The impact of FDI on the Labor Productivity: Evidence from Vietnam[1]

Bui, Thi Thuy Linh

ABSTRACT

Foreign direct investment (FDI) is anticipated to have externalities on domestic industries and boost productivity in the host country, which is often referred to as FDI spillovers. Despite this expectation, empirical evidence on FDI spillover remains ambiguous. This study examines how technology spillovers from FDI affect the productivity of domestic enterprises in Vietnam using firm-level data from the Census 2012-2018. Technology spillovers are distinguished into horizontal spillovers (which capture intra-industry effects) and horizontal spillover (which captures inter-industry effects). The results obtained from the regression models are mixed. There is evidence that domestic enterprises benefit from technological spillovers via vertical linkages with multinational companies. Yet, foreign enterprises' horizontal presence on local firm productivity is negative. Furthermore, the type of firm ownership affects the presence and strength of horizontal and vertical spillovers.

1 Introduction

FDI is considered an important development stimulant and a component of an open international economic system (Boghean et al., 2015). In recent decades, these have become the primary source of private external finance for emerging countries (Sauvant et al., 1993).

In the case of Vietnam, FDI is thought to contribute significantly to Vietnam's rapid growth after *Đổi Mới* - the economic reforms initiated in Vietnam in 1986 (Thuy, L. T. et al., 2007). In this period, the first Foreign Investment Law was enacted in December 1987 with price, exchange, and property ownership reforms, laying the foundations for the long-term strong growth of FDI and exporting activities. these reforms have helped Vietnam transition from one of the world's poorest countries to a lower middle-income one within a generation. Since 1990, real GDP per capita growth has averaged 5.5 percent per year, resulting in a more than quadrupling of real GDP per capita, reaching nearly 2,800 USD in 2020 (World Bank, 2020).

[1] This working paper is a personal research project completed as part of the advanced macroeconomics course in the EGEI master's program. The code and data for reproduction: https://github.com/LinhBTT09/FDIproject/tree/main/project%20FDI

As an inevitable result, Vietnam's economy has heavily depended on FDI. Foreign-invested companies, accounting for 71.7 % of Vietnam's total export turnover in 2020[2]. The net FDI inflow of Vietnam was also very high, at 6.3% of its GDP in 2019, whereas that in China was 1.3%, Japan was 0.776%, and Thailand was 2.23%[3].

With such characteristics, Vietnam's productivity is expected to be high and to grow rapidly to allow an economic take-off to high income. Still, it didn't turn out as expected in the real economy. Vietnam's productivity remains low, and labor productivity growth is slowdown. According to Vietnam Productivity Report (Ohno Kenichi et al., 2021), from 1991 to 2019, the labor productivity of the whole economy grew by 3.74 times, and on annual average, the growth was 4.65%. Any rapidly industrializing economy is expected to achieve a higher labor productivity growth than this. China's labor productivity close to Vietnam in 1990, but it was increased by 8.98% per year, or 9.4 times, by 2017.

As such, the reliance on FDI and slow down labor productivity growth raise a "*globalization paradox*" puzzle that must be solved if Vietnam is to achieve long-term prosperity. The question of how globalization and FDI impact productivity, specifically in terms of labor productivity, has provoked significant interest among policymakers.

The theoretical literature suggests that the FDI is likely to improve the productivity of local firms (Blomstrom and Kokko, 1998; Bellak, 2004). Still, empirical researches reveal mixed results. These findings can be classified into two categories. One concludes that FDI improves domestic firm productivity (Anh, N. T. T et al., 2006; Kien, P. X., 2008; Cuyvers, L, 2008; Mebratie, 2010). Another is which argues that the effect of FDI is unclear or even negative for developing countries (Aitken, B. J., & Harrison, A. E., 1999; Görg, H., & Greenaway, D., 2004; Vahter, 2004; Linh, T. C., 2014). The mixed results in empirical evidence might come from the difference in the degree of spillover effects of FDI in host countries. To be more specific, it is different dependent on the characteristics and potential of the host country, such as the technology gap between host country firms and FDI firms, the host country's absorptive capacity, the ownership structure of foreign firms, and so on (Iacovoiu and Panait, 2019; Voica, M. C. et al., 2020).

