

Productivity Spillovers From Foreign Direct Investment To Ethiopian Manufacturing Sector

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Research

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Posted Date: October 1st, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-903290/v1>

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Productivity Spillovers From Foreign Direct Investment To Ethiopian Manufacturing Sector

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Abstract

The study attempted to investigate productivity spillover from FDI to domestic firms in Ethiopian manufacturing industries. The analysis was conducted using panel data for the years 2011 up to 2016 on 260 large and medium scale-manufacturing firms deployed under 24 industries. The System Generalized Method of Moments (SYS-GMM) estimator was employed to conduct the analysis.

Accordingly, the study found that a coexistence of both negative and positive effects from FDI through productivity spillover to domestically owned firms using absorptive capacity as determining factor of spillover occurrence in moderate level. Specifically, foreign presence in industry contributed a positive and significant horizontal and backward productivity spillover effect to domestic firms within the industry in average level. The horizontal productivity spillover transmitted to local firms through demonstration and competition effects in moderate level. Likewise, vertical productivity spillover occurred through the channel of sales of intermediate goods and services to foreign firms. Finally, we can conclude that technology gap is critical factor among those factors that determines the productivity spillover occurrence.

Key words: Foreign Direct Investment, Foreign Firm, Domestic Firm, Horizontal productivity spillover, Vertical productivity Spillover, Labor Competition

1. Introduction

1.1. Back Ground of the Study

Foreign direct investment (FDI) has outlined as future investment that involves injection of foreign funds into associate enterprise that operates in a very different country of origin from the capitalist. During the last 20 years', the recognition on the importance of foreign direct investment (FDI) within the developing policy and strategies of the emerging economy was growing. To this end, substantial range of developing countries in transition became a lot of receptive to FDI and is exploring ways in which for increasing inflows (Miroux et.al, 2009).

In addition, this development may be through spillover effects whose presence will have an effect on development of business enterprises within the host economy. Theoretically, FDI in developing countries have perceived not solely as a supply of capital flow, however conjointly as a vehicle for feat trendy technology and the necessary managerial skills that these countries need for development. These have number of the explanations why most of the developing countries have continued to pursue domestic policies that encourage many FDI inflows. To realize these, they have provided a number of investment incentive packages, such as lowering income taxes, import duty exemptions, tax holidays and subsidies for infrastructures facilities with the motive of attracting more foreign direct investment (Waldkirch and Ofosu, 2010; Glass and Saggi, 2002).

According to Blomstrom et al., (2003), the well-known channels through which FDI-induced externalities to domestic firms are: - (1) demonstration effect, which may help the domestic firms to imitate, (2) competition effect (creating competitive atmosphere between firms), (3) enhancement of export capacity through the reduction of export related costs and the last is backward and forward linkages with foreign firms in the industries.

As a result, since the mid Eighties, the speed of growth of worldwide outflow of FDI has well exceeded that of world GDP, worldwide exports and domestic investment. The developed countries have continued to draw in the majority of the inflows (UNCTAD, 2016). However, recent Proof indicates that the flow of FDI to developing countries has inflated well. UNCTAD (2014) report shows that the share of FDI flows destined to the developing countries reached 54% of the world FDI lows in 2013 compared to 39% for developed countries

In contrary, despite efforts to attract foreign direct investment (FDI) by African countries has been undertaken, FDI flows to the continent still decline. Consistent with the UN Conference on Trade and Development (UNCTAD) World Investment Report on UNCTAD (2017), FDI flows to Africa fell by 3 % from \$61 billion in 2015 to \$59 billion in 2016, however with variance across regions and countries. The general decline of FDI flows to the continent is owing to weak trade goods costs. FDI inflows stay unevenly distributed across the continent – with solely 5 countries (Angola, Egypt, Nigeria, Ghana and Ethiopia) hosting 57 % of continent’s total FDI inflows, whereas Africa accounts for 3.4 % share of world FDI. East Africa received \$7.1 billion in FDI in 2016, which is greater by 13% from in flow in 2015. This increment was driven by increase in countries, Ethiopia, Mauritius and Madagascar. However, Kenya and Tanzania fell by 36 % to \$394 million and 15 % to \$1.4 billion respectively. Flows to African nation rose by 46 % to \$3.2 billion, propelled by investments in infrastructure and producing.

However, FDI capital flow to Ethiopia shows increasing trend from Birr 971 million in 2000 to Birr 63.6 billion in 2016. In the last four-year the flow lifts up from 1.3 billion USD in 2013 to 3.2 billion USD in 2016 in Ethiopia (UNCTAD, 2016). The trend for FDI capital inflow was fluctuating trend between year 1996 and 2012. However, it shows increasing trend from 2012 up 2016. The reason behind might be the amendment of investment proclamation of the country in 2014. Changes like, incentives and subsidies, business income tax exemption and import duty exemptions are among the issues addressed in the proclamation.

