firms in the manufacturing industry are likely to be foreign-owned.

7.4.3. Robustness Checks

To check the robustness of the findings that foreign-owned firms target productive firms, a sensitivity analysis is performed in Table 7.7 using current values of multifactor productivity and labour productivity. As opposed to increasing the lagged values of productivity to check the robustness of the findings, current values of productivity were used for estimation. Increasing the lagged values causes a loss in the number of observations since the majority of the firms reported in the dataset are singletons and are only observed once. The average marginal effect from the relationship between multifactor productivity and a foreign firm in the manufacturing sector is expressed in column (2) of Table 7.7, and it supports a positive correlation between foreign ownership and multifactor productivity. A 10% increase in multifactor productivity of a firm, increases the probability that the firm is targeted by a foreign-owned firm by 0.049 percentage points. Similarly, a 10% increase in labour productivity in the manufacturing industry increases
the probability that the firm is targeted by a foreign-owned firm by 0.071 percentage points. These results imply that foreign-owned firms are more likely to target productive firms in the manufacturing industry, although with very minimal probability.

Table 7.7. Probit Model Estimation (Dependent variable: Foreign ownership)

<table>
<thead>
<tr>
<th></th>
<th>Coefficient Estimates (1)</th>
<th>Average Marginal Effect (2)</th>
<th>Coefficient Estimates (3)</th>
<th>Average Marginal Effect (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multifactor Productivity</td>
<td>0.107**</td>
<td>0.00486**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(2.25)</td>
<td>(2.24)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Labour Productivity</td>
<td>-</td>
<td>-</td>
<td>0.154***</td>
<td>0.00708***</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>(4.25)</td>
<td>(4.17)</td>
</tr>
<tr>
<td>Size</td>
<td>-0.0000168</td>
<td>-0.000000761</td>
<td>0.0000620</td>
<td>0.00000286</td>
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<td></td>
<td>(-0.09)</td>
<td>(-0.09)</td>
<td>(0.34)</td>
<td>(0.34)</td>
</tr>
<tr>
<td>Age</td>
<td>0.00418</td>
<td>0.000189</td>
<td>0.00521</td>
<td>0.000240</td>
</tr>
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<td></td>
<td>(0.42)</td>
<td>(0.42)</td>
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<td>(0.52)</td>
</tr>
<tr>
<td>Age squared</td>
<td>0.0000744</td>
<td>0.00000337</td>
<td>0.0000574</td>
<td>0.00000264</td>
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<td>(0.48)</td>
<td>(0.48)</td>
<td>(0.37)</td>
<td>(0.38)</td>
</tr>
<tr>
<td>Skill (share of)</td>
<td>0.857***</td>
<td>0.0388***</td>
<td>0.810***</td>
<td>0.0374***</td>
</tr>
<tr>
<td></td>
<td>(3.62)</td>
<td>(3.59)</td>
<td>(3.44)</td>
<td>(3.42)</td>
</tr>
<tr>
<td>Addis</td>
<td>0.407**</td>
<td>0.0184**</td>
<td>0.423**</td>
<td>0.0195**</td>
</tr>
<tr>
<td></td>
<td>(2.43)</td>
<td>(2.44)</td>
<td>(2.54)</td>
<td>(2.54)</td>
</tr>
<tr>
<td>Trend</td>
<td>0.0323***</td>
<td>0.00146***</td>
<td>0.0351***</td>
<td>0.00162***</td>
</tr>
<tr>
<td></td>
<td>(2.62)</td>
<td>(2.66)</td>
<td>(2.84)</td>
<td>(2.90)</td>
</tr>
<tr>
<td>Constant</td>
<td>-5.424***</td>
<td>-</td>
<td>-6.576***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(-14.97)</td>
<td>-</td>
<td>(-13.33)</td>
<td>-</td>
</tr>
<tr>
<td>Observations</td>
<td>10425</td>
<td>10425</td>
<td>10425</td>
<td>10425</td>
</tr>
<tr>
<td>Industry Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>No of Foreign Firms</td>
<td>580</td>
<td>580</td>
<td>580</td>
<td>580</td>
</tr>
<tr>
<td>Total No of Firms</td>
<td>3282</td>
<td>3282</td>
<td>3282</td>
<td>3282</td>
</tr>
</tbody>
</table>

