Productivity Spillovers from Foreign Direct Investment to Ethiopian Manufacturing Sector

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Research

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Abstract

The study investigates productivity spillover from foreign direct investment to domestic firms in the Ethiopian manufacturing industries. The System Generalized Method of Moments (SYS-GMM) estimator using panel data of manufacturing firms for the years 2011 to 2016 with 12006 observations grouped under 102 industries was employed. The results show a coexistence of both negative and positive productivity spillover effects from FDI to domestic firms at moderate level of absorptive capacity. Specifically, foreign presence in the industries contributed a positive and significant horizontal and backward productivity spillover effect to domestic firms on an average level. The horizontal productivity spillover is transmitted to local firms through demonstration and competition effects at a moderate level. Likewise, vertical productivity spillover occurred through the channel of sales of intermediate goods and services to foreign firms. We have observed that the technology gap is a critical factor among those factors that determine the productivity spillover occurrence. Finally, policy measures aimed at minimizing the technology gap between foreign and domestic firms to maximize the productivity spillover effect are suggested. Since the result shows that the spillover effects in all firms are not equal, prioritization as per their promise is recommendable in an FDI attracting framework.

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JEL Classification Codes: C33, D29

1. Introduction

Foreign direct investment (FDI) has been outlined as a future investment that involves the injection of foreign funds into an associated enterprise that operates in a very different country of origin from the capitalist. During the last 20 years, the recognition of the importance of foreign direct investment (FDI) in emerging economies has been growing. Thus, several developing countries have become more open and friendly to FDI and are exploring ways to increase inflows (Miroux et al., 2009).

Theoretically, FDI in developing countries has been perceived not solely as an inflow of capital but conjointly as a vehicle for both fast-trendy technology and the necessary managerial skills that these countries need for long-term development. Blomstrom et al. (2003) identify four well-known channels through which FDI-induced externalities to domestic firms occur: (1) demonstration effect (creating a competitive atmosphere among firms); (2) competition effect (improving export capacity through lower export-related costs); and (4) backward and forward linkages with foreign firms in the industries.

To realize this, developing countries have provided a number of investment incentive packages, such as lowering income taxes, import duty exemptions, tax holidays, and subsidies for infrastructure facilities, to attract FDI (Waldkirch and Ofosu, 2010; Glass and Saggi, 2002). Recent evidence indicates that the flow of FDI to developing countries has inflated well. According to the united nation conference report on the trade and development of year, the share of FDI flows destined for developing countries reached 54% of the world FDI flows in 2013, compared to 39% for developed countries.

Despite efforts to attract foreign direct investment (FDI) by African countries, FDI flows to the continent are still declining. UNCTAD (2017) documented that FDI flows to Africa fell by 3 % from $61 billion in 2015 to $59 billion in 2016, even though there was variation across regions and countries. FDI inflows are unevenly distributed across the continent, with only 5 countries (Angola, Egypt, Nigeria, Ghana, and Ethiopia) hosting 57% of the continent's total FDI inflows. East Africa received $7.1 billion in FDI in 2016, which is an increase of 13% from the in-flow in 2015. This increment was driven by an increase in countries like Ethiopia, Mauritius, and Madagascar.

The FDI capital flow to Ethiopia shows an increasing trend from birr 971 million in 2000 to birr 63.6 billion in 2016. In the last four-year period, the flow increased from 1.3 billion USD in 2013 to 3.2 billion USD in 2016 in Ethiopia (UNCTAD, 2016). The inflow shows an increasing trend from 2012 up to 2016. The potential reason for the increment might be the amendment of the investment proclamation in 2014. The amendment brought incentives and subsidies, including business income tax exemptions and import duty exemptions for FDI. In contrast, between 1981 and 2016, Ethiopia's share of manufacturing value added in GDP fluctuated between 3.22%, the lowest recorded in 1992, and 7.8%, the highest recorded in 1997 (UNCTAD, 2016).

The empirical work shows contradictory results regarding the existence of a productivity spillover effect from FDI on domestic firms. The first strands of literature show the existence of a positive horizontal and backward productivity spillover effect from FDI on domestic firms. Tomohara and Yokota (2006), Vahter (2004), Ayyagari and Kosova (2010); and Damijan et al. (2003) reported positive and significant horizontal productivity spillover effects. On the other hand, Turi (2015), Tomohara and Yokota (2006), Atieno (2015), Boly et

al.(2015), Smarzynska Javorcik (2004), and Lenearts & Merlevede (2017) found a positive and significant backward spillover effect.

In contrast, the second strand of empirical literature reports the negative productivity spillover effect of FDI on domestically owned firms. For example, Sanfilippo and Seric (2016), Atieno (2015), and Kong (2003) documented negative horizontal spillover effects from multinational firms to local firms. There are also a considerable number of studies which find negative empirical evidence on backward spillover effects (Di Ubaldo et al., 2018; Dogan et al., 2017). Turi (2015) documented the existence of negative forward productivity spillovers from FDI to domestic firms using unbalanced panel data of large and medium-scale manufacturing industries in Ethiopia for a period between 2004 and 2010. Apart from these two extremes, Bruhn & Calegario (2014) documented the coexistence of negative and positive productivity spillover effects from FDI for domestic firms. The possible reason is the reliance on spillover effects on absorptive capacity, labor quality, the presence of supportive structures and institutions, market orientation (import and export), and openness to trade, technological gap, financial markets, sectorial competition, and domestic firm size (De Mello, 1999; Görg and Greenaway, 2004; Crespo and Fontoura, 2007, Smarzynska Javorcik, 2004; Gachino, 2010; Görg and Greenaway, 2004; Girma and Gorg, 2005).

