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Impact of FDI spillovers on productivity in Nigeria: Evidence from manufacturing sector

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Abstract
This study examines the impact of FDI spillovers on productivity of firms in the manufacturing sector in Nigeria. While there are numerous studies focusing on the direct impact of FDI in Nigeria, only very few studies have investigated the spillover effects of FDI on productivity. The study uses firm level panel survey data obtained from the World Bank's Enterprise Survey. The techniques of analysis used are pooled OLS, random effects and generalised method of moments (GMM). Our results show that there is presence of significant FDI spillover effects in the manufacturing sector in Nigeria. We find positive and significant impact of FDI spillovers through the horizontal and forward channels while backward FDI spillover has a negative and significant impact on productivity. While the result of horizontal and forward spillovers can be attributed to the competitiveness of local firms and quality of inputs from foreign owned suppliers respectively, the negative backward spillover may be due to poor transportation networks and low absorptive capacity of local suppliers. We recommend that for domestic firms to benefit from their foreign customers in the downstream sector, there must be improved infrastructure especially transportation networks and local firms have to upgrade their capacity in terms of education.

Keywords: FDI spillover, horizontal spillover, backward spillover, forward spillover, productivity, manufacturing sector, Nigeria

Introduction
Foreign direct investment (FDI) has been regarded as an essential channel of transferring capital, technologies, ideas, know-how and good management practices from developed to developing countries to boost productivity and economic growth (Aitken & Harrison, 1999; Javorcik, 2004; Sinani & Meyer, 2004, Wang & Blomström, 1992) [1, 18, 19, 30-32]. FDI is considered a less volatile source of capital inflow and a carrier of large, mostly positive externalities because the technologies being transferred have a feature of public goods where their use by others may be difficult to prevent (Wang & Blomström, 1992; Liu, 2008; Hadded & Harrison, 1993) [17, 31, 32].
The effects of FDI in the host country are both direct and indirect. FDI can affect the host country directly through revenue generation to the host country's government in the form of tax, generation of employment, increasing export and increasing the gross domestic product (GDP) of the host country. The indirect effects occur through the horizontal, backward and forward spillover effects on the productivity and innovation of firms that foreign subsidiaries generate in the host country. The horizontal spillover effects occur when foreign subsidiaries operate in the same industries with domestic firms. Backward spillover effects occur due to the linkages between foreign subsidiaries and their domestic suppliers of intermediate inputs. The forward spillover effects occur as a result of the linkages between domestic firms and their suppliers of intermediate inputs (Crespo & Fontoura, 2007; Djankov & Hoekman, 2000; Javorcik, 2004; Lenaerts & Merlevede, 2011, 2015; Sinani & Meyer, 2004; Saggi, 2002) [8, 9, 18, 19, 20-25, 28, 30].
The Nigerian government over the past few decades has provided numerous incentives [1] to both foreign and domestic investors in Nigeria and because of this the country began to experience huge FDI inflows making it one of the leading FDI recipients in Africa.

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[1] See NIPC Investors' Guide to Nigeria, 7th edition 2014 for detail of investment incentives in Nigeria.

Nigeria is also the third host economy for FDI in the African continent, after Egypt and Ethiopia, with the FDI stock of $89.7 billion, $94.2 billion, $97.7 billion and $99.6 billion in 2015, 2016, 2017 and 2018 respectively (UNCTAD, 2018). These total FDI stocks represent about 18.2 percent, 23.2 percent, 24.4 percent and 25.1 percent of the Nigeria's GDP, with most of the investors originating from the USA, China, United Kingdom, the Netherlands and France (UNCTAD, 2018).

Despite the presence of multinational investors in Nigeria, to our knowledge, no study has examined the spillover effects of FDI on productivity of local firms by combining the horizontal, backward and forward channels. Therefore, the aim of this study is to examine the impact of FDI spillovers on productivity of local firms in the manufacturing sector in Nigeria through the horizontal, backward and forward channels. This study is the first to employ the World Bank's Enterprise Survey firm level data to examine the impact of FDI spillovers on productivity of firms in Nigeria. The organisation of this study starts with the introduction, review of literature, review of empirical studies, data, model specification, results and discussion as well as conclusion.