[2] Vietnam's General Statistics Office (GSO), retrieved 1 January 2021 https://www.gso.gov.vn/en/px-web/?pxid=E0810&theme=Trade%2C%20Price%20and%20Tourist

[3] World Bank, "Foreign direct investment, net inflows (% of GDP)", retrieved 27 December 2021, https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS?end=2020&locations=VN-TH-ID-MY-CN-JP&most_recent_year_desc=false&page=4&start=1970.

On the other hand, In comparison to the huge body of literature on FDI-growth, relatively less attention has been paid to exploring how FDI inflows have contributed to productivity (Hu, D. et al., 2021). In particular, studies on the spillover of FDI on labor productivity in Vietnam's case are still very few. Most of the former studies (except, e.g., Thuy, L. T. (2007)) consider the effects of FDI in some industries and have not yet reached a consensus. For instance, this impact is indeed negative in Vietnam's textile sector (Linh, T. C., 2014). It is positive in food processing, textile, garment & footwear, electronics & mechanics (Kien, P. X., 2008), manufacturing sector (Le, H. Q., 2011). The main reason behind these mixed results is the lack of firm-level data for the whole economy and a long enough time. Thus, more study is needed to fill this gap in research.

This research focuses on the technical spillover effects of FDI flow on Vietnamese domestic firms' labor productivity. It aims to answer the following research questions: *(i) Are there spillover effects from FDI to labor productivity of Vietnamese domestic firms? And through what major channels? (ii) Whether domestic firm characteristics (State enterprises, Private firms, Collective firms) impact the strength of technical spillover effects?*

The rest of the paper is structured as follows. Section 2 summarizes previous research on technological spillover effects, while the theoretical model and empirical work on spillover effects in Vietnam from 2012 to 2018 are presented in Section 3 and Section 4. Finally, section 5 summarizes the concluding remarks.

2 Literature review

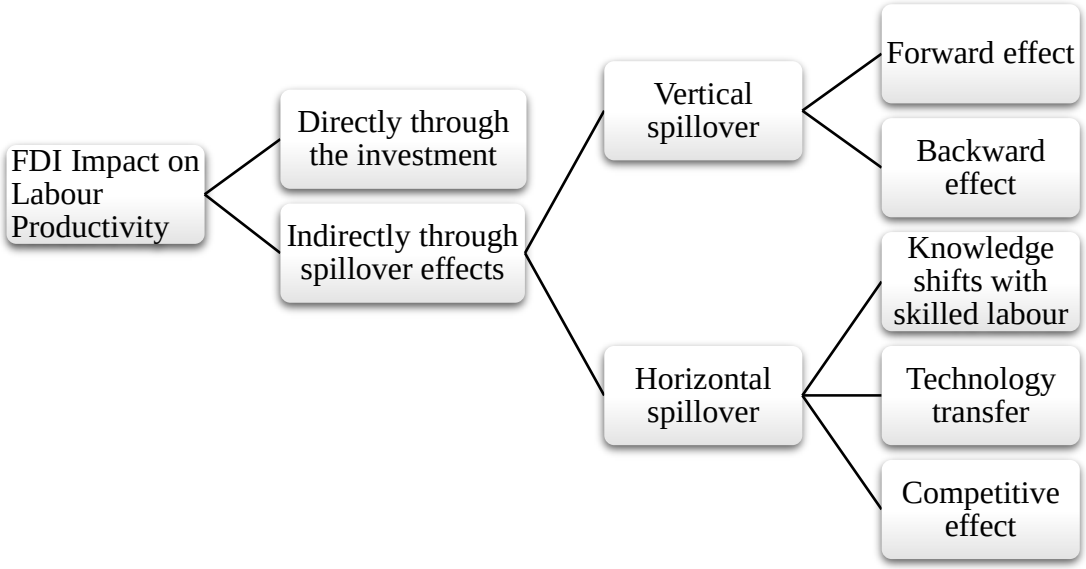
2.1 Spillover Effects – An overview

In endogenous growth models, FDI technologies have been deemed a key externality with long-run effect since they have the characteristics of a public good (Grossman, G. M. et al., 1991; Romer, P. M., 1990).

