Does the Presence of Downstream and Upstream Foreign Direct Investments Affect the Labor Productivity of Domestic Industries? The Case of the Philippine Manufacturing Sector

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With the premise that foreign direct investments (FDI) facilitate technology and knowledge transfer to domestic industries, eventually contributing to the country's sustainable economic development, the Philippine Government further liberalized its Foreign Investment Act in March 2022 to attract more foreign investors. However, recent empirical evidence showing that FDI does facilitate transfer of technology and knowledge and benefit domestic industries remains limited in the Philippines. This study, based on a balanced panel of industry-level data of manufacturing firms in the Philippines from 2010 to 2017, examines the effect of downstream and upstream FDI presence on the labor productivity of the manufacturing industries in the country. Empirical results suggest that FDI presence in the downstream industries negatively affects the labor productivity of domestic suppliers, while FDI presence in the upstream industries does not significantly affect the labor productivity of domestic final-goods producers. To reap the positive productivity benefits from FDI, the findings of this study recommend the development of policies and programs to raise the absorptive capacities of domestic industries, upgrade the local quality standards of the domestic suppliers, and strengthen the collaboration between foreign suppliers in the local market and domestic final-goods producers.

Keywords: FDI, technology and knowledge transfer, labor productivity

I. INTRODUCTION

With the aim of promoting more foreign investment in the country, the Philippine Government further liberalized its Foreign Investments Act (FIA) in March 2022 through Republic Act No. 11647. Aside from the provision of international capital, the purpose of attracting FDI lies in the Philippine Government's belief that the entry of foreign investors could facilitate the transfer of advance technologies and knowledge expertise to domestic firms and industries which might then contribute to the country's sustainable and inclusive economic growth, industry productivity and competitiveness, the promotion of consumer welfare, and increased access to global-market networks.

Given these assumptions, the FIA offers several fiscal and non-fiscal incentives to attract foreign investments, including income-tax holidays, employment of foreign nationals, and simplification of customs procedures for imported products. However, the provision of incentives to attract foreign investors may pose either positive or negative implications to existing domestic firms and industries in the country. Economic theories suggest that in order to ensure a more sustainable economic development through FDI, especially in this period of Industrial Revolution 4.0, the transfer of advance technologies and knowledge expertise to domestic firms and industries must be given utmost priority.

One of the measures to assess whether FDI facilitates technology and knowledge transfer to domestic firms and industries is the increase in labor productivity. It can be assumed that the use of advanced technologies and provision of technical assistance from foreign investors would result in increased production of higher quality products given the same amount of labor resources. Increase in labor productivity could eventually result in increases in firm income, salaries of workers and government revenue, and in lower prices of goods and services (Sprague, 2014). Moreover, higher quality products should boost firm and industry competitiveness and increase access to export markets.

Ideally, and if it is to their advantage, foreign investors transfer their technology and knowledge of management and production processes to local firms and industries firms. Foreign investors entering the domestic market mainly as customers (downstream) of intermediate inputs may intentionally transfer their technology and knowledge to their local suppliers in order for them to produce higher quality products at lower cost and meet the higher demand on time (Alcacer & Oxley, 2014; Giroud, 2007; Javorcik, 2004). In addition, foreign investors entering the domestic market mainly as suppliers (upstream) may bring advanced technologies and high-quality inputs that could result in efficient production of their local buyers (Jabbour & Mucchielli, 2007). As a strategy to market their products, foreign suppliers in the domestic market may sometimes offer technical assistance on how local buyers could attain efficient production through the use of these advanced technologies and high-quality inputs (Javorcik, 2004). On the other hand, foreign investors that enter the domestic market as final-goods producer often have intellectual-property protection to prevent leakage of their advantages in technology and knowledge to local competitors. Worse, domestic final-goods producers might not be able to cope with the new and advanced technologies and lose market share to foreign competitors. (Orlic, Hashi, & Hisarciklilar, 2018; Le & Pomfret, 2011; Gertler & Blolock, 2008; Jabbour & Mucchielli, 2007).

Due to limited empirical studies carried out for the Philippines, the evidence is weak that FDI presence in the downstream and upstream industries facilitates technology and knowledge transfer to domestic firms and industries in the country. Thus, this study aims to examine whether FDI in the downstream and upstream industries affects the labor productivity of domestic industries through technology and knowledge transfer from foreign investors. This is also to assess whether the costly incentives provided to foreign investors could translate to sustainable and inclusive economic growth of the country.

The study utilized the most recent industry-level data, from 2010 to 2017, that reflects the current situation of the Philippine manufacturing sector. This sector will be the focus of this study following the statement of the country's Department of Trade and Industry (DTI) that the manufacturing sector promotes stronger inter-industry and inter-sectoral linkages, firm productivity, technological development and innovation compared to other sectors of the economy.