T-statistics in parentheses: *** Significant at 1% significance level, ** Significant at 5% significance level, * Significant at 10% significance level. Robust standard errors. The dependent variable is a foreign ownership variable that encompasses foreign-owned firms. Column 1 and 3 report the coefficients of the xtprobit regressions while, Columns 2 and 4 report the average marginal effects from the xtprobit regressions. Multifactor productivity and labour productivity are expressed in logarithm form, while the control variables are in linear form.
The average marginal effects of firm characteristics such as firm size and age in column (2) are not statistically significant and thus imply that they are not considered when foreign firms target productive firms in the Ethiopian manufacturing industry. However, the average marginal effects of the share of skilled workers in the industry indicate that the higher the share of skilled workers in a firm increases the probability that they are likely to be targeted by a foreign-owned firm. Finally, a firm setting up its operations in the country’s capital city, Addis Ababa, increases the probability that it is targeted by a foreign-owned firm.

7.5. Discussion

Between 1996 and 2010, the relationship between foreign ownership and productivity in Ethiopia’s manufacturing industry provided unexpected results. Foreign ownership had no effect on multifactor productivity and labour productivity in the overall manufacturing industry, which is consistent with the findings of Benfratello and Sembenelli (2006), Aitken and Harrison (1999) and Patibandla and Sanyal (2005) who provide empirical evidence to prove that foreign ownership does not impact productivity. However, some subsectors demonstrated a positive relationship with foreign ownership, which is consistent with the general consensus in the literature (Batool et al, 2009; Javorcik, 2004) that states foreign ownership increases productivity. On the other hand, a negative relationship between foreign ownership and productivity was found as well, which is consistent with the results of Aitken and Harrison (1999) and Suyanto and Salim (2010). Aitken and Harrison (1999) interpret this negative effect as a “market-stealing” effect of foreign ownership in the industry. The results from estimating whether foreign-owned firms target productive firms in the manufacturing sector proved positive and statistically significant. A 10 percent increase in productivity in a manufacturing firm in the previous period increases the probability that a foreign-owned firm would target it. This implies that a foreign-owned firm
considers the productivity of a firm in the previous period, before targeting it. The result is consistent with Fons-Rosen et al (2014) and Arnold and Javorcik (2009) who find that foreign-owned firms actually target more productive firms in developing countries and increase their productivity, only if foreigners control the majority of the shares of the firm.
Chapter 8

Conclusion, Policy Implications and Future Research

8.1. Conclusion

This study examines foreign ownership and multifactor productivity in the Ethiopian manufacturing industry, using firm-level panel data from the Large and Medium-Scale Manufacturing Industries Survey collected by the Central Statistical Agency of Ethiopia (CSA), covering the periods 1996 to 2010. This firm-level panel dataset was used to answer two main research questions: 1) Do foreign-owned firms increase productivity? 2) Do foreign-owned firms target productive firms? These research questions are investigated in a three-step strategy. First, a Cobb-Douglas production function is used to estimate multifactor productivity based on the Levinsohn and Petrin methodology. Second, the effect of foreign ownership on the estimated multifactor productivity is evaluated using a Fixed Effects approach. Finally, a panel Probit model is used to estimate the second research question, to estimate whether foreign-owned firms target productive firms through a correlation approach, using lags of productivity. Robustness checks for the first research question is analyzed using a different productivity index- labour productivity, while robustness checks for the second research question are analyzed using current values of productivity.

The main findings of this study suggest that there is no evidence that foreign ownership improves multifactor productivity in the Ethiopian manufacturing sector. The results reveal that foreign-owned firms have no effect on multifactor productivity in the manufacturing sector, which
contradicts the existing literature that states that foreign ownership increases productivity. On the other hand, the insignificant effect of foreign ownership could be attributed to the significantly low number of foreign-owned firms in Ethiopia’s manufacturing sector, whose impact cannot be fully observed in the entire industry. The textiles and leather and footwear subsectors, however, experienced a positive effect of foreign-owned firms on their productivity levels. Finally, foreign ownership had a negative and significant effect on productivity in the wood manufacturing industry.