Review of literature

The effect of FDI on productivity of domestic firms takes the indirect form through the horizontal, backward and forward spillovers resulting from domestic interactions and linkages. According to Helpman (2006) [16], FDI spillovers have been traditionally classified based on horizontal and vertical effects. The horizontal FDI tends to serve domestic market whereas vertical FDI consists of foreign subsidiaries that add value which may not necessarily target the local market. The vertical linkage is further divided into backward – between local suppliers of inputs and foreign affiliates and forward – between foreign affiliates and their domestic customers.

It has been argued that technology and knowledge transfer will rapidly take place if foreign subsidiaries establish upstream and downstream networks because local firms engaged in supply and distribution chains gain from exposure to new technology (Görg & Greenaway, 2004; Görg, 2002) [12]. Similarly, according to Grossman and Helpman (1990) [16], productivity relies on the stock of capital knowledge which includes scientific, engineering and industrial know-how in the domestic economy. This stock of knowledge capital in the economy can be increased with the degree of interactions between domestic firms and multinational enterprises. As these interactions increase with commercial exchange between the two, so does the productivity of domestic firms.

Seyoum et al., (2015) [29] noted that FDI influences the productivity and competitiveness of host-country economic activities at least for two reasons. The first reason is that multinational enterprises bring superior productive assets such as technological know-how, managerial and entrepreneurial skills as well as marketing techniques to the host country. Secondly, they are full of potentials for possible spillovers of technology transfer which affect the productivity and innovation of domestic firms, especially when the foreign firms cannot fully internalize all quasi-rents resulting from their productive economic activities.

Accordingly, a theoretical model by Helpman (2006) [16] shows that technological adoption can influence firm's productivity. The model divides technology into advanced and traditional. After learning about the technology introduced by foreign entry, a firm can choose to use advanced or traditional technology. While the advanced technology requires higher fixed costs, it has the advantage of lower variable costs. Helpman demonstrates that only the most productive firms use the advanced technology to serve both domestic and international markets while the unproductive firms exit. The firms in between – firms with intermediate productivity use the traditional technology and serve only the domestic market.

Crespo and Fontoura (2007) [8] provide a summary of five channels through which foreign technology can be diffused among the domestic firms. (i) demonstration or imitation, (ii) mobility of labour from foreign firms to domestic firms, (iii) exportation, (iv) competition and finally (v) backward and forward linkages with domestic firms.

Horizontal FDI spillover provides a channel for both foreign-owned multinationals and domestic firms to interact in the same industry or sector which may impact the productivity of local firms. According to Javorcik (2007) [18, 19], there are many channels through which horizontal FDI spillover can affect domestic firms. The most pronounced channel is technology or knowledge diffusion through demonstration effect, imitation and labour turnovers (Crespo et al. 2009; Wang & Blomstrom 1992) [8, 31, 32]. Görg and Greenway (2004) also stress that domestic firms learn from multinationals in their sector through imitation of new products or processes, management and organisational practices. This medium becomes more relevant and effective with the increase in the similarities of products made by both foreign and domestic-owned firms (Barrios, Gorge & Strobl 2005; Javorcik, 2007) [5, 18, 19].

Another important channel of horizontal linkages is the competition effect as a result of the foreign presence in the same industry. Competition brought by multinationals in the industry may positively or negatively affect the productivity of domestic firms depending on their technological and management strengths and the ability of foreign firms to prevent technology leakage (Blomstrom & Kokko, 1998; Crespo & Fontoura, 2007, Lenaerts & Merlevede, 2011) [8, 20-25, 31, 32]. In this regard, Crescenzi, Gagliardi and Iammarino (2015) [7] argue that tougher competition is associated with productivity-enhancing externalities resulting from the entry of foreign firms which forces domestic firms to employ new technologies as well as best organisational and management practices to enable them compete with the foreign firms.

Backward spillover is the transfer of knowledge from foreign subsidiaries to their local suppliers of inputs has received a great deal of attention in the literature and there is consensus that this channel generates positive productivity spillovers (Javorcik, 2004; Javorcik, 2007) [18, 19]. As noted by Barrios et al. (2011) [5], various theoretical contributions indicate that backward linkage is another important channel of technology and knowledge transfer because it benefits local firms that operate in sectors supplying intermediate inputs to foreign subsidiaries.