Unlike most of the previous studies that make use of a single Input-Output (I-O) table to estimate FDI presence in the downstream and upstream industries, this study used annual I-O tables to account for changes in customer-supplier behavior at industry-level over time. More importantly, policy implications based from the results of this study are proposed which could serve as one of the references of the Philippine Government to attain strategic promotion of foreign investments.

The remainder of this paper is structured as follows: section II reviews the literature on FDI and domestic productivity; section III describes the data and methodology employed in the study; section IV discusses the empirical findings, policy implications, and data limitations; and finally, the last section concludes.

II. REVIEW OF RELATED LITERATURE

Policy makers in developing nations continuously strive to attract more foreign investments with the assumption that foreign firms are superior to domestic firms in terms of technology and resources (Lipsey & Sjöholm, 2005), and that interactions with foreign firms facilitate the transfer of advanced technologies to domestic industries, eventually increasing their productivity. Earlier literature accounted only for the productivity effect arising from FDI presence within the industry (horizontal effect) until Rodriguez-Clare (1996) examined the impact of FDI on domestic suppliers (backward effect) and domestic final goods producers (forward effect).

Despite the vast number of empirical studies examining the productivity effects of FDI on the host countries' domestic firms and industries, results still vary considerably. A review of literature surveys (Santos, 2017; Martin, De Piniés, & Antoine, 2015; Havranek & Irsova, 2011; Popescu, 2010; Meyer & Sinani, 2009), reveals that differences in the results may be attributed to variations in the following: how FDI presence and productivity variables are defined; causal assumptions; the type and quality of data used; the methodologies employed; as well as characteristics of the country, industry, and firm being investigated. Hence, host countries must ensure that strategic provision of costly incentives and resources to attract more foreign investments are in place and supported by strong empirical evidences.

Looking into country-specific literature, one of the most influential and most cited studies is that of Javorcik (2004), in which she examined the effect of FDI presence on the productivity of Lithuanian manufacturing firms for the period 1996 to 2000. FDI presence in the same sector, commonly termed in the literature as "horizontal" measure, was defined as the weighted average of the foreign equity capital of all firms in the sector, weights being the firm's share in sectoral output. On the other hand, FDI presence across sectors, commonly termed in the literature as "backward" and "forward" measures, was defined as the weighted average of FDI presence in the downstream and upstream sectors, respectively, with weights taken from the 1996 Input-Output (I-O) Table at two-digit Nomenclature of Economic Activities (NACE) level.

The 1996 I-O table included imports of intermediate goods, although she mentioned that in the calculation of the backward measure, I-O tables that exclude imports of intermediate goods were preferrable since the interest of the study was to examine the productivity effect of downstream FDI on domestic suppliers. Moreover, she noted that the use of multiple I-O tables was ideal to account for changes in sectoral relationship across time. She also noted that inputs supplied within sectors are excluded in the calculation of the backward and forward measures since these were already captured by the horizontal variable.

The productivity variables in her study were the firm output and firm Total Factor Productivity (TFP). The estimation of the effects of FDI presence on TFP involved a two-step procedure. The first step was the estimation of TFP using the Olley-Pakes Regression, which took into account the endogeneity of input demand. The second step was the estimation of the effects of FDI presence on the firm's TFP using the Ordinary Least Squares (OLS) Regression in differences. The use of a time-differencing approach, with industry, region, and year fixed effects, accounted for any firm-, region-, and industry-specific unobservable variations.

Since the interest of her study was the productivity effects of knowledge transfer resulting from FDI presence, industry concentration and downstream demand were controlled in the study in order to isolate the productivity effects of increased competition and downstream demand arising from the entry of foreign firms. Estimation was done using the full sample of all firms and sub-sample of domestic firms (firms with less than 10% foreign-equity share).

Results of her study suggested that increase in FDI presence in the downstream industries is associated with increase in domestic suppliers' TFP. Furthermore, she also investigated whether the extent of the effect differs according to the type of foreign ownership (partially owned vs. fully-owned), industry competition (concentrated vs. competitive), and export-orientation (domestic-oriented vs. domestic-market-oriented) of the foreign firms in the downstream industries. Results suggested that only the partially-owned foreign firms are associated with the increase in domestic supplier's TFP. On the other hand, foreign firms in both levels of industry competition and in both types of export-orientation are associated with the increase in domestic supplier's TFP.

