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# Spillover effects of Japanese firms and the role of absorptive capacity in Vietnam

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The paper examines the role of the absorptive capacity of Vietnamese manufacturing firms in facilitating the link from Japanese spillovers to the productivity of local firms in the manufacturing sector. By using the Generalized Method of Moments (GMM) and threshold regression model with dynamic panel data from 2005 to 2018, the paper finds the following points. Firstly, the appearance and operation of Japanese firms can bring the positive horizontal labour effect and backward competition effect but it also brings the negative backward labour effect. Secondly, the absorptive capacity of domestic firms can help reduce the negative spillover effects and increase the positive spillover effects. Finally, if domestic firms cannot reach a threshold of absorptive capacity, they will suffer from Japanese spillovers while if they meet the threshold of absorptive capacity, they can enjoy the externalities from the operation and cooperation with Japanese firms.

## Introduction

### Overview and motivation

Various studies show that local firms can benefit from FDI through spillover effects (Jaffe et al. 1993; Kokko et al. 1996; Blomström and Sjöholm 1999; Javorcik 2004; Vu and Le 2017; Vu 2020). Spillovers are externalities caused by the operation of FDI firms in host countries. According to Javorcik (2004), spillovers can occur within an industry or between industries. Within an industry, spillovers can take place through competition, labour turnover or learning by doing/demonstration. Domestic firms can improve their efficiency by duplicating the technologies or production methods of multinational corporations (MNCs; learning by doing/demonstration) or by hiring trained workers from these foreign firms (labour turnover). Multinational corporations with higher productivity than domestic firms can place pressure on those firms to self-develop otherwise the domestic firms can be replaced (competition). Interindustry spillovers can occur through backward and forward linkages. Backward linkage refers to the relationships between MNCs and their local providers, in which MNCs may transfer knowledge or new

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technology to their suppliers and thus benefit from using better-quality intermediate goods. The higher quality and time-delivery requirements of MNCs may also encourage domestic firms to improve their performance and thus compete with other local suppliers. Forward linkage occurs when domestic firms use the final products of foreign firms as production inputs. This can increase the productivity of domestic firms due to the high-quality intermediate goods provided by foreign firms. Generally, FDI firms are expected to create spillover effects on domestic firms when they cooperate. However, the presence and operation of FDI firms do not automatically generate impacts on domestic firms; rather, this is conditional on the absorptive capacity of domestic firms. For the development of domestic firms, it is essential to have absorptive capacity. According to Cohen and Levinthal's (1990) definition, absorptive capacity refers to a company's capability to identify the significance of external information, integrate it and utilise it for commercial purposes. Domestic firms can only enjoy positive spillover effects if they have good absorptive capacity (Cohen and Levinthal 1994; Lane and Lubatkin 1998; Zahra and George 2002; Girma 2005; Vu 2020). Furthermore, the impact of absorptive capacity on the link between FDI and domestic firms may be non-linear (Criscuolo and Narula 2008; Vu 2020). This implies that there are certain thresholds for the absorptive capacity of domestic firms, and at these thresholds, the impact of FDI spillovers can change direction. Generally, theories and empirical studies show that it is important to examine the impact of spillover effects on the part of FDI on domestic firms, as well as the role of absorptive capacity in this relationship.