The existence of these contradicting empirical studies makes the productivity spillover effects of FDI on domestic firms inconclusive. Furthermore, this study differs from the previous studies undertaken in developing countries' contexts, especially in Ethiopia, because, for instance, the study of Turi (2015) considers both domestic and foreign firms for the analysis, which may result in parameter overestimation. Likewise, studies undertaken by Negash et al. (2020) and Seyoum et al. (2015) didn't address the inter-industry (vertical) spillover and didn't investigate the spillover effect channels, respectively.

Therefore, this study aimed to investigate whether the domestic manufacturing firms in Ethiopia have benefited from the presence of foreign firms via productivity spillover or not, and the determinants of the horizontal spillover effect. The study also examines the labor market competition effects and the channels of vertical spillover (backward and forward spillover) resulting from foreign presence on domestic manufacturing industries. This study also enables us to pose a question about the aggressive government policies formulated to attract FDI and to transfer productivity. The survey data collected from manufacturing firms by the Ethiopian central statistical agency in the period between 2011 and 2016 was used for analysis.

The study is structured as follows. Section 2 provides the theoretical and empirical literature reviews. Section 3 outlines the materials and methodology employed. Section 4 describes the results of the dynamic panel data model and dictates the results. Finally, Section 5 presents the conclusions.

2. Literature Review

2.1. Theoretical Framework of FDI and Productivity Spillovers

A foreign investment can be a direct investment or a portfolio investment. Direct investment is the acquisition or construction of an actual capital asset by an enterprise from a source country in the host country. Thus, FDI is an investment involving a long-term relationship and controlled by a resident entity of one country, located in a country other than the investment country (Duce and España, 2003). Based on the definition of IMF (1993) and

OECD (1996) foreign firms are defined as a firm in which there is at least 10% foreign equity in the firm and other wise domestic

According to Wei and Liu (2001), the presence of multinational firms has the potential to accelerate and lower the cost of technology transfer. Competition by multinationals may encourage local firms to innovate and to operate more efficiently. As mentioned earlier, competition, demonstration, learning-by-imitation, contagion effects, and the training of workers by foreign firms may help to facilitate the speed of the transfer of technology to domestic firms via labor turnover. Gorg and Greenaway (2004) also theorized possible mechanisms through which spillover may occur, such as imitation, worker mobility, competition, and linkages. However, a theory developed by Gachino (2010) states that spillover effect occurrences have a strong relationship with the potential of hosting enterprises to absorb know-how skills and technologies.

In contrast, Yuri (2007) argued that foreign companies might have negative effects on domestic firms' output and potency if they take over their market or take over their best competent workers. If the simplest workers leave for foreign companies, potency within the domestic companies declines, which eventually affects the productivity of the domestic companies.

Vertical Productivity Spillovers

When inter-industry spillovers are primarily the result of a customer-supplier relationship, there exist two types of linkage between the domestic and foreign firms, i.e., backward and forward linkage. The backward linkage occurs when the local supplier firms have to meet the demands of the foreign firm in the form of higher quality, price, and delivery standards (Smarzynska, 2003). When these local firms supply certain raw materials, the high quality, reliability, and speed of delivery that MNC affiliates demand force them to enhance productivity. In some cases, local suppliers upstream receive technical and managerial training in the production of required inputs, called the backward spillover effect. This is likely to generate additional economic activity, income, and a transfer of technological and managerial skills to the host country.

Horizontal Spillovers

According to Görg and Greenway (2004), domestic firms can benefit from horizontal spillovers through three channels. Firstly, via demonstration effects in which the local enterprises become familiar with superior technologies, marketing and managerial practices used by their foreign affiliates. Thus, spillovers can take place in the form of imitating the foreign subsidiaries' technology. Local enterprises may learn simply by observing and imitating multinationals (Sasidharan, 2006). Secondly, via labor turnover, this occurs when employees from foreign affiliates leave multinationals to join local firms. Through this, knowledge and skills are transferred from foreign to local enterprises. The last channel of transmission is the competition effect, which occurs when the presence of a foreign firm exerts pressure on local firms to adopt methods that are more efficient. This can allow the domestic firm to survive successfully or even compete with foreign firms. Due to their nature of entry, for example, efficient management and heavy capital investment, among others, foreign firms have an advantage over domestic enterprises (Sasidharan, 2006).

2.2. Empirical Evidence on FDI Productivity Spillover

Assessing the effect of productivity spillovers is becoming an essential device in designing country wide regulations regarding inward FDI. Thus, a considerable number of empirical studies have been attempted to

examine the impact of productivity spillover effects from foreign-owned firms (FDI) on domestic firms and have found contradictory results. The first strand of empirical studies shows a positive impact of FDI on the productivity of domestic firms. For instance, Tomohara and Yokota (2006) reported a positive productivity spillover effect of FDI to domestic firms through horizontal and backward channels on average using plant level data in Thailand. Similarly, Vahter (2004), Ayyagari and Kosova (2010), and Damijan et al. (2003) found that FDI had a positive and significant horizontal productivity spillover effect on local firms. On the other hand, Atieno (2015), Boly et al.(2015), Smarzynska Javorcik (2004), and Lenearts & Merlevede (2017) found positive and significant backward spillover effects.