The share of manufacturing value added in GDP in Ethiopia has been fluctuating between a minimum value 3.22% scored in 1992 and 7.8 % scored in 1997 during the period between 1981 and 2016 (UNCTAD, 2016). To justify this fluctuating and currently decreasing trend of share of local firms manufacturing value added in GD, empirical evidences have needed.

The finding of empirical studies has proven the presence of productivity spillover effect from multinational firms to domestic firms (Wei & Liu ,2001; Tomohara & Yokota, 2006; Getachew ,2013; Begum 2016). Despite of the above clear theoretical conception and empirical results that FDI generates positive externalities, there are controversies in the findings of former studies (Yuri ,2007; Konings ,2001; Bruhn & Calegario, 2014, Lemma & Kitaw, 2014).

This contradiction creates a question on the aggressiveness of government's policies action taken to attract in FDI with long run goal which is productivity spillover effect from foreign firm to domestic's firms.

So far as the author knows, no study has been done yet on examining productivity spillover from FDI to domestic manufacturing firms based on theory of sensitivity of domestic firms to receive productivity spillover from FDI firms. This research also differs from the former researches by giving more concern for endogeneity and simultaneity problem. Furthermore, researches have not yet conducted in this topic using firm level dynamic panel data using system GMM estimator modeling in Ethiopia.

Therefore, this study aimed to investigate whether the manufacturing domestic firms in Ethiopia have benefited from foreign firms via productivity spillover or not, and the determinants FDI spillovers occurrence. The study also examines the labor market competition effect resulted by foreign presence on domestic manufacturing firms. The survey data collected from large and medium scale manufacturing sector by Ethiopian central statistical agency in the period between 2011 and 2016 used for analysis.

2. Literature Review

2.1. Theoretical Framework of FDI and Productivity Spillovers

Foreign investment can be a direct investment or portfolio investment. Direct investment is the acquisition or construction of an actual capital 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 investment country (Duce and España, 2003).

Wei and Liu (2001) theorized the presence of multinational firms has possibility to speed up the technology transfer process and reduce the costs of the 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

mechanism through which spillover may occur, such as imitation, worker mobility, competition, and linkages. However, theory developed by Gachino (2010) states that Spillover effect occurrence have a strong relationship with the potential of hosting enterprises to absorb know how skills and technologies.

In contrary, 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, that eventually affects the productivity of the domestic companies.

Vertical Productivity Spillovers

Vertical spillovers happen when inter industry spillovers arise mainly by 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 demand from 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 MNCs 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 backward spillover effect. This is likely to generate additional economic activity, income and transfer of technological and managerial skills to the host country

Horizontal Spillovers

According to Görg and Greenway (2004), the domestic firms can benefit through horizontal spillovers through three channels. Firstly, via demonstration effects in which the local enterprises become familiar with superior technologies, marketing and managerial practices used in foreign affiliates. Thus, spillovers can take place in the form of imitating the foreign subsidiaries' technology. The local enterprise may learn simply by observing and imitating the multinationals (Subash, 2006). Secondly, via labor turnover, which occurs when employees from foreign affiliates leave multinationals to join local firms. Through this, knowledge and skills are transferred from the foreign to local enterprises.

The last channel of transmission is 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, heavy capital investment among others, foreign firms have an advantage over domestic enterprises (Subash, 2006).

2.2. Empirical Evidence on FDI Productivity Spillover

Assessing the effect of productivity spillovers is becoming an essential device to design countrywide regulations regarding inward FDI. So that number of empirical studies has been attempting to measure the value of FDI spillovers, particularly, in the case of developing countries. Parts of the literatures come up with positive result regarding the FDI productivity spillover effect on the productivity of domestic firms. Contrarily, the other counterpart appeared with nonexistence and even negative results in some developing countries.

To mention some, Tomohara and Yokota (2006) conducted study using plant level data in Thailand and found that FDI affects the domestic firm productivity through horizontal and backward productivity spillover effect on average, while it has no effect through forward linkage. However, challenge full to conclude this because both foreign and domestic firms were used in the analysis. Consequentially, the results may cause overestimation on the estimated coefficients of parameters. Similarly, Turi (2015) has done a study to evaluate the productivity spillover from foreign firms to local firms by using unbalanced panel data of large and medium scale-manufacturing industries for the years 2004 up to 2010 in Ethiopia. Finally, from the analysis evidence, he concludes that the presence of foreign firms has positive backward and negative forward productivity spillovers to the total productivity of the manufacturing firms in the country. Getachew (2013) has also undertaken a study using cross-sectional data of 1630 manufacturing firms for the year 2009, applying OLS estimation method. On his result, he confirmed the presence of horizontal spillover effects in the industry at national level

Similarly, Bruhn & Calegario (2014) done research using unbalanced panel data to examine the productivity spillover effect from FDI employing Moderated Multiple Regression (MMR) and generalized linear model (GLM). Finally, they come up with result showing coexistence of negative and positive effect of FDI productivity spillover in domestic firms. The negative impact concerns the firms who are performing below the average level of technological gap between

domestic and foreign firms whereas the positive signals the firms who have at moderate and above technological gap.