It has been argued that because multinational enterprises (MNEs) tend to benefit from high quality inputs from their local suppliers, they usually provide training and assistance to their domestic suppliers and many foreign affiliates play an important role in actively helping their suppliers to enhance quality and efficiency (Barrios et al., 2011; Moran,

2001; Zhang, 2019) [5, 26, 33]. Zhang (2019) [33] stresses that in most cases, backward spillover effects occur due to the intentional assistance offered to domestic suppliers through the provision of technology and training by their multinational customers.

Zhang (2019) [33] notes that the productivity effects of FDI spillover can equally run through the high quality of material inputs supplied by foreign subsidiaries to their domestic customers. Moreover, some of the equipment supplied by foreign affiliates to their domestic customers require additional instructions on how to use, it may also require the technical assistance of the multinational firms for installations and initial operations. The knowledge so acquired in this process can facilitate the efficiency of domestic firms, as well as improve their innovations and productivity.

Review of empirical studies
Empirical studies on the effect of FDI on host countries are numerous and different conclusions have been reached despite the theoretical propositions regarding the benefits of FDI spillovers (Hale & Long, 2011; Javorcik, 2004; Liu, 2008; Haddad & Harrison, 1993; Wang & Xie, 2016) [15, 17-19, 31, 32].

Several empirical studies that employ different methodologies tend to provide evidence in support of positive backward spillover effects – positive productivity spillovers taking place through contacts between foreign subsidiaries and their domestic suppliers of intermediate inputs in upstream sectors. Javorcik (2004) [18, 19] is one of the earlier studies to investigate the FDI productivity spillovers and show such positive backward spillovers in the case of Lithuanian firms.

Hale and Long (2011) [15] attribute the mixed FDI spillover results in the literature on failure to account for endogeneity and therefore examine the spillover effect of FDI on the domestic firms in China find no evidence of positive productivity. Liu (2008) [17] argues that such differences could be due to firm or industry differences. The author also finds a negative effect of foreign share participation after controlling for industry and firm-specific effects.

In more recent studies, Anwar and Sun (2018) [3] contributed by examining the relationship between FDI and export quality upgrading in China's manufacturing sector and find a positive correlation after accounting for firm heterogeneity using Melitz-type theoretical model. Differentiating the effect of FDI based on their sources, the authors find that foreign firms originating from Hon Kong, Macao and Taiwan regions leads to much greater improvement in quality of China's export. This may be explained in terms of moderate technology gaps between China and these countries and possibly good investment climate which have not been captured and may have facilitated the absorptive capacity of the export oriented domestic firms.

Similarly, Lenaerts and Merlevede (2011, 2015, 2016 and 2017) [20-25] contribute to the FDI spillover literature by examining the spillovers from various perspectives. Using Romanian firm-level panel data, their results provide some important points worthy of note on the differences that exist in the literature by estimating different specifications taking into account different factors. They find vertical spillovers as the level of industry aggregation declines while horizontal spillovers appear to take place at the higher level of industry aggregation. Three important points have become clear from the study of Lenaerts and Merlevede using Romanian firm-level panel data: (i) there is evidence of positive horizontal spillover effects in three out of four cases unlike in the case of Lithuania, Czech Republic, Latvia and Portugal (Javorcik, 2004; Javorcik, 2006; Crespo et al., 2008) [8, 18, 19]; (ii) there is strong evidence of greater positive backward spillovers across size, industry aggregation, ownership structure and quality of FDI; (iii) in all cases there is poor connection between foreign suppliers of intermediate inputs and domestic firms customers as evidenced by the negative forward spillover effects.