## Problem statement and objectives of the paper

In the case of Vietnam, Japan has been one of the most important investors, with an accumulated registered capital of US$38,623.5 million in 2020, meaning that Japan was ranked second, after Korea, in this regard (GSO 2022).[1] Therefore, FDI from Japan has played an important role in the development of the Vietnamese economy. In addition to the direct impact of increased capital, Japanese firms are expected to create positive spillover impacts on the performance of domestic firms. However, Duong and Quynh (2018) show that some large Japanese firms, specifically Honda and Toyo Denso, operating in Vietnam could scarcely find any local suppliers due to their lower capability. This implies that the spillover effects from these Japanese firms are unlikely to be absorbed by domestic firms. This situation is good for neither Japanese firms nor Vietnamese manufacturing firms. The former cannot find local partners that have local knowledge about the market, which may negatively affect their operations. The latter cannot benefit from cooperating with Japanese firms. Consequently, Vietnamese firms may face challenges in terms of learning from Japanese firms, potentially causing them to fall further behind. Given the fact that there are many Japanese firms in Vietnam already, it is necessary to find a way to utilise their positive impacts. The key point is the absorptive capacity of domestic firms. The paper argues that domestic firms must have a certain level of absorptive capacity before they can cooperate with and derive benefits from Japanese firms. Therefore, the main purpose of this paper is to provide empirical evidence of the impact of absorptive capacity in the link from spillover effects to the performance of Vietnamese manufacturing firms. More specifically, the paper singles out the spillovers from Japanese firms and finds the threshold of absorptive capacity at which domestic firms can benefit from the appearance of Japanese firms.

## The practical contribution of the paper

The paper provides the Vietnamese government with empirical evidence with which to create FDI policies in the future. Additionally,

[1] https://www.gso.gov.vn/en/px-web/?pxid=E0413&theme=Investment.

the paper provides the threshold of absorptive capacity for domestic firms that desire to take full advantage of cooperation with Japanese firms. Moreover, Japanese firms should also note this threshold for absorptive capacity, as it is a solid indicator of good local suppliers. The threshold is a good signal for both Vietnamese manufacturing firms and Japanese firms. Vietnamese manufacturing firms only enjoy the spillover effects from Japanese firms when they are ready to learn from them. In fact, domestic firms must be ready to learn because this is the only way to improve themselves if they do not want to be dominated by foreign investors. Then, we aim to identify the threshold for absorptive capacity at the sub-sectoral level in the manufacturing sector in Vietnam. Therefore, based on the results of the paper, domestic firms can know when and in which sector they should cooperate with Japanese firms to enjoy spillover effects. The results of the paper will be important to Japanese firms in Vietnam as well because they will be able to choose local partners based on this threshold for absorptive capacity. Even though the paper only focuses on the case of the Japanese firms in Vietnam, the approach can be generalised to other foreign firms in other countries to identify the threshold domestic firms must reach to benefit from spillovers from foreign firms.

### Methodology and key findings

Based on the theory and literature review, we test two hypotheses:

H1. The absorptive capacity of domestic firms can affect the impact of FDI spillovers from Japanese firms to domestic firms in Vietnam.
H2. There is a threshold for FDI absorptive capacity that must be reached before Vietnamese manufacturing firms are affected by Japanese spillover effects.

The paper makes use of the production function and applies fixed-effects and threshold estimation with panel data from 2005 to 2018 to test the two hypotheses. The spillover effects are measured via the horizontal labour effect, horizontal competition effect (Horizontal_labour and Horizontal_comp), backward labour linkage and backward competition linkage (Backward_labour and Backward_comp). In this paper, absorptive capacity is considered to be the persistent efficiency gap between domestic firms and foreign firms in the same industry/sector. The results of the paper show that the appearance of Japanese firms can have either negative (backward labour linkage) or positive spillover effects (the horizontal labour effect and backward competition effect). Essentially, if domestic firms have good absorptive capacity, which means a higher level than the threshold, they can receive positive impacts and, at the same time, reduce negative ones.

### Structure of the paper

The structure of the paper is as follows: the next section provides the background and develops the hypotheses. This is followed by the Methodology section, which shows how to test the hypotheses. After that, the Results and discussion will be presented, and finally, the main remarks are provided in the Conclusion.

## Background

This section provides an overview of the contribution of Japanese firms to the manufacturing sector in Vietnam to highlight to importance of examining the spillover effects of that group. Then, the paper puts forward two hypotheses based on the theory and literature on the topic of FDI spillovers and absorptive capacity.

### Overview of Japanese firms in Vietnam

Japanese firms are mainly concentrated in the manufacturing sector in Vietnam, with 58 per cent of Japanese firms currently operating in

this sector. Other sectors account for less than 10 per cent of Japanese firms (Figure 1).