In other hand, Gachino (2010) conducted a study to identify the determinants of spillover using evidence from west Bengal engineering industries. He found that the occurrence of productivity spillover mainly depends on absorptive capacity, presence of supportive structures and institutions, presence of interactions and trade orientation rather than the presence of foreign firms. In addition, he also includes firm size, age, ownership structure, performance, firm strategy and industry structures. Likewise, Lemma & Kitaw (2014) examined the role of Foreign Direct Investment (FDI) on technology transfer in Ethiopian metal and engineering industries by using survey data of 47 metal and engineering industries. Their findings show that the technology absorptive capacity of local firm is poor. Thus, local firms to adopt, modify and improve a given technology is very weak, un-collaborative operating environment between foreign and local industries.

The analysis was undertaken based on sensitivity of domestic firms to receive productivity spillover from the foreign owned firm so called conditional spillover effect theory. According to this theory, the occurrence of the productivity spillover effect from foreign firms to domestic firms depends on the absorptive capacity of the domestic firm, firms' market orientation (import and export), sectoral competition, size of the firm, foreign participation and other related characteristics of a firm or an industry (Schoors and Van der Tol, 2002; Javorcik, 2004; Gachino,2010; Görg and Greenaway, 2004; Girma and Gorg, 2005; Mugendi ,2014; Bruhn and Calegario, 2014).

In other hand, quality of labor which is measured by proxy variable skill intensity gap, ownership ratio, capital intensity gap, embodied technology gap between domestic and foreign firms, organizational capabilities like practice of skilled labor, and experience are factors affecting spillover effect (Kokko et al ,1996; and Blomstrom, 1986). The result indicates that when there is a small technological gap between domestic and foreign firms, the positive effect can be far more success full owing to the higher absorptive capacity.

Similarly, the horizontal and vertical productivity spillover, which are caused by interaction among firms by supplying or purchasing either inputs or finished materials each other are the main interest area of this study. The possible mechanisms through which the horizontal spillover effect

may occurs are imitation, worker mobility and competition and vertical spillover effect occurs through linkages (Görg and Greenaway, 2004).

Generally, positive spillover effects depend on a number of factors, including host country's openness to trade, the capacity of its local firms to internalize spillovers, and the ability of sectors to support learning. Another factor is the technological gap between foreign and local firms confirmed by De Mello (1999), as well as the existence of relatively developed local financial markets and qualified human capital (Görg and Greenaway, 2004).

2. Research Methodology

3.1. Operational Definition of Variables

The objectives this study which is investigating the productivity spillover from FDI to domestic firms in Ethiopian manufacturing industries is turned into operational definition of variables as follows:

- i.* Manufacturing industries in this study are defined as large and medium scale manufacturing industries in which at least ten people are deployed as worker, use powered machines, and covers public, private and foreign owned firms in all regions of the country.
- ii.* Productivity spillover from FDI to domestic firms is defined as the influence of presence of foreign-owned firms on productivity of domestic owned firms through knowledge spread. It is measured by proxy variable labor productivity of firm.
- iii.* Based on the definition of IMF (1993) and OECD (1996) foreign firms are defined as one in which there is at least 10 per cent foreign equity in the firm.
- iv.* In contrary, a firm is defined as domestic firms when foreign equity share is less than 10 percent.

3.2. Data Description

This paper relied on annual survey of large and medium scale manufacturing industries data, conducted by the Ethiopian Central Statistical Agency from 2011 to 2016. CSA has used Stratified-sampling method in each region. The nature of the data set was unbalanced panel data that covers 260 domestic and 52 foreign firms under 24 manufacturing industries with a total number of 1511 domestic and 213 foreign observations in firm level. By aggregating the firms

small (short panel). VAD_{ijt} 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; VAD_{ijt-1} is the natural logarithm of one lag period home firm productivity, K_{ijt} is the Capital input, L_{ijt} is the Labor input, MR_{ijt} is the input materials, FP_{ijt} is the foreign firm presence, EXT_{ijt} is export of firm, SZ_{ijt} is the size of firm, TG_{ijt} is technological gap between foreign firm and domestic firm, CI_{ijt} is the capital intensity of firm, SI_{ij} skill intensity gap firm, $Horz_{ij}$ is the horizontal spillover, HEF_{ij} is the Herfindahl index and $Horz_{ij} * TG_{ij}$, $Horz_{ij} * CI_{ij}$ and $Horz_{ij} * SI_{ij}$ are the interaction of horizontal spillover with technological gap, capital intensity gap and skill intensity gap, respectively. foreign presence with capital intensity of firms,