Another study is by Jabbour and Mucchielli (2007) who examined whether the linkages from FDI presence lead to TFP gains among Spanish manufacturing firms for the period 1990-2000. In their study, the weights for the calculation of the horizontal linkage was the foreign firm's share in sectoral employment. On the other hand, the weights for the backward and forward linkages for the years 1990 to 1994 observations were taken from the 1995 I-O table at the three-digit NACE level, while the weights for the 1999 to 2000 observations were taken from the 1998 I-O table. Imports of intermediate inputs are excluded in the calculation of the backward measure.

Inputs supplied within the sector are included in the calculation of the backward and forward measures. According to the authors, the high level of data aggregation in the I-O tables might capture a considerable proportion of products supplied within sectors. Further, since the horizontal measure used the foreign firm's employment share as weights, the output share within sectors was not captured by this variable.

The estimation of the effects of FDI linkages on TFP also involved a two-step procedure. The first step was the estimation of TFP using the Olley-Pakes approach. The second step was the estimation of the effect of FDI linkages on TFP using fixed-effects regression, controlling for the scale of the firm (measured by the number of employees) and industry and year effects. Since the interest of the study was the productivity effects of technology transfer from FDI presence, industry competition and downstream demand were also controlled for the same reasons as those in Javorcik's study (2004). Estimation was done in the sub-sample of domestic firms only (firms with less than 10% foreign-equity share).

Results of the estimation suggested that backward linkage with foreign firms in the downstream sectors increases the productivity of domestic suppliers, while horizontal linkage with foreign firms negatively affects the productivity of their local competitors in the same sector. The authors also investigated whether the existence of technology transfer from backward linkage with foreign firms is affected by the extent of technological gap, mode of entry of foreign firms (partially-owned vs. fully-owned), and nature of activity of the foreign firms (export-oriented vs. home-market oriented). Results suggested that backward linkage with fully-owned and export-oriented foreign firms offers greater potential for technology transfer to domestic suppliers.

On the other hand, Orlic, Hashi, and Hisarciklilar (2018) investigated the relationship between FDI presence in the manufacturing and service sectors and the TFP of domestic manufacturing firms in the Czech Republic, Estonia, Hungary, Slovakia and Slovenia for the period 2002 to 2010. The study utilized annual I-O tables at two-digit NACE level from each country. However, the authors did not mention whether imports of

intermediate products are excluded in the I-O tables used in calculation of the backward measure.

Inputs supplied within the industry are included in the calculation of backward and forward measures. The authors mentioned that in an I-O table with a high level of data aggregation, the exclusion of inputs supplied within the industry would cause the productivity spillovers at the lower level of aggregation to be captured by the horizontal measure and lead to underestimation of backward and forward measures.

The estimation of the effects of FDI presence on TFP also involved a two-step procedure. The first step was the estimation of TFP using the production function estimator proposed by Wooldridge (2009). The second step was the estimation of the effects of FDI presence on TFP using the System Generalized Method of Moments (GMM) approach, controlling for the lagged TFP, industry concentration (measured by Herfindahl-Hirschman Index (HHI)), downstream demand, human capital (measured by the average labor cost per employee), intangible assets (measured by the ratio of intangible assets to tangible fixed assets), firm age, and firm size (measured by total assets). Human capital and intangible assets were regarded as proxies for the absorptive capacity of the firm. Industry, region and year effects were also controlled in the study.

The use of System GMM approach addressed the possibility of endogeneity issues between FDI presence and TFP. Furthermore, the dynamic nature of this approach and the inclusion of the lagged TFP in the model might serve as a proxy for historical factors affecting the current level of TFP. Hence, this could address the bias from the possibility of omitted variables that should be controlled in the study. Estimation was done for each country using the sub-sample of domestic firms.

Results of the estimation suggested that the presence of foreign firms in the downstream manufacturing industries benefits the domestic suppliers in all countries, except in Estonia. On the other hand, presence of foreign firms in the upstream manufacturing industries has negative effects on the TFP of domestic final-goods producers in all countries. As for the effect of the forward measure from the service sector, results suggested that domestic manufacturing firms in the downstream industries benefit from the presence of foreign firms in upstream service industries.

In the case of the horizontal measure, results showed no positive benefits from foreign presence in the same industry. Hence, the authors investigated the possible mechanisms involved in the occurrence of horizontal spillover effect: the demonstration effect (calculated in a similar way to the horizontal measure), worker mobility (measured by the interaction of horizontal measure and human-capital variable) and competition effect (measured by HHI). The model was re-estimated to include the effects of these three mechanisms. Results suggested that worker mobility has beneficial effects on the productivity of domestic firms, however, this beneficial effect was offset by the negative demonstration and competition effects from foreign presence in the same industry.

Some studies provide evidence that the productivity benefits from FDI is costly and may take time to be absorbed by the host country, which could possibly explain studies claiming that FDI has no effect or is causing a negative productivity effect on the host country. In this regard, Liu (2008) investigated the short-run and long-run effects of FDI presence on the level and growth of the TFP of Chinese domestic manufacturing firms for the period 1995 to 1999. The study utilized the 1997 I-O table which included imports of intermediate products.