FDI can affect labor productivity through various channels. According to Hymper (as mentioned in Parry (1997)), foreign enterprises bring not only money but also superior management and technology. Blomstrom, M. and Kokko, A. (1998) elaborate on this theory, stating that spillovers from FDI to host countries could occur through three channels: (i) Technology transfer; (ii) Knowledge shifts with skilled workers; (iii) Effective resource allocation due to competitiveness.

In general, technological spillovers from the presence of FDI to domestic firms are divided into two categories in literature: (i) vertical spillovers/ inter-industry; and (ii) horizontal spillovers/ intra-industry (Nguyen, A. N., & Nguyen, T.,2008).

Figure 2.1: Framework for the impact of FDI on labor productivity



Source: Authors synthesize from previous studies

Vertical spillover/ inter-industry includes forward effect and backward effect (Blomstrom, M. and F. Sjoholm (1999); Javorcik, B. S., 2004). The forward effect happens when foreign companies sell goods and services to companies in the host country, but this is often not obvious and less noticeable than the backward effect (Havranek, T. and Z. Irsova, 2010). The backward effect happens when foreign companies buy goods and services from the above industries.

Horizontally spillover/ *intra-industry* is the beneficial effects of foreign capital to domestic firms operating in the same sector / industrial fields (Aitken, B. J., & Harrison, A. E., 1999). The presence of FDI creates horizontal spillovers to domestic firms through three channels: knowledge shifts with skilled labor (Goerg H. and Strobl E, 2002), technology transfer (Haddad, M. and Harrison, A., 1993; Blomstrom, M. and F. Sjoholm, 1999), and effective resource allocation results from the competition (Aitken, B. J., & Harrison, A. E., 1999).

In contrast to the positive spillover benefits discussed above, literature also proposed that FDI could have negative spillovers to the productivity of domestic firms. For example, when a foreign firm enters the market, their technological and know-how advantages could encroach on the markets of

domestic enterprises, causing them to produce at less efficient scales, resulting in lower productivity of domestic firms (so-called "market stealing effects"). As domestic enterprises reduce production, fixed costs are spread over a narrower production scale, resulting in a higher average cost. (Aitken, B. J., & Harrison, A. E., 1999).

2.2 Previous empirical studies on technological spillover

Despite a range of theoretical channels mentioned above through which FDI can improve the productivity of domestic firms in host countries, it seems to be no consensus in the existing empirical literature on the actual efficiency of FDI.

On the one hand, several studies show that FDI has large positive spillover effects. On the other hand, some researchers find that technological spillover has no impact or is statistically insignificant.

Early studies by Caves, R. E. (1974) for Australia, Globerman, S. (1979) for Canada, reported positive spillover effects. For more recent studies, Liu, X et al. (2000) investigated horizontal spillovers from foreign FDI in UK manufacturing sector. Their findings showed that FDI has a positive spillover effect on the productivity of UK-owned firms. Javorcik, B. S. (2004) showed evidence of positive spillovers from FDI based on firm-level data of Lithuania. Bitzer, J., & Görg, H. (2009) find that inward FDI boosts productivity on average in a set of OECD nations, using both industry and country-level data.

Several studies, in contrast, discover considerable evidence of negative spillover effect. Foreign investment has a negative effect on the productivity of a panel of locally held plants in Venezuela, according to Aitken, B. J., & Harrison, A. E., (1999). According to Yudaeva, K. et al. (2003), FDI has positive horizontal spillover effects on domestic enterprises, but negative vertical spillover effects.

Meanwhile, several studies have found that FDI inflows have no effect on the productivity of the host economy. Girma, S. et al. (2001), for example, find no aggregate evidence of intra-industry spillovers from foreign to local companies in the UK manufacturing industry. N. Driffield and J. H. Love (2007) propose a taxonomy that connects FDI motivation (technological and cost-based) to predicted effects on domestic output in host countries. Their findings, based on FDI inflows to the UK, show that inbound FDI motivated by technology source considerations has no productivity spillovers.

Despite very little literature on the impact of FDI in Vietnam, previous studies have reported varied results. Several researchers have recognized the possible benefits of FDI in terms of productivity growth.