Moreover, Turi (2015) studies spillover effects resulting from foreign direct investment with a focus on the manufacturing firms in Ethiopia based on the Central Statistics Agency's (CSA) survey for the years 2004 up to 2010, and finds econometric evidence for positive backward spillovers and negative forward spillovers to the total productivity of the manufacturing firms in the country. In this study, the author used both domestic and foreign firms for the analysis. This may cause an overestimation of the parameters. Negash et al. (2020) utilize firm-level year 2011 data from Ethiopia and find that Chinese firms were more productive than local firms and that their presence may bring positive potential spillover effects for domestic firms. This study didn't address the inter-industry (vertical) spillover. The other shortcoming of this study is that we cannot be sure of the horizontal spillover reported because the spillover may occur from other firms owned by non-Chinese were not controlled in the model. Seyoum et al. (2015) also conducted a study using firm survey data of 1033 manufacturing firms operating in Ethiopia in 2011 and found that domestic firms with higher absorptive capacity experience positive spillovers. The channels through which the spillover effect happened were not addressed in this study. Thus, a clear policy recommendation was not forwarded.

In contrast, the second strand of empirical work found a negative productivity spillover effect from FDI to local firms. For example, Sanfilippo and Seric (2016) scrutinized the spillover effect of FDI on domestic firm productivity in sub-Saharan Africa and found negative and significant horizontal spillover effects stemming from subsidiaries' taking away of the domestic firm market shares by FDI. Atieno (2015) and Kong (2003) also claimed a negative horizontal productivity spillover effect from FDI on Kenyan manufacturing firms. There are also a considerable number of studies which find negative empirical evidence on backward spillover effects (Di Ubaldo et al., 2018; Dogan et al., 2017). Turi (2015) reported the existence of negative forward productivity spillovers from FDI to domestic firms using unbalanced panel data of large and medium-scale manufacturing industries in Ethiopia for a period between 2004 and 2010.

Employing Moderated Multiple Regression (MMR) and a generalized linear model (GLM) on panel data sets, Bruhn & Calegario (2014) and Campos and Bruhn (2014) documented the coexistence of negative and positive productivity spillover effects from FDI to domestic firms. The negative impact concerns the firms that are performing below the average level of the technological gap between domestic and foreign firms, whereas the positive signals concern the firms that have a moderate and above-average technological gap. Apart from these, there are a few studies that miss the mark in figuring out a significant effect (Damijan et al., 2003).

On the other hand, Crespo and Fontoura (2007), Schoors and Van der Tol (2002), Smarzynska Javorcik (2004), Gachino (2010), Görg and Greenaway (2004), Girma and Gorg (2005), Kokko et al. (1996), Blomstrom (1986), BA (2014), and Bruhn and Calegario (2014) conducted a study to identify the determinants of spillover effects in different contexts. They documented the absorptive capacity, quality of labor, presence of supportive structures and institutions, presence of interactions, firms' market orientation (import and export), sectoral competition, and size of the firm as determinants of productivity spillover effects. The positive spillover effects also depend on the host country's openness to trade, the existence of relatively developed local financial markets, the technological gap between foreign and local firms, and the ability of sectors to support learning (De Mello, 1999; Görg and Greenaway, 2004).

3. Data and Method

3.1. Data Description

This paper relied on an annual survey of large and medium-scale manufacturing firms and industrial data, conducted by the Ethiopian Central Statistical Agency from 2011 to 2016. CSA has employed stratified-sampling methods in each region and sub-sectors based on international industrial classification version 3.1. The nature of the data set was unbalanced panel data that covered 12006 domestic and 2550 foreign firms, with a total number of 14556 observations at the firm level. By aggregating the firms under 102 industries, a data set with 443 observations at industry level was also used to conduct vertical spillover effect analysis by assuming that spillovers to firms categorized under the same industry are the same.

3.2. Econometric Model Specification

Many studies use an augmented Cobb-Douglass production function to overcome the misspecification problem because it provides efficient estimates (Wang and Schmidt, 2002; De Mello, 1999). Hence, this study used the econometric specification approach used by many scholars (Buckley et al., 2010; Hale and Long, 2011; Nhamo , 2011 ; Xu and Sheng(2011), Pham (2016), Negara and Adam , 2012). The econometric model for firm level data analysis was built using Arellano and Bond's (1991) general method of moments and a specified dynamic panel data model as a foundation.