Using the endogenous growth model, Liu (2008) provided evidence that technology spillover from FDI presence might lower the short-run productivity level but could result in long-term productivity growth. Furthermore, he mentioned the implicit assumption of regression analysis: that the inclusion of the time trend variable in the model would account for the long-term growth. Hence, he assumed that the long-run productivity effect of FDI presence could be estimated by including the interaction of the time trend and FDI variables in the model. However, the downside of this approach is that short time periods may cause the coefficient of the time trend to be negative.

The estimation of the effects of FDI presence on TFP also followed the two-step procedure of previous studies. The first step was the estimation of TFP using the Olley-Pakes approach. The second step was the estimation of the short-run and long-run effects of FDI presence on TFP using fixed-effects regression, controlling for industry concentration, time trend, and individual firm-effects. A separate model was also estimated using the lagged values of FDI measures. Estimation was done using the full sample of all firms and sub-sample of domestic firms (firms without foreign-equity share).

Results of the estimation suggested that FDI presence at the same four-digit industry lowers the short-run productivity level of domestic firms, but boosts its long-run productivity growth. Results also indicated that FDI presence at the two-digit downstream industries positively affects the productivity of domestic suppliers in the long run.

Adopting the evidence from the endogenous growth model provided by Liu (2008), Fujimori and Sato (2015) also investigated the short-run and long-run effects of FDI presence on the TFP of Indian manufacturing industries from 1995 to 2004. The authors devised their own industry classification to account for the variation in the industry classification of the variables used in the study.

The horizontal measure was defined as the ratio of FDI stock to domestic capital stock in the industry. The coefficient of this variable pertains to the short-run productivity effect to domestic firms, arising from FDI presence in the same industry The backward measure was defined as the weighted average of the ratio of FDI stock to domestic capital stock in the downstream industry, with weights taken from the 1998-1999 I-O table. This variable pertains to the short-run productivity effect of downstream FDI presence to the domestic suppliers. However, it was not clearly defined whether the I-O table excluded imports of intermediate products. Javorcik (2004) emphasized that in studies attempting to measure the productivity effect of downstream FDI presence, imports of intermediate goods should be excluded.

The estimation of the effects of FDI presence on TFP also involved a two-step procedure. The first step was the estimation of TFP, adopting the method of Levinsohn and Petrin (2003). The second step was the estimation of the short-run and long-run effects of FDI presence on TFP using four types of panel data estimation: fixed effects, random effects, pooled Ordinary Least Squares (OLS), and GMM. Only the time-trend variable was controlled in all the models. The long-run effects of FDI presence were measured by including in the model the interaction of the time trend variable with the horizontal and backward measures. Moreover, a separate model was estimated using the lagged values of the horizontal and backward measures. Results from the different panel data estimations suggested that FDI presence in the downstream industries negatively affects the TFP in the short run, but positively affects the TFP in the long run.

III. DATA AND METHODOLOGY

This study utilized data from the Annual Survey of Philippine Business and Industry (ASPBI), and the Census of Philippine Business and Industry (CPBI) conducted by the Philippine Statistics Authority (PSA). The dataset constitutes a balanced panel of two-digit industry-level data of manufacturing firms with total

employment of twenty and over, for the period 2010 to 2017 (except 2011, since ASPBI was not conducted in that year). The Organisation for Economic Co-operation and Development (OECD) annual I-O tables for the Philippines from 2010 to 2017 (except 2011) were also used in this study. Industry categories in the dataset and in the OECD I-O tables are based on the International Standard Industrial Classification (ISIC), Revision No. 4.

The dataset contains industry level information on value added, total output, input cost, and end-of-year employment, tangible and intangible assets, and number study, foreign firms are defined as firms with at least 10% foreign-capital participation. This is consistent with the OECD and International of firms with foreign-capital participation. For this Monetary Fund (IMF) definition of foreign firm.

In this study, labor productivity is defined by the ratio of gross value added of the current year, deflated by the implicit price index for gross value added in manufacturing, per total number of workers in the previous year-end. FDI presence in the industry is defined as the share of foreign firms in number. Although the common practice in the literature is to make use of the share of foreign firms in output or in employment, this is not possible with industry-level data due to limitations on firm-level information.