Thuy, L. T. (2007) used industry-level data from 1995-1999 and 2000-2002 to examine the technology spillover effects of FDI on labor productivity in 29 sectors in Vietnam. She discovered spillovers from foreign direct investment on domestic industry productivity in Vietnam during 1995-1999, but this effect weakened during 2000-2002. (possibly due to the market stealing effect). Using firm-level data, Kien, P. X. (2008) investigated the FDI spillover impact. In general, the findings of these studies proved that the presence of FDI enhances the labor productivity of local firms in Vietnam.

Meanwhile, Le, H. Q., and Pomfret, R. (2011) investigated technological spillovers occurring through horizontal and backward linkages using firm level data from 2000 to 2004. Their empirical findings show that local firms benefit from technology spillovers through vertical linkages with foreign enterprises, while the effect of foreign firms' horizontal presence on domestic firm productivity is negative. Similarly, Nguyen, A. N., and T. Nguyen (2008) found mixed outcomes on spillover effects. They discovered evidence of positive backward spillovers in the manufacturing sector but found no evidence of spillovers in the service sector.

Recent studies mainly examine the spillover effects of FDI in specific industries such as textiles (Linh, T. C., 2014) or in a particular area such as in the manufacturing and processing industry in Hanoi (Hoang, D. T, 2021).

3 Data and Model

3.1 Data

This study use data source is from the Statistical Office (GSO), the Vietnam Annual Enterprise Survey (VAES) provided by the General Statistics Office (GSO). This panel data set covers 2012 to 2018 (seven years), including almost all enterprises in 29 industries, three industrial groups (23 in manufacturing, four sectors in mining and quarrying, and 2 in electricity, gas, and water supply). It provides a variety of information on the property structure of enterprises, employment, output, investment, capital stock, sales, location, wages, and so on.

The input-output table also is use for the year 2012 – 2018 provided by the ADB.

3.2 Model

The model used in this study is similar to those used in earlier research (Caves, R. E., 1974; Globerman, S., 1979, and so on). The production function of the domestic sector is assumed to have a Cobb-Douglas form and be homogenous with degree one, as shown below.

$$Y_{ijt} = (K_{ijt})^{\alpha}(L_{ijt})^{1-\alpha}e^{Z_{ijt}} \quad (1)$$

Where Y_{ijt}, L_{ijt}, and K_{ijt} are output, labor and capital of domestic firm i in industry j at time t. Foreign presence is assumed to be an externality that influences output, including other factors such as scale economics, labor quality, and concentration. (Z_{ijt} which will be detailed later).

Dividing both sides of equation (1) by L_{ijt} yields the function below for labor productivity of domestic firm i.

$$\frac{Y_{ijt}}{L_{ijt}} = \left(\frac{K_{ijt}}{L_{ijt}}\right)^{\alpha} e^{Z_{ijt}} \quad (2)$$

In a review of the literature on total factor productivity, Felipe, J. (1999) defines Z as "a measure of elements such as R&D, managerial capabilities and organizational competence, embodied technical progress, inter-sector transfers of resources, increasing return to scale, and technology diffusion." Thus, domestic firm i's labor productivity can be described as follows:

$$\frac{Y_{ijt}}{L_{ijt}} = \left(\frac{K_{ijt}}{L_{ijt}}\right)^{\alpha} e^{\beta_1 Labor_{quality}{}_{ijt}} e^{\beta_2 Scale_{ijt}} e^{\beta_3 Concentration_{jt}} e^{\beta_4 Technology_{gap}{}_{ijt}} e^{\beta_5 Technology_{spillovers}{}_{jt}} \quad (3)$$

Taking log both sides of equation (2) the labor productivity of domestic firm is estimated as follows.

$$ln\left(\frac{Y_{ijt}}{L_{ijt}}\right) = \gamma + \alpha \ln\left(\frac{K_{ijt}}{L_{ijt}}\right) + \beta_1 Labor_{quality}{}_{ijt} + \beta_2 Scale_{ijt} + \beta_3 Concentration_{jt} + \beta_4 Technology_{gap}{}_{ijt} + \beta_5 Technology_{spillovers}{}_{jt} + \varepsilon_{ijt} \quad (4)$$

Where $\frac{Y_{ijt}}{L_{ijt}}$ is average labor productivity of domestic firm i in industry j, expressed as the ratio of gross output to total employees. $\frac{K_{ijt}}{L_{ijt}}$ is the capital intensity of domestic firm i, which is calculated as the ratio of fixed assets to total employees in firm i. Foreign enterprises may be more capital-intensive and larger than local firms, and these traits may account for some of the productivity differences between the two. Hence, I use this variable to account for the effect of capital intensity on productivity.