$$\begin{aligned} \boldsymbol{VADijt} &= \Upsilon \boldsymbol{VADijt{-}1} + \mathbf{Q1}\boldsymbol{Kijt} + \mathbf{Q2}\boldsymbol{Lijt} + \mathbf{Q3}\boldsymbol{MRijt} + +\mathbf{Q4}\boldsymbol{FPijt} + \mathbf{Q5}\boldsymbol{EXTijt} \\ &+ \mathbf{Q6}\boldsymbol{SZijt} + \mathbf{Q7}\boldsymbol{TGijt} + \mathbf{Q8}\boldsymbol{CIijt} + \mathbf{Q9}\boldsymbol{SIijt} + \mathbf{Q10}\boldsymbol{Horzijt} * \boldsymbol{TGijt} \\ &+ \mathbf{Q11}\boldsymbol{Horzijt} * \boldsymbol{CIijt} + \mathbf{Q12}\boldsymbol{Horzijt} * \boldsymbol{SIijt} + \mathbf{Q13}\boldsymbol{Horzijt} + \mathbf{Q14}\boldsymbol{HEFijt} \\ &{}^{+}\alpha \boldsymbol{i} \; {}^{+}\varepsilon \boldsymbol{ijt} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{1} \end{aligned}$$

Where, denotes the firm (i =1, 2, …, 14556), t denotes time period (t = 2011, …, 2016) and j (j=1, 2…102) denotes the industry in which the firms exist; and also, assuming that N is large and T is small (short panel). $\boldsymbol{VADijt}$ is the observation on the dependent variable for firm i, in industry j and in period t and denotes the natural logarithm of labor productivity of firms; VADijt-1 is the natural logarithm of one lag period home firm productivity, Kijt is the Capital input, Lijt is the Labor input, MRijt is the input materials, FPijt is the foreign firm presence, EXTijt is export of firm, SZijt is the size of firm, TGijt is technological gap between foreign firm and domestic firm, CIijt is the capital intensity of firm, SIij skill intensity gap firm, Horzij is the horizontal spillover, HEFij is the Herfindahl index and Horzij * TGij , Horzij *CIij and Horzij *SIij are the interaction of horizontal spillover with technological gap, capital intensity gap and skill intensity gap, respectively. By

following similar procedures to the above model specification, the following dynamic econometrics model is specified to evaluate the FDI productivity spillover effect on domestic industry level as follows.

$$\begin{aligned} \boldsymbol{VADjt} = \boldsymbol{\alpha j} + \Upsilon \boldsymbol{MVADjt{-}1} + \mathbf{Q1}\boldsymbol{Kjt} + \mathbf{Q2}\boldsymbol{Ljt} + \mathbf{Q3}\boldsymbol{MRjt} + +\mathbf{Q4}\boldsymbol{FPjt} + \mathbf{Q5}\boldsymbol{EXTjt} \\ + \mathbf{Q6}\boldsymbol{SZjt} + \mathbf{Q7}\boldsymbol{TGjt} + \mathbf{Q8}\boldsymbol{CIjt} + \mathbf{Q9}\boldsymbol{SIjt} + \mathbf{Q10}\boldsymbol{FPjt} * \boldsymbol{TGjt} \\ + \mathbf{Q11}\boldsymbol{FPjt} * \boldsymbol{CIijt} + \mathbf{Q12}\boldsymbol{FPjt} * \boldsymbol{SIijt} + \mathbf{Q13}\boldsymbol{Horzjt} + \mathbf{Q14}\boldsymbol{Forwardjt} \\ + \mathbf{Q15}\boldsymbol{Backwardjt} + \mathbf{Q16}\boldsymbol{LabComjt} + \mathbf{Q17}\boldsymbol{HEFjt} \\ + \boldsymbol{\varepsilon jt} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (2) \end{aligned}$$

Where, $\boldsymbol{VADjt}$ denotes the mean of total value added per labor at industry level in each year. MVAt-1 denotes the lag value of the total value added of firm production per labor at the industry level in each year. Forward_{ij} stands for forward spillover, Backward_{ij} stands for backward spillover, and Labcom_{ij} stands for labor competition effect. The other remaining explanatory variables denote the mean of the observed variable in equation (1).

Similarly, to meet objective three, the spillover identified in objective one (horizontal spillover) was regressed against the horizontal spillover channels, technology gap, and skill using the SYS-GMM estimator based on Green (2006) and Baltagi et al. (2015). The results are presented as follows:

$$\boldsymbol{Horzjt} = \alpha\text{j} + \Upsilon \boldsymbol{Horzjt{-}1} + \mathbf{Q}'\boldsymbol{MXjt} + Ujt \qquad (3)$$

Where, $rzjt$ denotes the mean of horizontal spillover of domestic firm from foreign firms in the same industries. $Horzjt{-}1$ denotes mean of lag value of horizontal spillover of domestic industries from foreign firms in the same industry. Xjt denotes a vector of the mean of explanatory variables such as skill intensity gap, technology gap, demonstration effect, and labor turnover and competition effects. Skill is represented by the average wage of workers. The demonstration effect was captured by the percentage of firms who have changed production technique (process) due to competitive pressure (in order to keep up) from FDI within the same industry. Labor turnover is measured by the proxy variable, the percentage of firms in the same industry that hired employees with previous experience in FDI firms. The competition effect is proxied by the percentage of firms in the same industry that directly adopt or imitate production techniques by observing or copying from FDI competitors. The measurement of variables and the expected signs for the coefficients of the explanatory variables included in the system GMM model are presented in the following table.