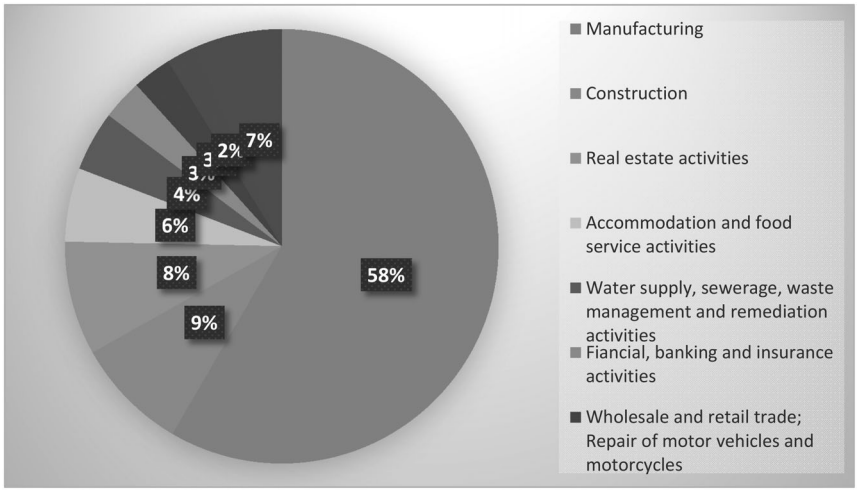
From 2005 to 2018, in Vietnam, Japanese firms have been in the top three countries in terms of number, along with Korean and Taiwanese firms (Figure 2). Interestingly, the number of Korean firms has been increasing over the years, which is equivalent to the decrease in the number of Taiwanese firms. However, Taiwanese firms still dominate among FDI firms in the manufacturing sector. The proportion of Japanese firms has remained relatively unchanged over the years, at about 13 per cent. Similarly, Taiwanese and Korean firms create the most jobs for the manufacturing sector (Figure 3), while the portion of jobs created by Japanese firms fluctuated around 13 per cent from 2005 to 2018.

Although the number of firms and the number of workers in Japanese firms are less than for Korean and Taiwanese firms, Japanese firms create no less revenue than their two counterparts (Figure 4). Figure 4 also shows a rapid increase in revenue for Singaporean firms. In 2005, they were far below the top three countries, but after 2012, revenue increased steeply, and Singaporean firms remained in first place in this regard until 2018.

Importantly, Japanese firms have more capital and are more technology-intensive[2] than Korean and Taiwanese firms in Vietnam. More specifically, the average ratios of fixed capital and asset depreciation to workers for Japanese firms are VN$658.11 million/per worker and VN$290.77 million/per worker, respectively. These ratios for Taiwanese firms are VN$368.27 million/per worker and VN$225.47 million/per worker, respectively, and those for Korean firms are VN$441.89 million/per worker and VN $137.39 million/per worker, respectively. Thus, Japanese firms use more capital and technology than Korean and Taiwanese firms in Vietnam.

Generally, Japanese firms play an important role in the development of the manufacturing sector in Vietnam. Along with Korean and Taiwanese firms, they contribute significantly to revenue and job creation in