$Labor\_quality_{ijt}$ denotes worker skills that affect firm i 's productivity. Due to the lack of firm-specific information on the number of skilled labor, labor costs (such as training costs and wage) per employee are applied as a proxy for the firm's human capital stock. This is based on the assumption that enterprises with higher average labor costs per worker hire more skilled workers.

The scale effect ($Scale_{ijt}$) is measured as the ratio of sales in firm i to total industry sales to account for the effect of scale on productivity. The Herfindahl index for domestic enterprises is used to calculate the level of concentration in industry j ($Concentration_{jt}$):

$$\text{Herfindahl index} = \sum_1^n \left(\frac{x_{ijt}}{X_{ijt}}\right)^2 \quad (i = 1, \dots, n) \qquad (5)$$

where x_{ijt} signifies the sales of domestic firm i in industry j; and X_{ijt} represents the total sales of industry j. A greater Herfindahl index suggests a high degree of industry concentration, and consequently less competition.

$Technology_{gap}$ is defined as a percentage difference between each domestic firm's labor productivity and that of the average foreign firm in the same industry:

$$Technology\_gap_{ijt} = \frac{Average\ LP_{ijt} - LP_{ijt}}{LP_{ijt}} \qquad (6)$$

where $Average\ LP_{ijt}$ is the mean of foreign firms' labor productivity in industry j at time t and LP_{ijt} is the labor productivity of local firm i industry j at time t. A negative value implies that domestic firm i is more productive than the average foreign firm in the same industry, while a positive value shows that firm i is less productive than the average foreign firm in the same industry.

$Technology\_spillovers_{ijt}$ from FDI are classified into horizontal spillovers and vertical spillovers. Because most foreign enterprises in Vietnam are export-oriented and do not provide Vietnamese clients, this model focuses on backward spillovers (from foreign companies to their domestic suppliers). It means that this study does not consider technology spillovers through forward linkages (from foreign companies to domestic customers).

Horizontal spillover (HS_{jt}) is defined as the proportion of employment accounted for by all foreign enterprises in industry j at time t:

$$HS_{jt} = \frac{\sum_{k=1}^{m} FL_{kjt}}{\sum_{k,j=1}^{m,n} (FL_{kjt} + DL_{ijt}} \quad (7)$$

where FL_{kjt} (k =1,…, m) represents employment of foreign enterprises k in industry j and year t, and DL_{ijt} (i =1,…,n) denotes employment of domestic firms i in industry j and year t. This measure mostly reflects level of competition that motivate domestic enterprises to produce new products in order to defend their market share and in order to boost productivity. This measure includes imitation, personal interaction, reverse engineering and industrial espionage.

Backward spillover (BS_{jt}) is measured by determining the extent of foreign presence in industry j that is supplied by other industries. It reflects the extent of potential interactions between domestic suppliers and foreign enterprises in industry j.

$$BS_{jt} = \sum_{h=1}^{p} \alpha_{jt} * HS_{jt} \quad (h = 1, \dots, p) \quad (8)$$

where α_{jt} ($0 \leq \alpha_{jt} \leq 1$) denotes the proportion of industry r's output that is supplied to industry j. Inputs supplied within the industry are not included because the HS variable already captures them. The values of α_{jt} from 2012 to 2018 are based on the input-output table in 2012.