Table 3.1. Explanation of variables measurements

Symbol	Variable name	Measurement	Expected signs
VAD	Natural logarithm of home firm productivity	Measured by proxy, logarithm of the ratio of total value added firm production of firm to its employment figure	
VAD (-1)	natural logarithm of one lag period home firm productivity	Measured by proxy, logarithm of one lag period value added to its employment figure	+
K	Capital intensity	Logarithm of the (Capital - labor ratio) which is computed by dividing net assets of firm to their employment (Hale and Long ,2007; Cuyvers et al. 2008; Nhamo, 2011)	+
L	Labor input	Logarithm of Total number of labors in firms	+

MR	Input materials	Logarithm of the ratio of the value of material input purchases to their employment (Cuyvers e al., 2008).	+
HEF	Herfindahl index	Measured by proxy variable, which is the square of the ratio of output of firm to total output of sector	+
EXT	Export of firm	Logarithm of the of export value of firm	+
SZ	Size of the firm	*SIZE* is the firm's output as a share of the average output in the sector to which the firm belongs,	+
FP	foreign presence	The ratio of foreign firms' employment in a sector to the total employment of that sector	+
FP*CI	The interaction of foreign presence with capital intensity of firms,	Logarithm of the (Capital - labor ratio) centered at its mean multiplied by foreign presence centered at its mean., Skill is measured by a proxy variable the	+
FP*SI	The interaction between foreign presence and skill intensity gap	The difference between the wage of a worker in a domestic firm and the average wage payment of a worker in foreign owned firms centered at its mean multiplied by centered foreign at its mean.	+
FP*TG	The interaction of foreign presence with Technological gap	The difference between the logarithm of firm's labor productivity and the logarithm of average labor productivity in foreign firms in the same industry multiplied by foreign presence (all are centered at their means)	+
Horz	Horizontal spillover	$Horz_{ijt} = \frac{FP_{ijt} * y_{ijt}}{\sum y_{ijt}}$ Where, $\boldsymbol{FP}_{ijt}$, $* y_{ijt}$, is foreign firms' output and $\sum \boldsymbol{Y_{ijt}}$ is Total output	+

4. Result and Discussion

4.1. Descriptive Result Analysis

A table 4.1 and 4.22 provides descriptive statistics of the variables and enables us to compare domestic firms with foreign firms. As shown in the two tables, the mean gross value of production of domestic and foreign firms over the period of 2011 to 2016 was about 120 million and 150 million Ethiopian birr, respectively. The mean productivity (total value of production per total worker) of foreign firms is 790624.8ETB, whereas the domestic average is 623405.7ETB over the specified period. This means that foreign firms are 13% more productive than firms owned by citizens of the host country. In a similar fashion, the average capital and raw material consumption intensity on average are 2443425 ETB and 1925665 ETB in foreign firms and 664942 ETB and 4183345 ETB in domestic firms, respectively. This figure shows that the employment of capital and raw material inputs in foreign firms was larger than the counterpart.

As presented in the summary Table 4.1 and Table 4.2, the average number of people engaged in the firms was 274.5234 in domestic firms and 212.1343 in foreign firms. Likewise, FDI productivity spillover to domestic manufacturing firms through horizontal linkage is 0.132083 on average. The value of the variable 'foreign presence' in an industry ranges from a minimum value of 1.7 percent to a maximum value of 51 percent, with a mean value of 13 percent. Since foreign presence at the industry level is proxied by the share of foreign firm employment in the total employment of an industry, we can understand from this figure that foreign firms have a 13 percent employment share in the manufacturing sector of Ethiopia on average.

The significant differences in skill, capital, and technological intensity between foreign and domestically owned firms range from -1.76E+09 to 1.25E+07, -2.52E+08 to 10020408, and -5.39E+07 to 1.63E+07, respectively. The negative sign in the skill intensity gap shows that the average wage of foreign firms in that specific industry is greater than the average wage of domestic firms. The negative sign in the capital intensity gap shows that the average capital per labor in a specific industry is greater than the domestic firm capital per labor. Similarly, the negative sign in the technological gap shows that the average productivity of foreign-owned firms in the same industry is greater than that of domestic firms. The opposite is true for the positive values in the preceding case.

Table 4. 1. Descriptive Statistics of Domestic Firms' Performance

Variable	Mean	Std. Dev.	Min	Max
TVP	1.20E+08	8.20E+08	18325	1.22E+10
VAD	623405.7	3215798	839.279	6.17E+07
K	664942.3	8753521	0.007246	2.92E+08
RM	418334.6	2526024	26.98795	4.26E+07
L	212.1343	1821.707	10	52013
AVEWE	43191.58	276168.5	123.8399	7411137
Export	1.39E+07	3.18E+08	0	9.44E+09
FP	0.131537	0.11988	0.017142	0.517291
HEF	0.011394	0.06414	6.19E-07	0.915361
SZ	0.892574	5.913551	0.000072	144.4533
Horz	0.132083	0.170475	0.001439	0.519199
SI	-6972471	8.73E+07	-1.76E+09	1.25E+07
CI	-469372	8144890	-2.92E+08	1020408
TG	879829.1	4214955	-5.39E+07	1.63E+07

Source: Own Computation from Central Statistical Agency Survey data (2011-2016)

As far as the market concentration is concerned in this study, its value ranges from a minimum of 6.19E-07 to a maximum of 0.9153, with a mean value of 0.0132, as portrayed in Table 4.1. Since the average value of the HI is low, it may indicate that, on average, firms do not have greater market power. Firm size also ranged from 0.000072 to 144.4533, with a mean value of 0.893, suggesting the existence of huge variation among firms' total value of production in the industries.