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

$$\begin{aligned}
 VAD_{jt} = & \alpha_j + \gamma MVAD_{jt-1} + \beta_1 K_{jt} + \beta_2 L_{jt} + \beta_3 MR_{jt} + \beta_4 FP_{jt} + \beta_5 EXT_{jt} \\
 & + \beta_6 SZ_{jt} + \beta_7 TG_{jt} + \beta_8 CI_{jt} + \beta_9 SI_{jt} + \beta_{10} FP_{jt} * TG_{jt} \\
 & + \beta_{11} FP_{jt} * CI_{ijt} + \beta_{12} FP_{jt} * SI_{ijt} + \beta_{13} Horz_{jt} + \beta_{14} Forward_{jt} \\
 & + \beta_{15} Backward_{jt} + \beta_{16} LabCom_{jt} + \beta_{17} HEF_{jt} \\
 & + \varepsilon_{jt} \dots \dots \dots (2)
 \end{aligned}$$

Where VAD_{jt} denotes the mean of total value of firm production per labor in industry level in each year. $MVAD_{jt-1}$ denotes mean of lag value of total value of firm production per labor in industry level in each year. $Forward_{ij}$ denotes forward spillover, $Backward_{ij}$ denotes backward spillover and $Labcom_{ij}$ denotes labor competition effect. The other remaining explanatory variables denotes the mean of observed variable in equation (1).

Similarly, to meet the objective three, the spillover identified in objective one (horizontal spillover), were regressed against their determinants in addition to technology gap and skill using SYS-GMM estimator based on Green (2006) and Baltagi et al (2015) is presented as follows:

$$Horz_{jt} = \alpha_j + \gamma Horz_{jt-1} + \beta' MX_{jt} + U_{jt} \dots \dots \dots (3)$$

Where $Horz_{jt}$ denotes the mean of horizontal spillover of domestic firm from foreign firms in the same industries. $Horz_{jt-1}$ denotes mean of lag value of horizontal spillover of domestic industries from foreign firms in the same industry. X_{jt} denotes a vector of the mean of explanatory variables such as skill intensity gap, technology gap, demonstration effect, labor turn over and competition effects. Skill is represented by average wage of workers. Demonstration effect was represented by percentage of firms who has changed production technique (process) due to competitive pressure (in order to keep up) from FDI within the same industry. Labor turnover is represented by the proxy variable the percentage of firms in the same industry who hired employees with previous experience in FDI firms. Competition effect is proxied by the percentage of firms in the same industry that directly adopted or imitates production techniques by observing or copying from FDI competitors. The measurement of variables and the expected signs of the coefficients of the explanatory variables for the above models were presented in Appendix B for further detail.

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 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 gross total value firm production of firm 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 in put	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	<i>SIZE</i> 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	+

Symbol	Variable name	Measurement	Expected signs
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	$Horz_{ijt} = \frac{FP_{ijt} * y_{ijt}}{\sum Y_{ijt}}$ <p>Where, $FP_{ijt} * y_{ijt}$, is foreign firms' output and $\sum Y_{ijt}$ is Total output</p>	+

4. Result and Discussion

4.1. Descriptive Result Analysis

In the summary statistics Table 4.1 and Table 4. 2, the variables used in this study are described and compared each other for both domestic and foreign firms for simplicity and clarity. As portrayed in Table 4. 1 and Table 4.2, 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 firm is 790624.8ETB whereas the domestic is 623405.7ETB over the specified period. Literally this mean that foreign firms on average are 13% more productive than domestic owned firms. In similar fashion, capital and raw material consumption intensity in average are 2443425 ETB and 1925665 ETB in foreign firms and 664942 ETB and 4183345 ETB domestic firms, respectively. This figure indicates that the employment of capital and raw material inputs in foreign firms were larger than the counterpart.

As presented in the summary Table 4.1 and Table 4.2 the average number of persons engaged in the firms were 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 in

average. The value of the variable ‘foreign presence’ in a given industry ranges from a minimum value of 1.7 percentage share to a maximum of value of 51 percent with mean value of 13 percent share. Since, foreign presence in the industry level is proxied by share of foreign firm employment in total employment of industry; we can understand from this figure that foreign firms have 13 percentage employment shares in the manufacturing sector of Ethiopia in average.

In this study, skill, capital and technological intensity gap between foreign and domestic owned firms ranges from values -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 skill intensity gap indicates that the average wage of foreign firm in that specific industry is greater than the average wage of domestic firms. The negative sign in the capital intensity gap indicates that the average capital per labor in specific industry is greater than the domestic firm capital per labor. Similarly, the negative sign in technological gap indicates that the average productivity of the foreign owned firm in the same industry is greater than that of domestic firm. In contrary, the reverse holds true for the positive values of the above case.