Finally, this paper uses the basic model as follows:

$$ln\left(\frac{Y_{ijt}}{L_{ijt}}\right) = \gamma + \alpha \ln\left(\frac{K_{ijt}}{L_{ijt}}\right) + \beta_1 Labor_{quality_{ijt}} + \beta_2 Scale_{ijt} + \beta_3 Concentration_{jt} + \beta_4 Technology_{gap_{ijt}} + \beta_5 HS_{jt} + \beta_6 BS_{jt} + \delta_j + \tau_t + \theta_r + \varepsilon_{ijt} \quad (9)$$

This research use OLS with heteroskedasticity correction. Fixed effects for time (τ_t), region (_r), and industry (δ_j), are included to control for the potential endogeneity of foreign presence and region or industry characteristics. Foreign enterprises may decide to locate in a particular region with better infrastructure, which increases domestic firms' efficiency. If foreign investors are attracted to industries with greater labor productivity, the observed correlation between FDI and domestic productivity might overestimate. Lagged values of relevant variables are used as instruments to account for endogeneity.

4 Results

4.1 Technology spillovers from FDI

Table 1 shows empirical results of technology spillovers from FDI. In general, the impact of FDI on the labor productivity of domestic firms is demonstrated through both horizontal and vertical linkages, with the estimated coefficients being statistically significant.

The results reveal that backward spillovers have a positive effect on productivity. This means that increased backward linkages from foreign enterprises would improve Vietnamese firms' labor productivity. To be more specific, a 1-unit increase in backward linkages would result in an approximately 3.031 % rise in domestic firm labor productivity.

Some reasons could explain why backward linkage is a crucial channel for technology diffusion. First, intermediate products supplied are specific to foreign firms' production processes; thus, they are more willing to share their know-how and technology with domestic firms. Second, local firms could benefit from technology spillovers thanks to foreign firms' training and turnover of labor or technical staff of foreign firms visiting local firms.

The horizontal spillover of FDI on domestic firms is negative significantly. This finding is in line with previous research, which has found evidence of a negative intra-industry effect on developing countries. The reason might come from the fact that foreign enterprises' presence reduces domestic enterprises' productivity through competition effects (“market stealing effect”).

The model is also re-estimated with lagged horizontal and backward spillover variables, given that technology spillovers from foreign enterprises to domestic enterprises could take time to occur. The results confirm those with contemporaneous spillover factors, indicating that backward linkages result in positive technology spillovers, but that foreign enterprises in the same industry have a negative impact (column 2, Table 1).

Domestic enterprises' absorptive capacity may encourage technology spillovers. To account for local firms' absorbent ability to determine the magnitude of spillovers, this model uses interactive variables between the technology gap or labor quality with the spillover variables. The interactions between labor quality and the spillover variables are significantly positive (column 3 of Table 1). This suggests that technological spillovers from FDI to domestic firms are greater in those with higher labor quality.

The interaction coefficient between horizontal linkages and the technology gap is significantly negative (column 4 of Table 1). This implies that local firms with a minor technology gap might have

enough technological capacity to compete with foreign firms, thereby minimizing the adverse consequences of foreign firm competition.

4.2. Firm ownership and technology spillovers

This part will discuss the relationship between firms' ownership structure and technology spillovers (Table 2). The findings reveal that the presence of foreign enterprises has no effect on the productivity of domestic firms. However, the presence of foreign enterprises has a negative impact on private and collective firms in the same industry. This may be because these firms are small in terms of technology, skilled labor, and capital, making them less equipped to absorb technology and compete with foreign presence than state firms. State enterprises, in contrast, may have more technological capabilities and skilled people to compete with international firms in the same field. Meanwhile, the findings for private firms show that they benefit from backward linkages with foreign enterprises.

5. Conclusion

This study examines the impact of FDI on the labor productivity of Vietnamese domestic firms through technology spillovers. In other words, the research explores technological spillovers via horizontal and backward linkages by using firm-level data for 2012-2018. In addition, the nexus of firm ownership and such spillovers was also analyzed.