To measure FDI presence in the downstream and upstream industries, the common practice in the literature of using the transactions from the I-O tables was adopted. FDI presence in the downstream and upstream industries are defined as the weighted average of the share of foreign firms in the sourcing and supplying sectors, defined respectively as follows:

$$fdi\_downstream_{jt} = \sum_{for\ all\ k} fdi_{kt} * \alpha_{jkt}$$

Where:

fdi_{kt} is the share of foreign firms in industry *k* at year *t;* and

α_{jkt} is the share of industry *j* output that is supplied to industry *k* at year *t*. This value is taken from the I-O table for the year *t.*

$$fdi\_upstream_{jt} = \sum_{for\ all\ k} fdi_{kt} * \alpha_{kjt}$$

Where:

fdi_{kt} is the share of foreign firms in industry *k* at year *t*; and

α_{kjt} is the share of industry *j* inputs purchased from industry *k* at year *t*. This value is taken from the I-O table for the year *t*.

In the calculation of FDI presence in the downstream and upstream industries, Javorcik (2004) excluded inputs supplied within the industry (the case when *k=j*). However, due to the high level of industry aggregation in the OECD I-O tables, a considerable proportion of inputs supplied within the industry, occurring at lower levels of aggregation, will not be captured if we exclude inputs supplied within the industry in the calculation of $fdi\_downstream_{jt}$ and $fdi\_upstream_{jt}$. This is also the same approach considered by Orlic, et. al. (2018) and Jabbour and Mucchielli (2007).

To determine whether FDI presence in the downstream and upstream industries affects labor productivity, the following baseline model is estimated:

$$log(lprod)_{jt} = \beta_0 + \beta_1 log(lprod)_{j,t-1} + \beta_2 fdi\_presence_{jt} + \beta_3 controls_{jt} + \theta_j + \theta_t + \varepsilon_{jt}$$

Where $log(lprod)_{jt}$ is defined as the logarithm of labor productivity of industry *j* at year *t*; $fdi\_presence_{jt}$ is a vector of the measures of FDI presence in the downstream and upstream industries; $controls_{jt}$ is a vector of control variables; θ_j denotes individual industry effects; θ_t denotes time effects; and ε_{jt} denotes the error term. The lagged of labor productivity is also included in the model to serve as a proxy for unobservable historical factors affecting the current level of labor productivity in the industry.

Upon reviewing the literature, the most common control variables in the estimation were found to be capital intensity, absorptive capacity, downstream demand, and FDI presence within the industry. In this study, the control variables are defined as follows:

$fdi\_industry_{jt}$ – measures the foreign presence within the industry and is defined as the share of foreign firms in industry *j* at year *t*;

$log\ (capint)_{j,t-1}$ – measures the capital intensity of the industry, and is defined as the book value of tangible fixed assets at end-of-year *t-1*, deflated by the implicit price index for gross fixed-capital formation, per total number of employees at end-of-year *t-1*.

$intangibles_{j,t-1}$ – proxy for the industry's absorptive capacity, defined as ratio of the book value of intangible assets at end-of-year *t-1* to the book value of tangible fixed assets at end-of-year *t-1*. Intangible assets include research and development, computer software and databases, purchased goodwill, patents, trademarks, franchises, licenses, processes, and copyrights;

$log\ (demand)_{jt} = \sum_{for\ all\ k}\ \alpha_{jkt} * y_{kt}$

This variable measures the demand for intermediate inputs in the downstream industries and is controlled in the model to isolate the productivity effect of increased demand due to entry of foreign firms in the downstream industry. α_{jkt} represents the share of industry *j* output needed to produce one unit of industry *k* output at time *t*, computed using the I-O table at year *t* and excluding imports of intermediate inputs. y_{kt} represents the value of output of industry *k*, deflated by the producer price index, at year *t*.

Lastly, System GMM was used in the analysis to take into account the dynamic nature of the dataset and the model.

IV. RESULTS AND DISCUSSION

Table 8 reports the results of the estimation using one-step System GMM on the sample of manufacturing industries at the two-digit level. All model specifications satisfy the GMM assumptions of instruments' validity and no second-order serial autocorrelation.[1]

Table 8. Estimation results

Y = ln(labor productivity)	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
fdi_downstream	-1.1484** (0.3918)		-1.2401*** (0.3987)	-1.2601** (0.5902)	-1.1160 (0.7996)
fdi_upstream		-0.2049 (1.2771)	-1.0431 (1.5738)		-1.1210 (1.8361)
fdi_own industry	0.1799 (0.2087)	0.1042 (0.2507)	0.3726 (0.3216)	0.2027 (0.2453)	0.3634 (0.3111)
ln(capital intensity)	0.2021** (0.0690)	0.1961** (0.0681)	0.1999*** (0.0656)	0.2050*** (0.0696)	0.2023*** (0.0663)
intangibles	1.8844* (1.0081)	1.7420* (0.9712)	1.9140* (1.0349)	1.8522* (1.0509)	2.0065* (1.1219)
ln(demand)				0.0141 (0.0691)	-0.0187 (0.1031)
ln(labor productivity) lagged	0.6308*** (0.1363)	0.6893*** (0.1306)	0.6073*** (0.1458)	0.6233*** (0.1389)	0.6048*** (0.1465)
constant	2.5115** (1.0078)	1.6373 (1.0160)	2.9228** (1.3304)	2.2187 (1.9278)	3.4019 (3.1988)
year effects	Yes	Yes	Yes	Yes	Yes
No. of observations	85	85	85	85	85
No. of instruments	12	12	13	13	14
Hansen test	0.24	0.351	0.28	0.252	0.278
AR(2)	0.131	0.136	0.133	0.132	0.133