Table 4. 1. Descriptive Summary 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 the concern of this study, its value ranges from a minimum of 6.19E-07 to maximum of 0.9153, with mean value of 0.0132 as portrayed in Table 4.1. Since, the average value of the HI is somewhat low, it may signify that on average firms do not have a higher market power. Firm size also ranged from 0.000072 to 144.4533, with mean value of 0.893 suggesting the existence of huge variation among the firm's total value of production in industries. In the case of continuous dependent variables, the system GMM estimator (GMMSYS) resolves this type of problem.

Table 4. 2. Descriptive Summary of foreign owned firms' performance

Variable	Obs	Mean	Std. Dev.	Min	Max
TVP	213	1.50E+08	6.18E+08	322606	6.54E+09
PROL	213	793726.3	2285062	2979.329	1.74E+07
KI	210	2455056	1.44E+07	0.111111	1.72E+08
RMI	212	1934321	1.67E+07	294.7852	2.24E+08
TE	213	275.7887	850.0101	10	12013
AVEWE	213	21939.58	84903.57	312.9267	834071.7
Export	213	5.90E+07	5.96E+08	0	6.37E+09
HEF	213	0.0192816	0.0560266	1.44E-05	0.473184
SZ	213	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

As shown in the correlation matrix table 4.3. below, the firm productivity is positively related with explanatory variables such as capital intensity, labor, material input intensity, foreign presence, herfanlalex index, firm size and horizontal spillover effect. In contrary, it is negatively correlated with technological gap, capital intensity gap and skill intensity gaps between domestic and foreign owned firms. Except the highly strong correction between Herfindahl index and size of firms, the correlation score between other variables does not shows strong correlation. The highly strong correlation between Herfindahl index and size of firm may prove difficult to use them at the time in a single regression because of multicollinearity problem. Accordingly, based on the economic theory, this study uses Herfindahl index only for analysis. Since, Herfindahl index has better explaining power on firm productivity than firm size in relation to the industry and an indicator of the amount of competition among them.

Table 4.3. Correlation matrix for bivariate

	VAD	K	L	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	1.00							
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	-0.02	1.00

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

Diagnostic Test

Since only domestic firms were considered in the analysis, the Heckman two-step selection model was estimated to correct the selection bias resulted from the exclusion of foreign firms. The result of estimation was presented in the table 4.4. The specified result shows that the Mill ratio coefficient is not statistically significant in 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. Estimation Heckman two-step Sample

```
heckman VAD l.VAD K L RM antrho , noconstant twostep select(Ons = L K RM ISIC y
> ear FP HEF, noconstant) rhosigma
Heckman selection model -- two-step estimates      Number of obs      =      1,669
(regression model with sample selection)          Censored obs       =      178
                                                  Uncensored obs     =      1491

                                                  Wald chi2(5)       =      332.80
                                                  Prob > chi2        =      0.0000
```

		Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
VAD						
	VAD					
	L1.	.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
Ons						
	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 1.705488
	rho	0.00				
	sigma	0.00				

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

As showed in Table 4.5 below, (panel A and pane B), the relevant statistical diagnosis tests undertaken to ensure the statistical validity of the estimated model using Roodman (2009 a) test. The model1, model 2 and model3 columns in the table represents the diagnostic tests estimates for empirical model estimates for the model specified in equation (1) in firm level, equation (2) in industry level and equation (3) in industry level respectively.

- i. From (panel A) for the three models in firm level and in industry level, the reported number of instruments across all estimation is 231 less than 1211, 118 less than 120 and 77 less than 120 and the p-value of Hansen test for all estimations satisfies the rules.
- ii. The F-test of joint significance reports that the null hypothesis estimated coefficients on the regressors are jointly equal to zero (p=0.000) for the three models is rejected and is satisfied across all estimation for both estimations

- iii. As shown in table 4.5, for both firm and industry level estimation of the model, as the p-values of the correcting the null hypothesis of no autocorrelation in AR (2) process is not rejected for the three estimations. This test is therefore supporting the validity of the model specifications. It is noteworthy that the autocorrelation test and robust estimates of the coefficient standard errors assumes no correlation across individual in the idiosyncratic disturbance (Roodman,2009b).
- iv. The Hansen J-statistics of overidentifying restriction tests the null hypothesis of the validity of instruments. The high p-values of the Hansen J-test does not therefore reject the null hypothesis that the sets of instruments used is appropriate at any conventional level of significance for the three estimations as indicated in the Table 4.5. This suggests that the lags used in the model estimation have valid instrumentation across both estimations.

Consequently, considering the various diagnostic tests and checks that have been conducted, there exists sufficient evidence to satisfy the key assumptions of GMM estimation. Thus, the statistical appropriateness of the model is confirmed.