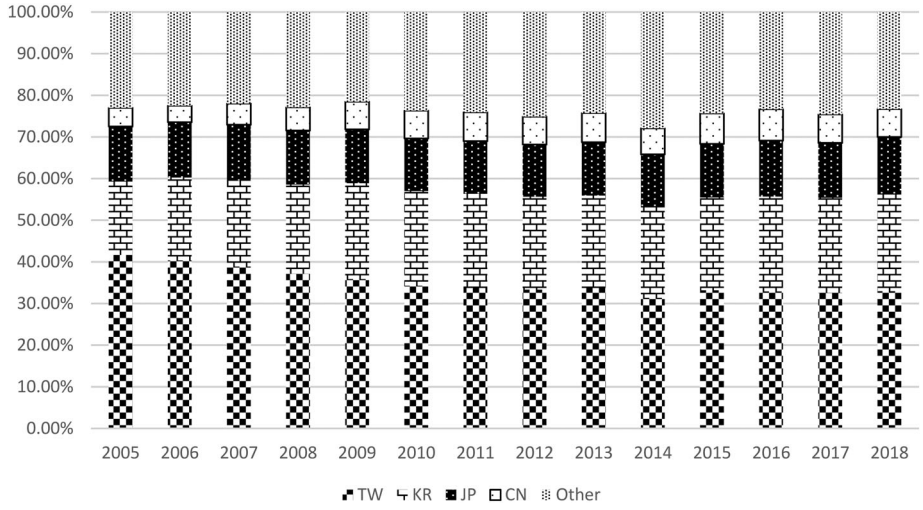
**Figure 1**
**Proportion of Japanese firms by sector (from 2005 to 2018)**




**Source:** Annual Enterprises Survey.

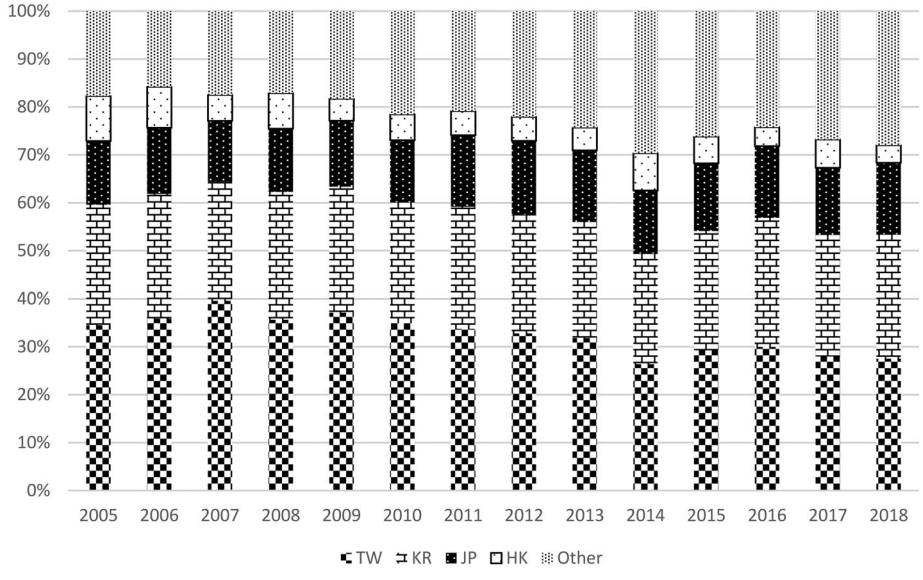
[2] Capital intensity is measured by fixed capital per worker, while technology intensity is measured by asset depreciation per worker.