Gorg and Seric (2015) employ [6, 9, 13] the cross-sectional data to examine the linkages between multinational enterprises and the performance of domestic firms in 19 Sub-Saharan African countries and find that independent of any assistance, forward linkages lead to positive labour productivity of domestic firms thereby supporting the previous findings of Amendolagine et al. (2013) [2]. Blanas, Seric and Viegelahn (2017) [6, 9, 13] use firm-level data from African countries to examine the differences in the quantity and quality of jobs offered by both foreign subsidiaries and domestic firms and find that foreign subsidiaries, especially those serving the domestic market and export-oriented firms offer more stable and secure jobs than local firms. Their result has two important implications for technology and knowledge spillovers through labour movements. Firstly, the higher training provided by foreign subsidiaries to locally sourced workers is a good indication that labour moving from foreign to domestic firms either to establish their own or work for other indigenous firms, can lead to increase in productivity of domestic firms if the knowledge is well implemented. Secondly, the fact that foreign subsidiaries offer more stable and secure jobs and pay higher wages to workers means that they can easily attract the most productive workers from domestic firms thereby negatively affecting the productivity and innovation of local firms.

In the case of Nigeria, studies of the effect of FDI spillovers on productivity of domestic firms are very scanty. The few available studies in this area (Dutse, 2012; Ayanwale & Bamire, 2004; Onyekwena, 2012) [4, 10, 27] appear to accord less importance to the channels of FDI spillovers and the standard methodology in the construction of these variables – horizontal, backward and forward spillovers. For example, Dutse (2012) [10] examines the technology spillovers in the manufacturing sector in Nigeria. The study examines the technology capabilities and FDI-related spillovers in manufacturing industries using survey data obtained based on questionnaires designed by the researcher. Ayanwale and Bamire (2004) [4] also find a positive FDI spillover effects on the productivity of domestic firms but the case of agro allied industries and does not clearly show the linkages. Nevertheless, Onyekwena (2012) [27] examines the impact of FDI on manufacturing firms and banks in Nigeria by considering only the horizontal channel due mainly to unavailability of data.

Data
We use panel survey data to examine the spillover effects of FDI on productivity of firms in the manufacturing sector. The data for the analysis were obtained from the World Bank's Enterprise Survey collected on manufacturing firms in Nigeria in 2007, 2009 and 2014 in the formal private

sector. Stratified random sampling method was used to select the sample firms across all the six geo-political zones in Nigeria and structured questionnaires were administered through face-to-face interview with the employees and managers of the organisations. The survey covers different sizes of the manufacturing firms such as micro, small, medium and large firms in different industries. We excluded micro firms from the analysis because of limited interactions between micro firms and multinational enterprises. Small firms are those with employees ranging from 5 to 20. Firms with employees ranging between 20 and 99 are considered as medium while large firms have employees above 99 as defined by the Enterprise Survey. This study adopts the methodology employed by Javorcik (2004) [18, 19] to construct FDI spillover variables using the

$$\log(LP)_{ijrt} = \beta_0 + \beta_1 \log(hz)_{ijrt} + \beta_2 \log(bw)_{ijrt} + \beta_3 \log(fw)_{ijrt} + +\beta_4 \log(Z)_{ijrt} + \omega_i + \vartheta_j + \eta_t + - - - - -(1)$$

Where LP is the labour productivity of a firm, hz, bw and fw are horizontal[2], backward and forward spillovers respectively. $\omega_i \ and \ \vartheta_j$ capture the unobserved firm and industry heterogeneity effects whereas u is the stochastic disturbance term which represents the unobserved factors that affect the productivity of domestic firms. Labour productivity is the ratio of output over labour where total annual sales are used to represent output and total workers (production and nonproduction) have been used to denote labour. z is an n x k matrix of control variables used in the analysis.

Results and Discussion

We start estimating the spillover effects of FDI on productivity of local firms by regressing the spillover variables on the productivity of firms using pooled OLS accounting for many other factors that could affect productivity. The pooled OLS enables us to use a large sample size and get more precise estimates and test statistics with more power. In order to account for the fact that the population may have different distributions in different time periods, we allow the intercept to vary across years by including dummy variables for all but one year using 2007 as the base year. The pooled OLS estimates for the effect of FDI spillovers on the productivity of manufacturing firms in Nigeria are presented in column 1 of table 1. Even though it is argued that pooled OLS does not pose serious estimation complications, the nature of data employed may be associated with heterogeneity among firms and endogeneity between productivity of firms and FDI spillovers which may bias the pooled OLS. We included dummy variables for industry and region to account for the possibility of such heterogeneity in the pooled data, and also used panel data with more suitable methods namely random effects and the generalised method of moments (GMM) estimators.