Table 4. 2. Descriptive Statistics of Foreign owned Firms' Performance

Variable	Mean	Std. Dev.	Min	Max
TVP	1.50E+08	6.18E+08	322606	6.54E+09
PROL	793726.3	2285062	2979.329	1.74E+07
KI	2455056	1.44E+07	0.111111	1.72E+08
RMI	1934321	1.67E+07	294.7852	2.24E+08
TE	275.7887	850.0101	10	12013
AVEWE	21939.58	84903.57	312.9267	834071.7
Export	5.90E+07	5.96E+08	0	6.37E+09
HEF	0.0192816	0.0560266	1.44E-05	0.473184
SZ	1.020681	4.700731	0.000518	55.89814

Source: Own Computation from Central Statistical Agency Survey data (2011-2016)

4.2. SYS-GMM Estimation Pre-test

Table 4.3 presents the correlation matrix of the variables used in the econometrics model. Capital intensity, labor intensity, material input intensity, foreign presence, Herfindahl index, firm size, and horizontal spillover effect are all positively correlated with firm productivity. In contrast, firm productivity is negatively correlated with the technological gap, capital intensity gap, and skill intensity gap between domestic and foreign-owned firms. Except for the strong correlation between the Herfindahl index and the size of firms, the correlation score between other variables does not show a strong correlation. The strong correlation between the Herfindahl index and the size of the firm may prove difficult to use at the same time in a single regression because of multicollinearity problems. Based on economic theory, this study uses the Herfindahl index only for analysis.

Table 4.3. Correlation Matrix for Bivariate

	VAD	KL	RM	HEF	SZ	FP	Horz	SI	TG	CI	FP*CI	FP*TG
VAD	1.00											
K	0.35	1.00										
L	0.61	0.34	1.00									
RM	0.54	0.35	0.55	1.00								
HEF	0.48	0.03	0.12	0.06	1.00							
SZ	0.44	0.02	0.07	0.04	0.92							
FP	0.02	-0.26	-0.02	-0.01	0.00	0.01	1.00					
Horz	0.18	0.29	0.20	0.17	0.02	-0.02	-0.02	1.00				
SI	-0.05	-0.04	-0.08	-0.03	0.00	0.00	0.00	-0.06	1.00			
TG	-0.28	0.03	-0.02	0.00	-0.47	-0.40	-0.01	0.10	-0.01	1.00		
CI	0.13	0.18	0.16	0.09	0.08	0.00	0.00	0.35	-0.05	-0.04	1.00	
FP*CI	-0.02	-0.03	-0.03	-0.03	0.01	0.00	-0.54	-0.01	-0.01	-0.01	-0.01	1.00
FP*TG	-0.01	0.05	-0.03	0.03	0.03	0.10	-0.01	0.12	-0.02	-0.14	0.03	1.00

Source: Author's estimation based on data series discussed in methodology

Diagnostic Test

Since I considered only domestic firms in the analysis, I employed the Heckman two-step selection model to correct the selection bias resulting from the exclusion of foreign firms. Table 4.4 presents the result of the Heckman two-step selection model estimation. The result shows that the Mill ratio coefficient is not statistically significant at any conventional level of significance. Thus, we do not reject the null hypothesis. This implies that there is no selection bias in the specified model.

Table 4.4. Heckman two-step Sample Estimation

					Censored obs= 1532 Uncensored obs =12804 Wald chi2(5) =332.80 Prob > chi2 = 0.0000
	Coef.	Std. Err.	Z	P>|z|	[95% Conf. Interval]
VAL1	.186846	.0742083	2.52	0.012	.0414003 .3322916

K	.184516	.0678397	2.72	0.007	.0515527	.3174793
L	.2897508	.1154152	2.51	0.012	.0635413	.5159604
RM	.4634927	.0768132	6.03	0.000	.3129417	.6140438
antrho	.357754	.5227002	0.68	0.494	-.6667196	1.382228
L	.2234048	.0352504	6.34	0.000	.1543152	.2924944
K	.0552008	.0225705	2.45	0.014	.0109635	.0994381
RM	-.0324187	.0279976	-1.16	0.247	-.087293	.0224557
ISIC	-.0000525	.000072	-0.73	0.466	-.0001936	.0000885
year	-.0011946	.0001855	-6.44	0.000	-.0015582	-.000831
FP	3.70e-08	1.10e-08	3.38	0.001	1.55e-08	5.85e-08
HEF	.0080278	.0050524	1.59	0.112	-.0018747	.017930
mills	lambda	.4679708	.631398	0.74	0.459	-.7695464
	rho	0.00				
	sigma	0.00				

Source: Author's estimation based on data series discussed in methodology

The model1, model2 and model3 columns in the Table represent the diagnostic tests estimates for empirical model estimates for the model specified in equation (1) at the firm level, equation (2) at the industry level and equation (3) at the industry level, respectively.