**Figure 2**
**Number of FDI firms in Vietnam (%)**




**Source:** Annual Enterprises Survey.

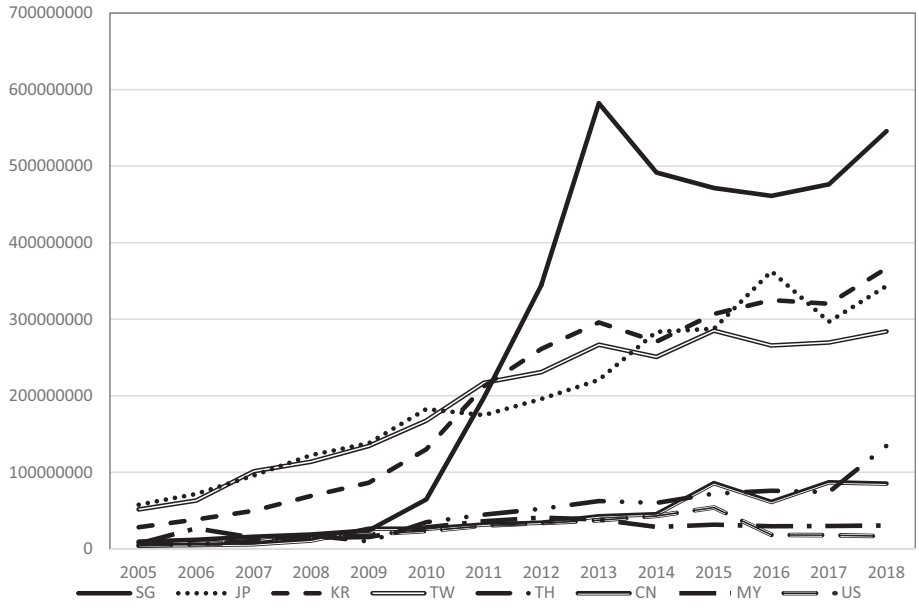
**Figure 3**
**Workers in FDI firms (%)**




**Source:** Annual Enterprises Survey.

the sector. Additionally, Japanese firms are more productive than Korean and Taiwanese firms in that they produce more revenue with fewer workers. Given the importance and contribution of Japanese firms, we argue that the spillover effects of Japanese firms are essential as well. Therefore, the paper focuses on the spillovers of Japanese firms.

**Figure 4**
**Total revenue for FDI firms by ownership from 2005 to 2018 (VN$ million)**




**Source:** Annual Enterprises Survey.

## Hypothesis development

Spillovers can be seen as externalities resulting from the operation of FDI firms in host countries, and they have productivity and efficiency benefits for local firms. Note that FDI firms may not intentionally create spillover effects; still, the spillover effects will occur when FDI firms appear and operate in host countries. These could take the form of horizontal effects or vertical effects. The horizontal effect can affect domestic firms in the same industry/sector as FDI firms, and it can occur due to competition, labour turnover or learning by doing (Blomstrom and Kokko 1998). The most visible way for domestic firms to improve their productivity or efficiency is to copy advanced technology from foreign partners (learning by doing). However, this is not the only way, as the FDI firms may not want to share technology, or even if they want to share it, the local firms may not be able to apply it in practice. Another kind of spillover occurs when FDI firms with advanced technology and management skills place high pressure on domestic firms via competition. Consequently, the latter must improve themselves. Alternatively, improvement occurs when local firms can hire workers who have been trained well in FDI firms (labour turnover; Blomstrom and Kokko 1998). The vertical effect can influence domestic firms in other industries/sectors, and there are two types of vertical effects, which involve backward and forward linkage. Spillovers with backward linkage can occur via direct or indirect technical support from foreign clients to local suppliers, or it may come from the high requirements from the FDI side regarding the quality of goods and services. Regarding forward linkage, domestic firms can certainly benefit as clients of FDI firms. They can improve productivity by using better inputs or services from foreign counterparts (Javorcik 2004). In terms of other perspectives, Bloom et al. (2013) argue that the positive impact of technology transfer and the negative impact of business stealing effects can

occur simultaneously. The authors develop a new Mahalanobis measure and incorporate the two types of spillovers in the case of the United States. The Mahalanobis norm is utilised to measure the distance between distinct technology classes by assessing the frequency of patents taken out in those classes by the same firm, which can be used to measure spillovers. Empirically, several papers point out the impact of spillovers across countries such as Lithuania (Javorcik 2004), Indonesia (Blomström and Sjöholm 1999), China (Cheung and Lin 2004; Liu 2008), Taiwan (Chen et al. 2022), Croatia and Slovenia (Vujanovic et al. 2021), Malaysia (Zhang and Yang 2022), and EU and OECD countries (Pietrucha and Zelazny 2020). In Vietnam, several authors found the impact of FDI spillover through vertical linkages (Anwar and Nguyen 2010; Le and Pomfret 2011) and horizontal effects (Vu 2016; Vu and Le 2017).