The choice of the random effects estimator is informed by the Hausman Test (see result at the appendix) and it has been shown that random effects estimator is generally more efficient than pooled OLS. Based on the Hausman test result, it is established that the unobserved effect is uncorrelated with the explanatory variables in all time periods and therefore applying random effects estimator

recent supply and use (SUT) table of Nigeria which was computed in 2010. This dataset appears to be the only most recent and available that is relevant for our study. After data cleaning, 2,165 firms were used for the estimation. We use pooled ordinary least squares (OLS), random effects (RE) and generalised method of moments (GMM) techniques for the estimation of the data. The possibility of heterogeneity among firms has been adequately corrected by including the industry/firm and size dummies.

Model specification

The estimated econometric model is built based on the Cobb-Douglas function and following the conventional specification of FDI spillover model adapted from Javorcik (2004) [18, 19] with little modification as given in equation 1

provides consistent estimates of the parameters.

The estimates of the random effects model in column 2 shows that the coefficient on foreign shares is positive (0.19) and statistically significant at 1 percent level of significance. This means that there is a strong statistical evidence to support that FDI has a positive effect on productivity. The result shows that firms with foreign shares are more productive than domestic firms and the size of the effect is large as their productivity is higher by 19 percent. The coefficients on the foreign shares are not significant for both the pooled OLS and GMM estimators in column1 and column 3.

Table 1: Results of FDI spill over effect on productivity of firms in Nigeria

	Pooled OLS	Random effects	GMM
Dependent variable: Productivity (Log of value added per worker)			
	(1)	**(2)**	**(3)**
Constant	-0.264 (2.877)	14.085 (8.716)	-15.252 (11.426)
Foreign Share (FDI)	0. 106 (0.109)	0.191*** (0.029)	0.146 (0.521)
Horizontal FDI spillover	0.501*** (0.022)	0.540*** (0.096)	0.487*** (0.109
Backward FDI spillover	-0.359*** (0.033	-0.220*** (0.026	-0.395** (0.169
Forward FDI spillover	0.337*** (0.022)	0.190** (0.071)	0.434** (0.231
Log of wages per worker	0.416*** (0.020)	0.469*** (0.015)	0.557*** (0.107
Technology	0.110*** (0.029)	-0.026 (0.031)	0.567 (0.409)
Exporting firms	0.006 (0.087)	-0.001 (0.002)	-0.078* (0.046)
Southern region	0.024 (0.018)	0.041 (0.033)	0.335* (0.163)
Experience	0.002* (0.001)	0.003*** (0.001)	0.003** (0.001
Education	0.067** (0.001)	-0.003 (0.060)	
Hours work per week	-0.0003 (0.0006)	-0.001 (0.002)	0.002 (0.003)
Capacity utilization	0.001 (0.001)	-0.0004 (0.0004)	0.001 (0.002)
Firm's age	0.003** (0.001)	0.006 (0.004)	0.004 (0.006)
Industry effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
Size effects	Yes	Yes	Yes
Observations	2,542	363	355
R²	0.76	0.81	

Note: *, **, and *** signify significant level at 10%, 5% and 1% respectively. Robust and cluster standard errors have been used to avoid heteroskedasticity and serial correlation

The results in column 1-3 for the pooled OLS, RE and GMM respectively show that the coefficients on the horizontal FDI spillover are positive (0.501, 0.540, and 0.487) and statistically significant at 1 percent level of significance. This is an indication that horizontal FD spillover increases the productivity of local firms in the

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[2] See Javorcik (2004) for comprehensive procedures on the construction of horizontal, backward and forward spillovers which were adopted in this study.

manufacturing sector in Nigeria suggesting that domestic firms operating in the same industries with foreign subsidiaries actually benefit in terms of productivity increase. In other words, the output share of foreign owned multinational enterprises significantly increases the competition in the industry and therefore forces the local firms to improve their productivity.

This finding is consistent with both theory and previous studies. The finding is particularly line with the theory of technology transfer by Wang and Blomstrom (1992) [31, 32] and Glass and Saggi (2002) [28] in which the presence of foreign multinationals in the same industry increases the competition in the sector compelling the inefficient ones to more efficiently employ existing technology or use new modern technologies in order to survive. It is also consistent with the argument that positive horizontal FDI spillovers are found in more technologically advanced sectors as well as in sectors where foreign firms operate in order to serve another market (exporting industry) in which case they are not concerned about local competition.