For both firm and industry level estimations of the model, the p-values of Arellano-Bond test for AR (2) is greater than 5%. Thus, the null hypothesis of no autocorrelation in the AR (2) process is not rejected for the three estimations. This test therefore supports the validity of the model specifications. As shown in the Table 4.5, the p-values for Hansen J-test are greater than the conventional level of significance. Hence, do not reject the null hypothesis that the sets of instruments used are appropriate. Therefore, the lags used in the model estimation have valid instrumentation.

Table 4. 5. Diagnostic tests for one-step system GMM estimation

Panel A	Model 1	Mode l2	Mode l3
Arellano-Bond test for AR (2) (p-value)	0.111	0.128	0.209
Hansen J-test of over identifying restrictions (p-value) H0: All over identifying restrictions are valid	0.293	0.741	0.801
Panel B Difference-in –Hansen tests of exogeneity of GMM instruments subsets			
Hansen tests excluding the differenced Instruments on the level equation (p-values):	0.872	0.89.0	0.856
Ho: Instruments on the differenced equation are exogenous (valid)	0.610	0.923	0.789
Hansen tests excluding the system GMM instruments (p-value) Ho: GMM differenced-instruments on the Level equation are exogenous			

4.3. The Econometric Model Estimation Result and Discussion

Model1, Model2, and Model3 in Table 4.6 columns represent empirical model estimation results for the models specified in equation (1) at the firm level, equation (2) at the industry level, and equation (3) at the industry level, respectively, for horizontal spillover occurrence determinants analysis. The coefficients of the control variables such as, fixed capital, labor, and material input per labor show positive and significant results at 1% level of significance. In contrast, the coefficients of the other control variables, such as capital intensity, skill intensity, and technology gap, show negative and significant levels at conventional levels of significance. Since

their logarithmic values have been taken, the coefficients are the elasticity. However, we have not probed further into them because they are not our interest.

As shown in table 4.6, column 2, the foreign presence has the expected positive sign and is significant at the 5% level of significance. The coefficient shows that a 1% increase in foreign presence will lead to a 4.86E-09 percentage increase in domestic firm productivity, ceteris paribus. This might be a sign of the occurrence of the direct effect of FDI on domestic firm productivity in the manufacturing sector.

To capture the effect of foreign presence on domestic firm productivity because of the absorptive capacity of the industry in which the firm was operating, we made interaction between the industry mean of foreign presence and the means of technology gap, capital intensity gap, and skill intensity gap.

The estimated coefficient of the interaction between foreign presence and technology shows a positive and statistically significant at 1% level. This implies that a 1% increase in foreign presence in industry results in an 8.39E-10% increase in industry productivity, in moderate levels of technology gaps (i.e., both variables are centered on the mean), keeping other factors constant. Even though the magnitude of the spillover effect in the industry because of the presence of the foreign firm seems small, it has similarities with the empirical findings of Blomström and Sjöholm (1999) for Malaysia and Liu et al. (2001) for China. Indeed, given China's and Malaysia's high levels of economic development, and total FDI in both countries is much higher than in Ethiopia, this may not come as a surprise. However, regarding developing countries, this finding is consistent with the study of Boly et al. (2015) conducted in selected Sub-Saharan countries. They reported that foreign presence has a positive effect on domestic firm productivity for those firms that have better absorptive capacity. The finding is also plausible with the theory that firms' absorptive capacity is a determinant for FDI productivity spillover occurrence. This explains why the productivity spillover effect from FDI depends on the industry's absorptive capacity. This implies that foreign presence in the manufacturing industry of Ethiopia appeared to be a determinant of domestic firm productivity, putting absorptive capacity as a condition.

As observed in Table 4.6, column 2, the horizontal spillover effect has a positive and significant coefficient at a 1% level. The coefficient for the interaction between the horizontal spillover and technological gap is positive and significant at a 1% level of significance. This implies that the effect of horizontal productivity spillover on domestic firms' productivity depends on the level of the technology gap. This means that a one-percentage-point increase in horizontal productivity spillover causes a 0.0107-percentage-point increase in domestic firm productivity at an average level of technology gap (i.e., has a score of zero on the centered technology gap variable), while all other variables remain constant. This is quite similar to the findings of Kokko (1994), Kokko et al. (1996), and Flores et al. (2000). Meyer (2004) and BA (2014) also point out that when the technology gap between domestic and foreign firms reduces, the spillover effect from FDI to domestic firms increases. The empirical work of Turi (2015) for Ethiopian manufacturing firms disagrees with this result. The reason might be the estimation method difference and the inclusion of foreign firms in his study for analysis.

Table 4.6 Model2 represents the empirical model estimation results for models specified in equation (2) using the industry-level data set. Except for the slight changes, the estimated coefficients observed in column 4 show similar results using the firm-level data set presented in Table 4.6 Model1. Thus, we delve into the vertical spillover (forward and backward productivity spillover) and labour competition effects only here. The result

shows that the backward spillover has a positive and significant effect at 5% level of significance. Forward spillover and labor competition, on the other hand, are statistically insignificant at any conventional significance level. This shows that industries in which firms have backward linkage with foreign firms are more productive than industries with no linkage. To be more precise, the movement of backward linkage among the industries from zero to one percentage point results in a 0.00425 percentage point change in domestic firms under that industry, holding other factors constant. These findings are consistent with the findings of Turi (2015) for Ethiopia and Tomohara and Yokota (2006) for Thailand using firm-level unbalanced panel data.