Additionally, the literature highlights the importance of absorptive capacity in the link between FDI spillover effects and domestic firms. The presence and operation of FDI firms do not automatically generate impacts on domestic firms; rather, such impacts are conditional on the absorptive capacity of domestic firms (Chen et al. 2011; Crespo and Fontoura 2007; Moralles and Moreno 2020; Razzaq et al. 2021; Shen et al. 2021; Vu 2020). The first definition of absorptive capacity is that it is 'the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends' (Cohen and Levinthal 1990, p. 1). Absorptive capacity is accumulative, and it requires prior knowledge. Firms should be at a certain level of related knowledge before cooperating/competing with FDI firms. At the individual level, workers at firms require prior knowledge, and accumulatively, at the firm level, the absorptive capacity of firms depends on the capabilities of their members. However, it is not a summation, as the absorptive capacity of firms also reflects their organisational structures and management (Vu 2018). Based on the initial definition of Cohen and Levinthal, several papers have developed the definition and measurement of absorptive capacity. Some papers focus on the within-firm aspect of absorptive capacity, including internal knowledge transfer (Szulanski 1996), knowledge complementarity and knowledge resource diversification (Zahra and George 2002), or the interaction between the micro level (workers) and the firm level (Martinkenaite and Breunig 2015). Some other papers pay more attention to the interfirm aspect of absorptive capacity, which highlights the importance of appropriate partner selection (Dyer and Singh 1998; Lane and Lubatkin 1998). It implies that firms can improve their capability if they can choose a good cooperation partner with similar characteristics. The measure of absorptive capacity varies from R&D intensity and expenditures to patents. However, it is necessary to consider interfirm and intrafirm factors when measuring absorptive capacity (Vu 2018). The author examines the capability of firms as the within-firm factor and the gap between domestic firms and foreign firms as the interfirm factor. Similarly, Aldieri (2013) underlines the importance of technology proximity in technology spillovers, and spillovers occur not only within the same technology class[3] but also between classes. The author also exploits the Mahalanobis norm to examine the spillover between technology classes. The distance between classes is measured using the difference in the frequency of patents received by the same firm as compared to other sectors. In the case of Vietnam, Vu (2020) and Vu and Le (2017) examine the impact of absorptive capacity in Vietnam, but these authors only examine the issue for all FDI firms in Vietnam. Several papers examine the spillover and the role of absorptive capacity but no paper examines the sole effect of one group of foreign investors. Singling out one foreign group will lead to direct empirical contributions. First, the methodology used for one foreign group can be replicated with

[3] The technology classes are based on the USPTO patent classification system: https://www.uspto.gov/web/patents/classification/selectnumwithtitle.htm.

other foreign groups, and then, it will be possible to draw a comparison. Second, it helps foreign and domestic firms choose the correct partners for cooperation. To the knowledge of the author, no paper examines the impact of the Japanese spillover effect on the role of absorptive capacity in this link in Vietnam. Therefore, this paper takes a further step by considering the absorptive capacity of Vietnamese manufacturing firms due to cooperation with Japanese firms specifically.

H1. The absorptive capacity of domestic firms can affect the impact of FDI spillovers from Japanese firms on domestic firms in Vietnam.