Robust standard errors in parenthesis
**** significant at 1% level, ** significant at 5% level, * significant at 10% level*

The coefficients of the Hansen test of instruments' validity and the AR(2) test of no second-order serial autocorrelation suggest that the models are correctly specified.

Results suggest that FDI presence in the downstream industries negatively affects the labor productivity of the local suppliers. It is possible that the standards required by foreign firms are of too high quality for local suppliers to meet, and technical specifications are constantly changing, necessitating continual upgrading of the production processes.

However, due to weak absorptive capacity of the local manufacturing industries – as evident in the low intangible-to-tangible-asset ratios of the industries in Table 2 – domestic suppliers may have difficulty to meet the quality and quantity requirements on time. Hence, foreign customers may find importing of intermediate inputs a more cost-efficient strategy to ensure high-quality and on-time delivery of products, than to transfer their technology and provide constant technical assistance to local suppliers. Such a situation is possible since the FIA allows tax-and-duty-free importation of spare parts and intermediate inputs for foreign firms registered under the Philippine Board of Investments (BOI), Philippine Economic Zone Authority (PEZA), Subic Bay Metropolitan Authority (SBMA), and Clark Development Corporation (CDC). Importation of intermediate inputs were also seen to be the reason for the negative or non-significant effects of downstream FDI presence on the productivity of domestic suppliers in the studies of Negara and Adam (2012) and Riesta (2019).

Once foreign investors acquire at least 10% of a firm's equity capital, it is possible that domestic firms previously sourcing their intermediate inputs locally may then be required to import due to the higher quality and constantly changing technological requirements of their foreign investors. Hence, such a situation could result in lower revenue for domestic suppliers and would be reflected as a decline in their productivity (Girma, Gorg, & Pisu, 2008). As evident in Table 2, industries with the highest share of imported inputs are also those with high technological requirements (per ISIC technological intensity)[2], such as ISIC 26 (manufacture of computer, electronic and optical equipment), ISIC 27 (manufacture of electrical equipment), and ISIC 29 (manufacture of motor vehicles, trailers and semi-trailers).

Export-orientation of the foreign investors may also influence their decision to import their intermediate inputs. It is possible that foreign firms engaged in global production networks rely on their parent company's sourcing policies to ensure the quality of their products. This is also one of the hypotheses examined in the literature, as in the study of Javorcik (2004) and Jabbour and Muchhielli (2007). Table 2 shows that industries with the highest share of foreign presence, such as ISIC 26 (manufacture of computer, electronic and optical equipment), ISIC 29 (manufacture of motor vehicles, trailers and semi-trailers), and ISIC 27 (manufacture of electrical equipment), are also among the top exporting industries, and among those with the highest share of imported inputs. Hence, it can be observed that foreign investors in high-technology industries were export-oriented and high on imports, resulting in low value-added for these industries. This is also consistent with the findings of Aldaba and Aldaba (2010).

This negative result is contrary to most studies in the literature which have suggested that FDI presence in the downstream industries positively affects the productivity of domestic suppliers, either through technology and knowledge transfer and/or increase in the demand for intermediate inputs (Orlic, et. al., 2018; Newman, et. al., 2015; Javorcik & Spatareanu, 2008; Jabbour & Mucchielli, 2007; Kugler, 2006; Bwalya, 2006; Reganati & Sica, 2005; Javorcik, 2004).

On the other hand, the literature does not provide a clear conclusion on the effect of FDI presence in the upstream industries. In this study, results of GMM estimation suggest that FDI presence in the upstream industries does not significantly affect the labor productivity of the sourcing industries. This may also be attributed to the weak capacity of the industries to immediately absorb and maximize the benefits of the advanced technologies and high-quality inputs from foreign suppliers in the domestic market. Export orientation of foreign suppliers may also influence this result. Since export-oriented foreign suppliers are primarily concerned with producing goods that satisfy the technological and input requirements of the international market, requirements of the domestic market are often neglected. Hence, domestic industries sourcing inputs from export-oriented foreign suppliers may have difficulty in integrating the advanced technologies and inputs to their production processes since they do not match their technological and input requirements.