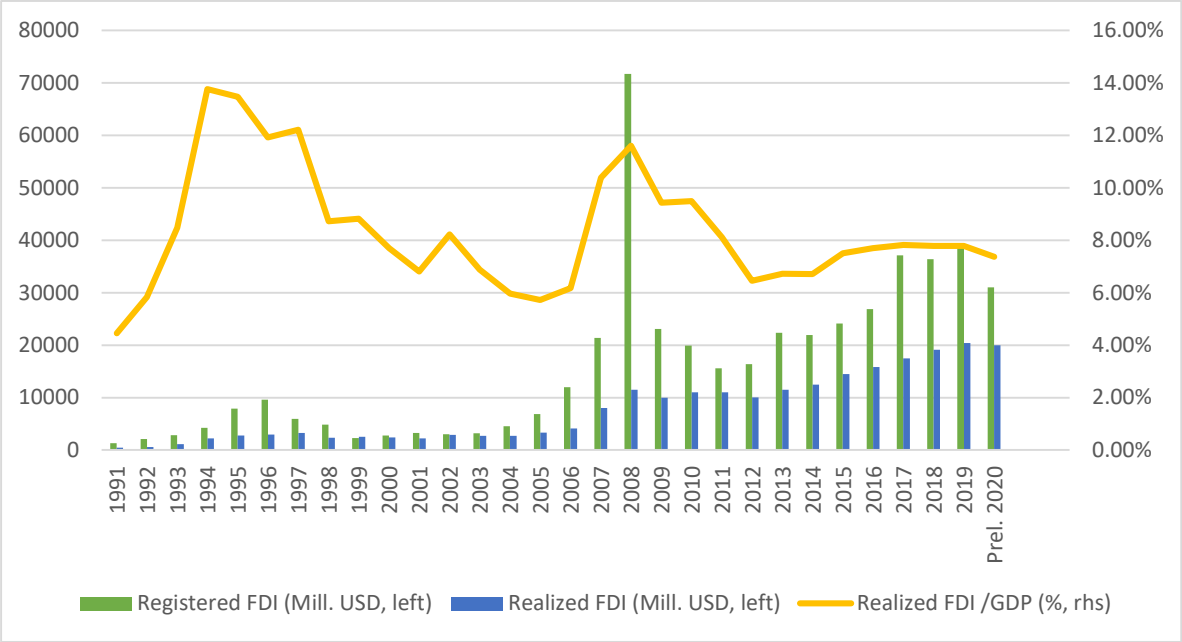
The empirical results indicate that FDI has spillover effects on labor productivity in Vietnam. Specifically, the vertical spillover (inter-industry, in downstream sectors-spillovers via backward linkages) and horizontal spillover (intra-industry) are acknowledged. In there, the backward linkage is the most crucial channel and positive effect of technology transfer from foreign to domestic enterprises. In addition, this backward spillover is affected by the quality of its labor force, the size of the local firm, and the technological gap.

Meanwhile, the horizontal spillovers of FDI have a negative impact on indigenous enterprise productivity. This implies that the competitive effect caused by foreign firms' presence is greater than its potential benefit from technology transfers.

Regarding ownership structure, private firms benefit from foreign firms through backward linkages, confirming the hypothesis of FDI attractiveness benefits in literature. Still, the same does not happen in the state-owned sector, with no evidence of linkage effect from the FDI sector.