The second finding of this study shows that foreign-owned firms target productive firms in the manufacturing industry. The results suggest that a 10 percent increase in multifactor productivity or labour productivity of firms in the previous period, increases the probability that the firm is targeted by a foreign-owned firm by 0.15 and 0.073 percentage points, respectively. This is consistent with Fukao and Murakami (2006) and Griffith et al (2004), who find that foreign-owned firms entering the market tend to target high productivity establishments in the industry and enjoyed growth in multifactor productivity and more labour efficient production processes. Griffith et al (2004) further explain that foreign firms target productive firms because they are more investment intensive, i.e., they use more capital and technology, and thus the foreign firm gets more value for their investment by selecting productive firms. Finally, foreign-owned firms target productive firms with the purpose of diversifying business risks, and such investments may not involve the transfer of technology- which may explain why the earlier results indicate an insignificant effect of foreign ownership on multifactor productivity in the industry.
8.2. Policy Implications

The results of this study provide valuable insights for policy regulations focused on improving productivity and productivity growth in the manufacturing industry. Although the results of this study show no evidence that foreign ownership impacts multifactor productivity in the overall manufacturing sector, some subsectors demonstrated a positive relationship between productivity and foreign ownership. This finding suggests that the Ethiopian manufacturing industry has a lot to gain from promoting net inflows of foreign direct investment, which can be done through infrastructure governance and providing quality inter-industry linkages, in order to maximize the transfer of technology from foreign countries at all levels of development. Incentives to attract more foreign-owned firms such as enhanced regional cooperation that expands the market size should be promoted. However, while prioritizing to attract foreign investors, certain steps need to be taken into consideration.

8.3. Future Research

Although the results of this study provide insight into the impact of foreign ownership on productivity in Ethiopia’s manufacturing sector, it would be interesting for future research to examine the spillover effects from foreign-owned firms to domestic firms in the industry. For instance, the introduction of industrial parks such as the Hawassa Industrial park in Hawassa, creates a form of regional industrial cluster that may encourage the spread of agglomeration benefits from foreign-owned firms in the textiles and garments sector. Javorcik (2004) provide evidence of positive productivity spillovers from foreign-owned firms to local suppliers in host economy. Batool et al (2009), however, find a negative spillover effect from foreign-owned firms operating in clusters.
References


Appendix

Table A.1. Distribution of Firms in the Manufacturing Industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Firms</th>
<th>Foreign Firms</th>
<th>Public Firms</th>
<th>% of Foreign Firms</th>
<th>% of Public Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>468</td>
<td>23</td>
<td>145</td>
<td>4.9%</td>
<td>31.0%</td>
</tr>
<tr>
<td>1997</td>
<td>493</td>
<td>20</td>
<td>123</td>
<td>4.1%</td>
<td>24.9%</td>
</tr>
<tr>
<td>1998</td>
<td>521</td>
<td>15</td>
<td>129</td>
<td>2.9%</td>
<td>24.8%</td>
</tr>
<tr>
<td>1999</td>
<td>530</td>
<td>26</td>
<td>125</td>
<td>4.9%</td>
<td>23.6%</td>
</tr>
<tr>
<td>2000</td>
<td>554</td>
<td>27</td>
<td>120</td>
<td>4.9%</td>
<td>21.7%</td>
</tr>
<tr>
<td>2001</td>
<td>532</td>
<td>32</td>
<td>106</td>
<td>6.0%</td>
<td>19.9%</td>
</tr>
<tr>
<td>2002</td>
<td>613</td>
<td>46</td>
<td>119</td>
<td>7.5%</td>
<td>19.4%</td>
</tr>
<tr>
<td>2003</td>
<td>682</td>
<td>43</td>
<td>126</td>
<td>6.3%</td>
<td>18.5%</td>
</tr>
<tr>
<td>2004</td>
<td>714</td>
<td>49</td>
<td>131</td>
<td>6.9%</td>
<td>18.3%</td>
</tr>
<tr>
<td>2005</td>
<td>636</td>
<td>49</td>
<td>124</td>
<td>7.7%</td>
<td>19.5%</td>
</tr>
<tr>
<td>2006</td>
<td>880</td>
<td>47</td>
<td>126</td>
<td>5.3%</td>
<td>14.3%</td>
</tr>
<tr>
<td>2007</td>
<td>952</td>
<td>49</td>
<td>122</td>
<td>5.1%</td>
<td>12.8%</td>
</tr>
<tr>
<td>2008</td>
<td>1,200</td>
<td>50</td>
<td>105</td>
<td>4.2%</td>
<td>8.8%</td>
</tr>
<tr>
<td>2009</td>
<td>1,370</td>
<td>71</td>
<td>93</td>
<td>5.2%</td>
<td>6.8%</td>
</tr>
<tr>
<td>2010</td>
<td>1,501</td>
<td>81</td>
<td>96</td>
<td>5.4%</td>
<td>6.4%</td>
</tr>
</tbody>
</table>

Source: Author’s calculation. Distribution of firms in foreign and public firms are based on total capital investment by non-Ethiopians and by state-owned firms respectively.