It is also possible that downstream industries sourcing advanced technologies and inputs from foreign suppliers experience inferior buying conditions. As shown in Table 2, an example could be ISIC 29 (manufacture of motor vehicles, trailers and semi-trailers), the industry with the highest upstream FDI presence but also with the lowest average ratio of value-added per intermediate input cost. Aside from the weak absorptive capacity, inferior buying conditions may also result when foreign suppliers gain market share in the upstream industries, and may have the ability to impose a high markup price of inputs (Newman et. al., 2015).

These non-beneficial effects of FDI presence in the downstream and upstream industries may also be due to the fact that there is limited room for technology and knowledge transfer, as evident in the stagnant amount of downstream and upstream FDI shown in Tables 6 and 7.

The low absorptive capacity of the industries may also explain why technology and knowledge transfers from foreign firms present within the industry were not able to significantly increase the labor productivity of the industry in general.

Robustness Checks

It is also possible that the benefits of FDI may take time to be absorbed by the industries. Hence, the baseline model was also estimated using one-year lagged values of FDI presence within the industry and FDI presence in the downstream and upstream industries. Table 9 shows the results of the estimation using lagged FDI variables.

Table 9. Robustness check: using lagged FDI variables

Y = ln(labor productivity)	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
fdi_downstream (lagged)	-1.1357** (0.3906)		-1.2171*** (0.3840)	-1.2722** (0.5695)	-1.1454 (0.7602)
fdi_upstream (lagged)		-0.1643 (1.3892)	-0.9592 (1.6380)		-1.0033 (1.8758)
fdi_own industry (lagged)	0.1881 (0.1995)	0.0988 (0.2468)	0.3691 (0.3198)	0.2149 (0.2317)	0.3636 (0.3046)
ln(capital intensity)	0.1985*** (0.0667)	0.1894** (0.0673)	0.1940*** (0.0635)	0.1999*** (0.0671)	0.1955*** (0.0642)
intangibles	1.8851* (0.9662)	1.6984* (0.9268)	1.8944* (0.9754)	1.8282* (1.0259)	1.9480* (1.0701)
ln(demand)				0.0180 (0.0640)	-0.0109 (0.0962)
ln(labor productivity) lagged	0.6366*** (0.1325)	0.6999*** (0.1263)	0.6169*** (0.1391)	0.6307*** (0.1336)	0.6152*** (0.1388)
constant	2.4061** (0.9818)	1.5077 (0.9741)	2.7926* (1.3163)	2.0107 (1.8578)	3.0744 (3.0841)
year effects	Yes	Yes	Yes	Yes	Yes
No. of observations	85	85	85	85	85
No. of instruments	12	12	13	13	14
Hansen test	0.213	0.298	0.23	0.224	0.235
AR(2)	0.135	0.136	0.134	0.139	0.136

Robust standard errors in parenthesis
**** significant at 1% level, ** significant at 5% level, * significant at 10% level*

Moreover, to examine the assumption of previous studies to exclude inputs supplied within the industry in the calculation of downstream and upstream FDI measures, Table 10 shows the results of the analysis.

Table 10. Robustness check: inputs supplied within the industry are excluded in the estimation of *fdi_dowsntream* and *fdi_upstream*

Y = ln(labor productivity)	Model 1	Model 2	Model 3	Model 4	Model 5
fdi_downstream	-1.0194** (0.4709)		-1.1118** (0.4493)	-0.1862 (0.5095)	-0.3917 (0.7248)
fdi_upstream		0.3785 (0.9099)	0.8155 (0.8204)		0.5996 (0.8465)
fdi_own industry	0.0109 (0.2128)	0.0187 (0.1651)	-0.1041 (0.1539)	-0.1465 (0.2360)	-0.2050 (0.2006)
ln(capital intensity)	0.1935** (0.0696)	0.2023** (0.0718)	0.2013** (0.0724)	0.1907** (0.0708)	0.1985** (0.0730)
intangibles	1.6508 (0.9637)	1.7897* (0.9918)	1.7235* (0.9766)	1.2937 (0.9821)	1.4151 (0.9900)
ln(demand)				-0.1261 (0.1182)	-0.1061 (0.1302)
labor productivity (lagged)	0.6652*** (0.1293)	0.6897*** (0.1304)	0.6620*** (0.1349)	0.6623*** (0.1338)	0.6577*** (0.1390)
constant	2.1487** (0.9073)	1.5262 (0.9050)	2.0798** (0.9534)	5.4112 (3.7434)	4.8576 (4.1401)
year effects	Yes	Yes	Yes	Yes	Yes
No. of observations	85	85	85	85	85
No. of instruments	12	12	13	13	14
Hansen test	0.351	0.312	0.268	0.32	0.268
AR(2)	0.133	0.133	0.13	0.137	0.133

Robust standard errors in parenthesis
**** significant at 1% level, ** significant at 5% level, * significant at 10% level*

Policy Implications

Results of the estimation suggest that in order to acquire the beneficial productivity effects of technology and knowledge transfer resulting from FDI presence in the downstream and upstream industries, priority should be given to strengthening the absorptive capacity of domestic firms and industries. Development of programs that will upgrade local quality standards to conform with global standards and requirements may strengthen the confidence of downstream foreign investors to facilitate technology transfer and prioritize local sourcing.