Our result is not surprising considering the competitive nature of some large domestic firms in the manufacturing sector in Nigeria, and as suggested in the proposed theory of technology transfer by Wang and Blomstrom (1992) [31, 32], if foreign subsidiaries face strong competition they are forced to use more advanced technology in order to gain market shares. In this situation, spillovers are expected to increase with competition in the local market which is reflected in the increasing productivity of indigenous firms.

The coefficients on the forward FDI spillover are also positive and statistically significant at 1 percent level of significance. This shows a strong statistical evidence of a positive forward FDI spillover effect on the productivity of domestic firms as indicated in table 1 for the pooled OLS, RE and GMM, indicating that domestic firms benefit by buying inputs from foreign owned firms. It shows that on average, for every 10 percent increase in the use of inputs purchased from foreign subsidiaries by domestic firms, the productivity of domestic firms increases by 3.3 percent to 4.3 percent. This is an indication that domestic buyers benefit from quality inputs and possibly training from their downstream foreign owned supplying firms. This finding is consistent with a cross-country study of linkages between domestic firms and multinationals in SSA by Gorge and Seric (2015) [6, 9, 13] in which they find evidence that buying from foreign subsidiaries in a country is positively associated with productivity of domestic firms.

However, the coefficients on the backward FDI spillover for the all the three estimators are negative and statistically significant at 1 percent level of significance. Unlike many previous studies that either find positive or zero backward FDI spillover effect, the results for all the cases in table 1 provide significantly strong evidence of a negative backward FDI spillover effect on the productivity of domestic firms signifying a decreasing productivity of domestic suppliers. The result shows that on average, increasing the backward supply chain relationship between domestic firms and their upstream foreign customers by 10 percent reduces the productivity of the local suppliers by 3.6 to about 4.0 percent, holding other factors constant.

The negative backward spillover effect is possible in the case of Nigeria especially if the entry of foreign firms stimulates a selection process through the backward linkages in the downstream supplying industries. In this case, foreign investors tend to pick the best local suppliers (companies) allowing those companies to dominate the market and crowd-out other local suppliers in the industries (Stancik, 2009). Hence, the negative backward spillover effects on productivity of domestic firms may be because the activities of the efficient and more productive domestic suppliers negatively affect the productivity of the inefficient and less productive ones, but not necessarily indicating that the presence of foreign multinationals reduces the productivity of their downstream suppliers.

Many factors may provide explanations for the presence of this significantly negative backward spillover effect. Firstly, low absorptive capacity of domestic suppliers. The technological as well as the educational levels of local suppliers in the downstream sector may be low, and this impedes on their ability to absorb new technologies and knowledge from their upstream foreign suppliers. Secondly, poor infrastructural facilities in Nigeria can be a big obstacle to backward linkages and may even lead to a significantly negative backward spillover effect. Domestic suppliers may not be able to meet with the deadline and quality set by their customers due to poor transportation system such as bad roads and inadequate railways that constitute major problems for businesses in Nigeria. Thirdly, according to Rodriguez-Clare (1996), backward linkages depend positively on transport costs (or distance) between the home and host country of foreign firms, social, cultural and legal differences. If these costs are not too high, foreign firms may have an incentive to import majority of their intermediate inputs from home country.

Conclusion

This study examines the spillover impact of FDI on productivity of firms in the manufacturing sector in Nigeria using panel firm level survey data obtained from the World Bank's Enterprise Survey. We use pooled OLS, random effects and GMM methods to estimate such impact following previous studies. The results of the analysis show that horizontal and forward FDI spillovers have a positive and statistically significant impact on productivity of local firms while backward spillover has a negative impact. Poor infrastructures especially transport networks and low absorptive capacity of local firms are the main reasons for such negative backward spillover effect. We recommend that policymakers accord priority to developing infrastructures in the country in order to maximise the benefits associated with foreign multinational enterprises. More research is needed in this area to provide a much better understanding of the spillover effects of FDI in developing countries especially in Nigeria.

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