Figure A.1. Trend in Number of Firms in the Manufacturing Industry
Table A.2. Distribution of Firms in the Subsectors of the Manufacturing Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Total Number of Firms</th>
<th>% of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and Beverages</td>
<td>862</td>
<td>26.3%</td>
</tr>
<tr>
<td>Textiles</td>
<td>86</td>
<td>2.6%</td>
</tr>
<tr>
<td>Wearing Apparel</td>
<td>81</td>
<td>2.5%</td>
</tr>
<tr>
<td>Leather and Footwear</td>
<td>195</td>
<td>5.9%</td>
</tr>
<tr>
<td>Wood</td>
<td>78</td>
<td>2.4%</td>
</tr>
<tr>
<td>Paper and Printing</td>
<td>170</td>
<td>5.2%</td>
</tr>
<tr>
<td>Chemicals</td>
<td>130</td>
<td>4.0%</td>
</tr>
<tr>
<td>Rubber and Plastics</td>
<td>168</td>
<td>5.1%</td>
</tr>
<tr>
<td>Non-metals</td>
<td>647</td>
<td>19.7%</td>
</tr>
<tr>
<td>Metals</td>
<td>287</td>
<td>8.7%</td>
</tr>
<tr>
<td>Others</td>
<td>578</td>
<td>17.6%</td>
</tr>
<tr>
<td><strong>Total Manufacturing</strong></td>
<td><strong>3282</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Figure A.2. Distribution of Firms in the Subsectors of the Manufacturing Industry
Table A.3. Share of Foreign and Public Capital Investment in the Subsectors

<table>
<thead>
<tr>
<th>Industry</th>
<th>Share of Foreign</th>
<th>Share of Public</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and Beverages</td>
<td>3.4%</td>
<td>16.1%</td>
</tr>
<tr>
<td>Textiles</td>
<td>5.5%</td>
<td>44.6%</td>
</tr>
<tr>
<td>Wearing Apparel</td>
<td>2.7%</td>
<td>12.0%</td>
</tr>
<tr>
<td>Leather and Footwear</td>
<td>5.9%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Wood</td>
<td>2.9%</td>
<td>41.8%</td>
</tr>
<tr>
<td>Paper and Printing</td>
<td>3.3%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Chemicals</td>
<td>3.6%</td>
<td>21.0%</td>
</tr>
<tr>
<td>Rubber and Plastics</td>
<td>8.8%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Non-metals</td>
<td>1.2%</td>
<td>12.9%</td>
</tr>
<tr>
<td>Metals</td>
<td>8.9%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Others</td>
<td>3.0%</td>
<td>6.3%</td>
</tr>
<tr>
<td></td>
<td>All Sectors</td>
<td>Food Manufacturing</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td><strong>Capital</strong></td>
<td>0.0724***</td>
<td>0.0615***</td>
</tr>
<tr>
<td></td>
<td>(9.54)</td>
<td>(6.04)</td>
</tr>
<tr>
<td><strong>Labour</strong></td>
<td>0.304***</td>
<td>0.238***</td>
</tr>
<tr>
<td></td>
<td>(18.97)</td>
<td>(9.93)</td>
</tr>
<tr>
<td><strong>Energy</strong></td>
<td>0.130***</td>
<td>0.153***</td>
</tr>
<tr>
<td></td>
<td>(12.71)</td>
<td>(8.95)</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>0.565***</td>
<td>0.694***</td>
</tr>
<tr>
<td></td>
<td>(48.69)</td>
<td>(40.96)</td>
</tr>
<tr>
<td><strong>Trend</strong></td>
<td>0.00273</td>
<td>0.000791</td>
</tr>
<tr>
<td></td>
<td>(1.11)</td>
<td>(0.25)</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>3.084***</td>
<td>1.396***</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>10461</td>
<td>3013</td>
</tr>
</tbody>
</table>