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

Panel A	Model1	Model2	Model3	
Number of observations		1211	144	144
Number of groups (firms)		260	24	24
Number of instruments		231	118	77
F-test of joint significance(p-value): Ho: The estimated coefficients on the regressors are jointly equal to zero		0.00	0.00	0.00
Arellano-Bond test for AR (2) (p-value) Ho: There is no second order-serial correlation in residuals		0.111	0.128	0.209
Hansen J-test of overidentifying restrictions (p-value) H0: All overidentifying restrictions are valid		0.293	1.00	1.00
Panel B Difference-in –Hansen tests of exogeneity of GMM instruments subsets				
Hansen tests excluding the differenced Instruments on the level equation (p-values): Ho: Instruments on the differenced equation are exogenous (valid)		0.872	1.00	1.00
		0.610	1.00	1.00

Hansen tests excluding the system GMM
instruments (p-value)
Ho: GMM differenced-instruments on the
Level equation are exogenous

4.3. Dynamic Panel Data Model Estimate Result Discussion on FDI productivity Spillover

Model1, model 2 and model3 in columns of the table 4.6 represents the empirical model estimation results for model specified in equation (1) in firm level, equation (2) in industry level for FDI productivity spillover analysis and equation (3) in industry level for horizontal spillover occurrence determinants analysis, respectively. As presented in Table 4.6, coefficients for all estimates of the explanatory variables show the expected signs. Most of the explanatory variables such as logarithm of labor, logarithm of capital-labor ratio, logarithm of material input per labor, foreign presence and Horizontal spillover has the expected positive signs and except foreign presence (FP), they are highly significant at 1% level significance. Thus, a one percent increase in the capital stock per worker ceteris paribus raises domestic manufacturing firm's productivity with about 0.09 percent. Likewise, 1% increase in material inputs result in an increase of 0.24 percent domestic firm productivity, ceteris paribus. The coefficient of labor in put also implies that a 1% increase in labor input result in an increase of 0.29% domestic firm productivity, ceteris paribus. As shown in table 4.6 column 2, the coefficient of foreign presence is positive and statistically significant at the 5% level, suggests that there are productivity gains associated with foreign presence in industry. This might be a sign for the occurrence of direct effect of FDI in domestic firm productivity in the manufacturing sector. The coefficient of foreign presence (FP) indicates that 1% increase in foreign presence, ceteris paribus, will lead to 4.86E-09 percentage increase in domestic firm productivity.

The interaction of the mean of foreign presence variable with means of technology gap, capital intensity gap and skill intensity gaps in industry level spillover analysis was incorporated in to the model in order to test the effect of foreign presence depending upon the moderating effect of industry absorption capacity. As presented in Table.4.6, the result for the interaction between foreign presence and technology gap shows a positive and statistically significant coefficient at 1% level. This shows FDI presence benefits depend on the industry absorptive capacity.

Figuratively it can be expressed as a 1% increase in foreign presence in industry results $8.39E-10$ % increase in industry productivity, in moderate level of technology gaps (i.e., both variables are centered on the means), keeping other factors constant. However, its significance seems low in contributing to domestic firm's productivity as the figure in result shows when it compared to the empirical findings of Blomström and Sjöholm (1999) for Malaysia and Liu et al. (2001) for China. In fact, this may not be too surprising given that the level of economic development of China and Malaysia is higher, and total FDI in both countries are much higher as compared to Ethiopia.

Even though, it is constrained with the technology gap, it is also similar with the finding of study conducted by Haskel et al. (2002) in UK during the period 1973 to 1992. They estimated a production function for domestic plants augmented with indicators measuring foreign presence in the industry. The estimate suggested that 10 percent increase in foreign presence in UK industry raised the total factor productivity of that industry's firm by 0.5 percent. However, with respect to developing countries cases, the finding is similar with the recent study of Boly et al. (2015) conducted in selected Sub-Saharan countries. They argued on their finding that the foreign presence has positive effect on the domestic firm productivity for those firms who have in better absorptive capacity.

Finally, the result is plausible with the theory that firms' absorptive capacity has shown to be a determinant for FDI productivity spillover occurrence. This explains that the benefit of FDI depends on the industry absorptive capacity and not all industries should be expected to benefit equally from foreign firm presence spillover. There are literatures that support the idea of better absorptive capacity to gain the better spillover effect benefits from foreign presence (Castellani and Zanfei, 2003; Girma and Gorg, 2005; Hale and Long, 2011). To sum up, foreign presence in manufacturing industry of Ethiopia appeared to be determinant of domestic firm productivity, putting absorptive capacity as condition.

The system GMM estimator output in Table 4.6 below shows, horizontal spillover effect has positive expected sign and statistically significant at less than one 1% conventional level of significance. Apart from this, the coefficient of technological and capital intensity gap between domestic and foreign owned firms has negative coefficient, which are similar with the expected

signs and statistically significant at one 1% and 10% level of significance, respectively. The interaction term variable is also highly statistically significant at less than 1% level of significance. This implies that the interaction between technology gap and horizontal spillover are positively significant at average level of variables.