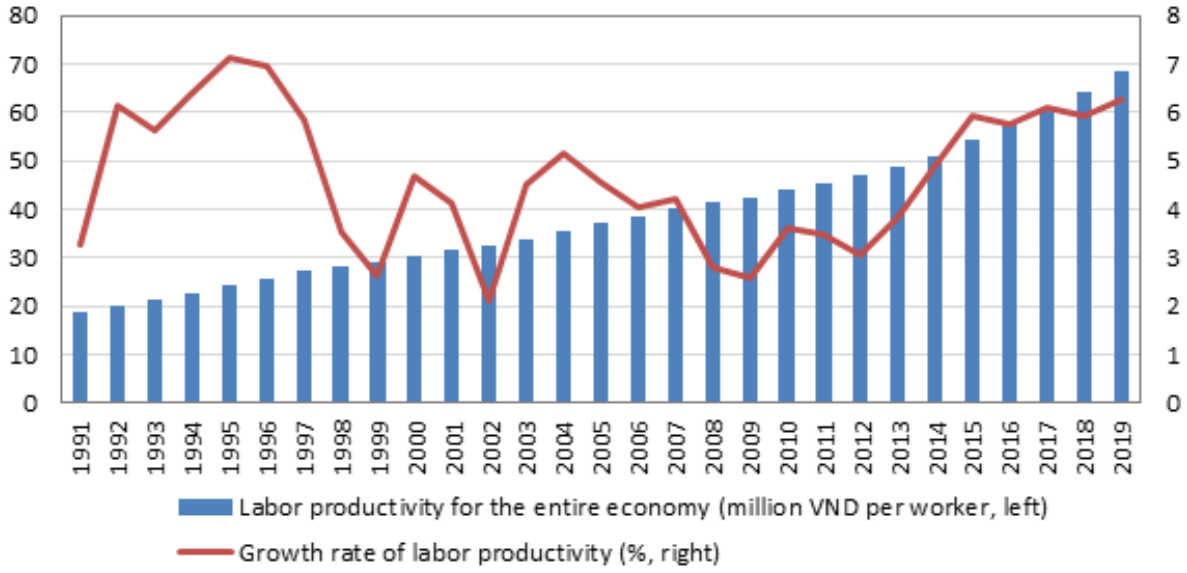
APPENDIX: TABLES AND FIGURES

Figure 1. FDI Inflows in Vietnam, 1991 - 2020



Source: Vietnam's General Statistics Office (GSO) (2021a) and World Bank

Figure 2. The Vietnam's labor productivity 1991 – 2019 (Constant 2010 price)



Source: Vietnam Productivity Report (Ohno Kenichi et al., 2021)

Table 1. Technology spillovers from FDI

VARIABLES	(1) log_output_D	(2) log_output_D	(3) log_output_D	(4) log_output_D
log_capital_D	0.467***	0.470***	0.466***	0.466***
	(0.00169)	(0.00176)	(0.00169)	(0.00169)
HS	-1.031***		-0.970***	-0.995***
	(0.120)		(0.120)	(0.120)
BS	3.031***		3.083***	3.010***
	(0.287)		(0.288)	(0.287)
LaborP_D	0.000623***	0.000723***	0.000890***	0.000620***
	(1.18e-05)	(1.30e-05)	(2.53e-05)	(1.18e-05)
Scale	23.32***	23.83***	23.19***	23.32***
	(0.497)	(0.548)	(0.497)	(0.497)
Concentration	-0.989***	-0.919***	-1.002***	-0.976***
	(0.130)	(0.177)	(0.130)	(0.130)
Tech_gap	-0.000767***	-0.000799***	-0.000764***	-0.00147***
	(3.12e-05)	(3.33e-05)	(3.12e-05)	(8.56e-05)
HS_lagged		-1.775***		
		(0.149)		
BS_lagged		4.711***		
		(0.385)		
LaborP_D_HS			0.000942***	
			(6.76e-05)	
LaborP_D_BS			0.000336***	
			(8.21e-05)	
Tech_gap_HS				-0.00596***
				(0.000315)
Tech_gap_BS				0.00599***
				(0.000456)
Constant	2.016***	1.809***	1.986***	2.018***
	(0.0819)	(0.108)	(0.0821)	(0.0819)
Observations	442,640	382,116	442,640	442,640
R-squared	0.297	0.301	0.297	0.298
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region FE	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2. The impact of ownership structure on technology spillovers

VARIABLES	State firms	Private firms	Collective firms
log_capital_D	0.383***	0.429***	0.351***
	(0.0114)	(0.00197)	(0.00369)
HS	-0.155	-0.961***	-2.329***
	(0.798)	(0.127)	(0.455)
BS	-0.0898	3.652***	-3.339***
	(2.037)	(0.305)	(0.906)
LaborP_D	0.00348***	0.000564***	0.00365***
	(0.000176)	(1.19e-05)	(0.000117)
Scale	6.123***	136.5***	939.1***
	(0.462)	(1.554)	(27.12)
Concentration	-1.482**	-1.045***	1.760***
	(0.680)	(0.135)	(0.638)
Tech_gap	-0.00240***	-0.000903***	-0.000481***
	(0.000543)	(4.40e-05)	(3.58e-05)
Constant	3.207***	2.128***	3.561***
	(0.448)	(0.0886)	(0.239)
Observations	7,413	381,174	53,517
R-squared	0.510	0.246	0.345
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Region FE	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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