The government may also need to revisit the tax incentives given to downstream foreign investors in relation to imports of intermediate goods. Instead of providing tax- and duty-free importation of spare parts and intermediate inputs, the government may consider fiscal and non-fiscal incentives for foreign investors to engage in technology and knowledge transfer and in local sourcing of intermediate inputs. This will ensure both parties benefit equally in the long run.

Furthermore, development of policies and programs to strengthen collaboration between upstream foreign investors and downstream domestic industries is necessary. This is to ensure that the technological and input requirements of the domestic market are met and sold at reasonable prices.

Lastly, development of a monitoring and evaluation framework on the efficiency of these programs is suggested to ensure sustainable, inclusive, and strategic promotion of foreign investments.

Limitations of the study

Limitations on firm-level information constrain the study from examining more accurately whether FDI presence affects the productivity of domestic firms and industries. High data aggregation at industry-level is a possible cause of the small variation in the variables used in this study and may have influenced the results. Furthermore, identification of the actual volume of domestic firms' intermediate inputs supplied to and purchased from foreign firms, and whether the former received direct technology transfer and technical assistance from the latter, would most likely give the direct productivity benefits of technology and knowledge transfer from FDI presence. However, this data is not available in the current establishment-based surveys in the Philippines. Improved data availability and further research is suggested to fully examine the different mechanisms of productivity gains through direct technology and knowledge transfer, and through indirect spillover effects resulting from FDI presence.

IV. CONCLUSION

With the intention to assess whether FDI facilitates technology and knowledge transfer to the Philippine domestic manufacturing industries, and whether FDI contributes to the country's sustainable and inclusive economic growth, this study empirically examined the effect of FDI presence in the downstream and upstream industries on the labor productivity of domestic industries. This study utilized a balanced panel of industry-level data from 2010 to 2017 (except 2011) of manufacturing firms with total employment of 20 and over and the annual Input-Output tables for the Philippines.

Although most studies in the literature suggest that FDI presence in the downstream industries positively affects the productivity of domestic suppliers – directly through technology and knowledge transfer, or indirectly through increased demand in intermediate products – this is not the case for the Philippines. Results of the empirical estimation suggest that FDI presence in the downstream industries negatively affects the labor productivity of domestic suppliers in the country. This situation may be attributed to the low absorptive capacity of domestic industries to meet the technological and input requirements of foreign customers in the domestic market, resulting in foreign customers importing their intermediate product requirements, and domestic suppliers losing customers and sales.

On the other hand, the literature provides mixed evidence of the effect of upstream FDI presence on the productivity of domestic buyers in the downstream industries. Empirically, the case of the Philippines shows that domestic industries sourcing advanced technologies and inputs from foreign suppliers do not experience an increase in labor productivity. This situation may also be attributed to the low absorptive capacity of the industries, or to the weak collaboration between foreign suppliers and downstream domestic industries to fulfill the technological and input requirements of the domestic market. This results in difficulty for domestic industries to match and maximize the productivity benefits from the advanced technology and high-quality inputs from foreign suppliers.

This study suggests that in order to acquire the beneficial productivity effects of FDI presence in the downstream and upstream industries, priority should be given to strengthen the absorptive capacity of domestic firms and industries. Upgrading of local quality standards to meet global standards and requirements may help strengthen the confidence of foreign investors to facilitate technology and knowledge transfer and prioritize local sourcing. Further, strengthening of collaboration efforts between foreign suppliers and downstream domestic industries may help ensure that the technological and input requirements of the domestic market are met and sold at reasonable prices.

Undoubtedly, FDI is an engine of economic growth for developing nations. However, in order to ensure sustainable and inclusive economic development from FDI presence, it is suggested that policies and programs be developed and monitored to strengthen the promotion of technology and knowledge transfer. More research is needed to fully understand the effect of FDI presence in the domestic market. Future research may consider improved data availability on firm-level information and the actual volume of domestic firms' intermediate inputs supplied to and purchased from foreign firms, and whether the former received direct technology transfer and/or technical assistance from the latter.