This significant positive sign for the interaction term (Horz* TG) indicates that the difference in technology gap between domestic and foreign firms had an important determinant factor for the horizontal productivity spillover occurrence in domestic firms. In other word, this means the effect of horizontal productivity spillover on domestic firm's productivity (VAD) depends on the level technology gap (TG). It implies also that the main effect of horizontal productivity spillover would be the effect of horizontal spillover on domestic firms who had zero technological gaps with foreign firms. Literally it means, a one percent increase in horizontal productivity spillover causes a 0.0107 percent increase in domestic firm productivity for a firm who has technology gaps equals with average technology gap (i.e., has a score of zero on the centered technology gap variable), keeping other factors constant.

This result is similar with the former findings of Kokko (1994), Kokko et al. (1996) and Flores et al. (2000). They argued in their study that certain gap between technology of foreign and domestic firms are necessary for spillovers to occur, for instance, when local firms get an opportunity to copy foreign production techniques or benefit from the training if they have not at least some capabilities to do so, it is impossible to get the benefit as expected. They found a positive result only for domestic firms who have in medium level of technology gap with respect to foreign firms. Literally, this means, the domestic firms with medium and above absorptive capacity to receive spillover have a benefit and the reverse works for the firms with lower absorptive capacity. Meyer (2004) also point out that the greater the size of technology gap between domestic and foreign firms, less beneficial FDI is for the host country. It is also similar with the recent finding of Mugendi (2014) in Kenya. He found that skills and technology gap as a major determining factor for horizontal and vertical spillover effect occurrence.

Nonetheless, this finding is the opposite with previous finding of study employed by Turi (2015) regarding horizontal spillover in Ethiopia in manufacturing sector. The reason might be the

estimation method difference and the effects of the determinants for horizontal productivity spillover occurrence were not controlled well in his study. The other possible reason is might be the inclusion of foreign firms in his study for analysis. It is also contradicting with the findings of Konings (2001), Aiteken, and Harrison (1999), who repeatedly come up with no existence of FDI productivity spillover on domestic firms. To sum up, the domestic firm who has technological gap in average level has benefited better from horizontal spillover effects.

As shown in Table 4.6 column 2, the coefficient of capital intensity difference is negative and statistically significant at 10% level, which suggests that a one-unit increase of capital intensity difference from the average level of capital intensity difference results 0.005% decrements in the domestic firm's productivity. The statistical insignificance of the interaction between capital intensity gap and horizontal spillover effect variable, may indicate that the capital intensity gap observed between domestic and the foreign firms is not as such determinant factor for horizontal spillover occurrence in the specified period of study.

The skill intensity gap between foreign and domestic firms, which is proxied by difference between the wage of a worker in a domestic firm and the average wage payment of a worker in foreign owned firms in the same industry, is not statistically significant. Similarly, the impact of industry concentration, which is proxied by the Herfindahl index, are not statistically significant as indicated in the Table 4.6.

As shown in Table 4.6 column 4, except slight changes in the coefficients of estimated parameters, the industry level data gives similar results with firm level data. The forward and backward productivity spillover effects are the interested variables for analysis in this estimation. Since, both of these variables are dummy variables, the domestic firms who did not benefited from forward and backward linkage from foreign firms were used as base or reference category. The result report in tables 4.6 column 4, shows that the backward spillover effect has positive signs as expected and statistically significant at 5% level of significance. This coefficient indicates that industries under which the firms have backward linkage with foreign firms are more likely productive than the industries under which firms had no linkage with foreign firms. To put in more detail, the movement of backward linkage in industry from zero to one percent point produces a 0.00425

percent point change in domestic firms under that industry, holding others factors constant. In contrary, forward spillover, is statistically insignificant at any level of conventional significance level. This indicates that the benefits from forward linkage had not exploited during the period covered by this study

These findings are consistent with the finding of Turi (2015) for Ethiopia. It is also similar with the previous work finding of Tomohara and Yokota (2006) in Thailand using firm level unbalanced panel data. They suggested in their study that, on average, FDI improves domestic firms' productivity in the same sector as well as in upstream sectors, but does not affect productivity of domestic firms in downstream sector.

The p-value in Table 4.6 column 4 for the variable labor competition shows statistically insignificant results in any conventional level of significance. As indicated in the descriptive statistics part of this study, the reason for insignificance of labor competition might be the nearly equal mean of the wage rate in both foreign and domestic firms. From this we can infer that the labor market competition for domestic firms has not resulted because of the presence of foreign firms in the industry.

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 to existence through demonstration and competition effects whereas the backward productivity spillover effect realized through local supplier firms related technology transfer.