**Note:** t statistics in parentheses, *** Significant at 1% significance level, ** Significant at 5% significance level, * Significant at 10% significance level. Robust standard errors.
Table A.5. Fixed Effects Estimates

<table>
<thead>
<tr>
<th></th>
<th>All Sectors</th>
<th>Food Manufacturing</th>
<th>Textiles and Apparel</th>
<th>Wearing Apparel and Footwear</th>
<th>Leather and Apparel</th>
<th>Wood and Printing</th>
<th>Paper and Printing</th>
<th>Chemicals and Plastics</th>
<th>Rubber and Plastics</th>
<th>Non-Metals</th>
<th>Metals</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>0.0465***</td>
<td>0.0461***</td>
<td>0.0637*</td>
<td>0.0516</td>
<td>0.121**</td>
<td>0.0444</td>
<td>0.0352</td>
<td>-0.0139</td>
<td>0.0593</td>
<td>0.0360</td>
<td>0.0874**</td>
<td>0.0173</td>
</tr>
<tr>
<td></td>
<td>(4.62)</td>
<td>(3.06)</td>
<td>(1.94)</td>
<td>(1.35)</td>
<td>(2.02)</td>
<td>(0.77)</td>
<td>(1.15)</td>
<td>(-0.25)</td>
<td>(1.22)</td>
<td>(1.10)</td>
<td>(2.29)</td>
<td>(0.64)</td>
</tr>
<tr>
<td>Labour</td>
<td>0.293***</td>
<td>0.0778</td>
<td>0.325**</td>
<td>0.622***</td>
<td>0.173*</td>
<td>0.610**</td>
<td>0.349***</td>
<td>0.272*</td>
<td>0.291***</td>
<td>0.444***</td>
<td>0.613***</td>
<td>0.424***</td>
</tr>
<tr>
<td></td>
<td>(8.30)</td>
<td>(1.31)</td>
<td>(2.54)</td>
<td>(3.11)</td>
<td>(1.67)</td>
<td>(2.01)</td>
<td>(3.43)</td>
<td>(1.95)</td>
<td>(2.87)</td>
<td>(4.14)</td>
<td>(4.52)</td>
<td>(5.01)</td>
</tr>
<tr>
<td>Energy</td>
<td>0.109***</td>
<td>0.151***</td>
<td>0.141*</td>
<td>-7.79E-3</td>
<td>0.0542</td>
<td>0.235***</td>
<td>0.0522</td>
<td>0.0530</td>
<td>0.108**</td>
<td>0.161***</td>
<td>0.0827</td>
<td>0.0672*</td>
</tr>
<tr>
<td></td>
<td>(7.18)</td>
<td>(6.12)</td>
<td>(1.97)</td>
<td>(-0.11)</td>
<td>(1.37)</td>
<td>(2.82)</td>
<td>(1.08)</td>
<td>(0.96)</td>
<td>(2.14)</td>
<td>(3.53)</td>
<td>(1.08)</td>
<td>(1.70)</td>
</tr>
<tr>
<td>Materials</td>
<td>0.542***</td>
<td>0.666***</td>
<td>0.441***</td>
<td>0.457***</td>
<td>0.546***</td>
<td>0.332***</td>
<td>0.553***</td>
<td>0.473***</td>
<td>0.555***</td>
<td>0.360***</td>
<td>0.510***</td>
<td>0.601***</td>
</tr>
<tr>
<td></td>
<td>(15.03)</td>
<td>(6.49)</td>
<td>(3.79)</td>
<td>(3.83)</td>
<td>(3.52)</td>
<td>(2.35)</td>
<td>(7.94)</td>
<td>(6.70)</td>
<td>(3.52)</td>
<td>(6.17)</td>
<td>(2.99)</td>
<td>(5.19)</td>
</tr>
<tr>
<td>Observations</td>
<td>10461</td>
<td>3013</td>
<td>435</td>
<td>325</td>
<td>747</td>
<td>215</td>
<td>898</td>
<td>614</td>
<td>612</td>
<td>1283</td>
<td>753</td>
<td>1566</td>
</tr>
</tbody>
</table>

Note: t statistics in parentheses, *** Significant at 1% significance level, ** Significant at 5% significance level, * Significant at 10% significance level. Robust standard errors.