Finally, on average, FDI improves domestic firms' productivity through the horizontal and backward channels but does not affect the increase in productivity of domestic firms through forward linkage. The horizontal productivity spillover effect comes into existence through demonstration and competition effects, whereas the backward productivity spillover effect has been transmitted through local supplier firms' related technology transfer.

4.4. Determinants of Horizontal Spillover

Table 4.6 Model3 provides the SYS-GMM estimation result for the horizontal spillover equation (3) at the industry level. As shown in column 6, the coefficients of demonstration and competition are positive and significant at the conventional level of significance. According to the estimates, a 1% increase in demonstration effect translates into a 0.84 percentage point increase in horizontal productivity spillover on average. Similarly, a percentage point increase in competition effect results in a 0.67 percentage point increase in horizontal productivity spillover, all else being equal.

The estimate for the coefficient of technology gap indicates a negative and significant level at 1%. Conversely, the coefficients of skill and labor mobility show insignificant results. The negative and significant coefficient of technology gap implies that an increase in one unit of technology gap between the domestic and FDI firms results in an 8.98E-09 unit decrease in horizontal spillover, ceteris paribus. This implied that domestic firms with low technology gaps were bigger recipients of horizontal spillover and vice-versa. This is consistent with the findings of BA (2014) in Kenya.

Table 4.6. Result of Dynamic Panel-Data Estimation, One-step System GMM

Model1	Coefficients	Model2	Coefficients	Model3	Coefficients
L.VAD	0.309***	L.VAD	0.318***	L.Horz	0.6471162***
K	0.0933***	K	0.294***	Demos	0.8361643**
L	0.290***	L	0.774***	Compn	0.664389**
RM	0.240***	RM	0.240***	LabMob	-3.82E-09
SI	-1.51E-10	SI	-1.97E-08	Skill	0.2838385
TG	-1.84e-07***	TG	-0.651**	TG	-8.98E-09***
FP	4.86e-09**	FP	8.39e-10**		
CI	-0.00459*	CI	-0.475**		
Horz	0.0107***	Horz	1.276**		
HEF	1.178	Labcom	0.0598		
		EXT	0.0094537		
Horz*TG	4.17e-07***	FP*TG	3.01e-09***		
Horz*CI	8.11E-09	FP*CI	0.00608		
Constant	5.480***	Forward	-1.12E-08		
		Bakward	0.452**		

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 (denote significance at the 1%, 5% and 10% level, respectively).

Source: own computation from CSA survey data

5. Conclusion

The agenda of attracting FDI in developing countries in recent years has been attracting the attention of many policymakers. Despite the fact that numerous studies have been employed regarding FDI productivity spillover effects in various countries; the empirical work in Africa is still inadequate (Boly et al., 2015). In this context and the gaps in the former research, the study was aimed at evaluating the productivity spillover effect from foreign-owned firms to domestically owned firms in the Ethiopian manufacturing sector.

Accordingly, the empirical result shows the coexistence of both negative and positive effects arising from foreign presence on Ethiopian manufacturing firms. This implies that foreign presence leads to positive productivity spillover effects in low technological gap firms and negative effects in high technological gap firms with respect to foreign firms. It confirms the theory contributed by Buckley et al. (2010, p.192) for such a complex spillover. They argued that the complexity of spillover effects challenges the fallacious expectation of an equal spillover effect in all firms. The results are consistent with the Boly et al. (2015), Campos and Bruhn (2014), and Bruhn and Calegario (2014) findings that FDI has a conditional effect on the host firm's characteristics. From this, we can deduce that moderate technology gaps between foreign and domestically owned firms are an important determinant of productivity spillover occurrence. It is also similar to the result of Girma and Gorg's (2005) argument that absorptive capacity is a crucial factor in diffusing advanced technology to the local industry.

Similarly, this study also shows evidence of interaction between the horizontal spillover from FDI and the technology gap. Local firms with technology gaps at an average level and below average level have benefited from FDI productivity spillover. This study also found evidence of the channels through which the horizontal spillover effect occurs for domestic firms. It occurs through demonstration and competition effects. The estimates also reveal that foreign presence positively and significantly influences the productivity of local firms through backward linkage. The occurrence of these spillovers, however, is determined by the level of technological disparity between the two counter firms.

Finally, policy measures aimed at minimizing the technology gap between foreign and domestic firms to maximize the productivity spillover effect are suggested. Since the result shows that the spillover effects in all firms are not equal, prioritization as per their promise is recommendable in an FDI attracting framework.

Abbreviations: CSA-Central statistical Agency, FDI-Foreign direct investment, GMM-General Momentum method, SYS-GMM-System General Momentum Method, EIC-Ethiopian investment commission, IMF-International Monetary Fund, MNCs-Multinational companies, MNEs-Multinational Enterprises, ISIC-International Standard Industrial Classification, OLS-Ordinary Least Square, UNCTAD-United Nations conference on trade and development, UN-United Nation

Availability of data and materials: The datasets used and/or analyzed during the current study will be available when requested.

Ethics approval and consent to participate: This study does not involve human subjects, human material, or

human data.

Consent for publication: This manuscript does not include details, images, or videos relating to individual participants.

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