4.4.SYS-GMM Estimation Result Discussion on Determinants of Horizontal Spillover

As shown in the SYS-GMM estimation output table 4.6 column 6 below, the variable such as demonstration and competition effect have positive sign coefficients as expected and they are statistically significant at 5% level of significance. Likewise, the lag of horizontal spillover and technology gap has positive and negative signed coefficients as expected respectively and they are statistically significant at 1% level. The other remaining variables such as skill and labor mobility from foreign firms to domestic firms are not statistically significant in any conventional level of

significance. The possible reasons for the insignificance of skill variable are the proxy variable (average wage of workers). As indicated in the descriptive statistics summary, the mean wage rate of workers in foreign firms was less than that of domestic firms, even though; the productivity of workers in foreign firm is greater than workers in domestic firm. From the positive and significant coefficient of demonstration effect, we can suggest that the domestic firms with demonstration effect have 0.84 percentage points more horizontal productivity spillover than firms with no demonstration effect on average, *ceteris paribus*. Similarly, the positive and significant coefficient of competition effect enables us to suggest that the domestic firms with positive competition effect have 0.67 percentage points more horizontal productivity spillover than firms with no competition effect in average, *ceteris paribus*. In other equivalent expression, it can be expressed as, domestic firms who used competition positively has 0.67 percentage points more horizontal spillover than firms who fail to use competition positively, or did not face competition.

The negative and significant coefficient of technology gap informed us that an increase in one unit of technology gap result $8.98E-09$ units increase in horizontal spillover in average, *ceteris paribus*. This implied that domestic firms with low technology gap were bigger recipients of horizontal spillover. Even though, the variable skill and labor mobility was not significant for the possible specified reason above, if workers move from foreign firms to domestic firms, there are possibility to transfer more spillover for domestic firms who had small technology gap. This result is also consistent with the recent finding of Mugendi (2014) in Kenya. He found that technology gap as a major determining factor for horizontal and vertical spillover effect occurrence

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

Model1	Coefficients	Model2	Coefficients	Model3	Coefficients
L.VAD	0.109***	L.VAD	0.218***	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 world has been attracting the attention of many policy makers. Despite the fact that, numerous studies have been employed regarding FDI productivity spillover effects in various countries; the empirical works in Africa is still inadequate (Boly et al., 2015). In this ground and the gaps in former research, the study was aimed to evaluate the productivity spillover effect from foreign owned firms to domestically owned firms in Ethiopian manufacturing sector.

Accordingly, empirical result of this study shows the coexistence of both negative and positive effect arising from foreign presence on Ethiopian manufacturing firms. This implies that foreign presence leads to positive effects in low technological gap firms and negative effect in high technological gap firms with respect to foreign firms. It confirms the theory proposed by Buckley, Clegg and Wang (2010, p.192) for such complicated results of spillover. They argued that complexity of spillover effect challenges the fallacious expectation of 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 conditional effect on the host firm characteristics. Accordingly, we conclude that Moderate technology gap between foreign owned firms and domestically owned firms are crucial determinant factor for productivity spillover occurrence. It is also similar with the result of Girma and Gorg (2005) argument that absorptive capacity is a crucial factor to diffuse the advanced technology to the local industry.

Similarly, this study also shows evidence on connection between the horizontal spillover from FDI and the difference in technology gap. However, technology gaps remain obstacles to FDI spillover for some firms. Local firms with technology gap in average level has benefited from FDI productivity spillover. This study also finds evidences on channels through which the horizontal spillover effect occurs to domestic firm. It occurs through demonstration and competition effects. In other word, this can explain us that both demonstration effect and competition effect are the determinants for the existence of horizontal spillover effect. The result also indicates that FDI has positive and significant role in an improvement of domestic firm productivity by generating backward linkage in the Ethiopian manufacturing sector.

Finally, we can comprehend from the finding of this study that productivity spillover from FDI to domestic firms in manufacturing firms of Ethiopia is dependent on the level of technological gap. The competition and demonstration effects and supply related technology transfer are the channels through which horizontal and vertical spillover effects are occurring, respectively.

These empirical findings have significant role for policy makers to design strategy which enables to minimize the technology gap between the foreign and domestic firms to maximize the positive impact of FDI in domestic firms via productivity spillover effect. The result shows that the spillover effects in all firms are not equal, so that the policy maker has recommended to give priority for the more promising firms in 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

Supplementary Information

Acknowledgements

I would like to show my warm thanks to the Central Statistical Agency for the contribution in survey data delivery.

Authors' contributions

Not applicable.

Funding

The author has not received funding from any sources for this research.

Availability of data and materials

The datasets used and/or analyzed during the current study is available in the attached supplementary materials.

Declarations

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.

Competing interests

The author ensures that there are no conflicts of interests concerning the publication of this article.

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