Additionally, there may be a threshold for absorptive capacity, or in other words, if domestic firms cannot reach a certain level of absorptive capacity, then they benefit from FDI spillovers. Kokko et al. (1996) measured absorptive capacity using the gap in technology between Uruguay firms and FDI firms, and the authors stated that positive spillovers only occur if the technology gap is moderate. More specifically, the impact of FDI spillovers can be either positive or negative depending on the level of absorptive capacity for domestic firms (Girma 2005). Absorptive capacity, in Girma's paper, is the distance in the technological frontier between firms and the top firms in a given industry. The findings in the paper suggest the presence of minimum and optimal absorptive capacity threshold levels, below which the productivity spillovers from FDI become negligible or even negative, indicating an inverted U-shaped effect, particularly in sectors in which technology-exploiting foreign investment is widespread. Criscuolo and Narula (2008) test the non-linear relationship between absorptive capacity and the technology gap by creating the four stages of technological development: the pre-catching-up stage, the catching-up stage, the pre-frontier-sharing stage and the frontier-sharing stage. At the pre-catching-up stage, the host country builds up its absorptive capacity through its R&D activities. At this phase, the contribution of FDI to the host country's knowledge accumulation is too small, as this requires a threshold level of absorptive capacity. During the catching-up phase, the already acquired absorptive capacity helps to exploit and assimilate FDI spillovers at a rapid rate. This will continue until the host country reaches the pre-frontier-sharing phase, in which the exploitation and assimilation of spillovers continue at a slower rate. Finally, when the country reaches the frontier-sharing stage, there will be a limited amount of new external knowledge to absorb. Consequently, extending this idea to a firm level, it is plausible to believe that domestic firms that are both too close to and too far from the foreign technology frontier will benefit least from FDI productivity spillovers. Anwar and Sun (2019) argue that FDI spillovers can generate direct and indirect effects that have opposite impacts. If the direct effect is positive (negative), then the indirect effect is negative (positive). Moralles and Moreno (2020) show that Brazilian firms may suffer from negative spillover effects but they can enjoy positive impacts if they have high absorptive capacity. Guo et al. (2022) use the panel data for firms in China from 2009 to 2015 to examine the idea that absorptive capacity affects the relationship between FDI spillovers and domestic firm performance. Absorptive capacity is measured using human capital and R&D strategy. Consequently, we detect two threshold points for human capital and one threshold point for R&D strategy in the case of China. In the case of Vietnam, Vu (2020) finds the threshold for absorptive capacity that domestic firms must reach to benefit from all FDI firms. However, no papers examine the impact of such a threshold in the case of Japanese spillover effects in Vietnam. As Japan is one of the main investors in Vietnam, it is important to single out Japanese firms when studying their spillover effects and the threshold for domestic absorptive capacity that must be reached to benefit from them.

H2. There is a threshold for FDI absorptive capacity that Vietnamese manufacturing firms must reach to be affected by the Japanese spillover effect.

## Methodology

### Estimation method

The paper uses the log-linear Cobb–Douglas production function (Aitken and Harrison 1999; Konings 2001). Specifically, the model development is based on the Cobb–Douglas production function, in which the output of firms is a function of production inputs as follows:

$$Y_i = A_i.L_i^{\alpha}.K_i^{\beta}.H_i^{\gamma} \quad (1)$$

where $Y$ is the output of firm $i$, $L$ is the number of workers, $K$ is stock physical capital, $H$ is human capital, and $A$ is total factor productivity. To measure the labour productivity of firm $i$, it is necessary to divide both sides by $L$; then, the equation becomes as follows:

$$\frac{Y_i}{L_i} = A_i.\left(\frac{K_i}{L_i}\right)^{\gamma}.\left(\frac{H_i}{L_i}\right)^{\gamma} \quad (2)$$

Taking the logarithm of both sides of the equation, we have the following:

$$\mathrm{Ln}(y_i) = \mathrm{Ln}(A_i) + \beta \mathrm{Ln}(k_i) + \gamma \mathrm{Ln}(hc_i) \quad (3)$$

After adding spillover variables, other control variables, random disturbance terms and the time ($t$) and sector ($j$) indexes, the estimated model is as follows:

$$y_{ijt} = \alpha + \alpha_i + \beta_1 k_{ijt} + \beta_2 hc_{ijt} + \beta_3 \mathrm{spill}_{jt} + \beta_4 \mathrm{spill}_{jt} * AC_{ijt} + \beta_5 AC_{ijt} + \beta_6 X_{ijt} + \varepsilon_{ijt} \quad (4)$$

The main purpose of the regression is to estimate the FDI spillover effects on the output of domestic firms and, then, examine the role of absorptive capacity in this relationship. In Equation 4, $i$ is firm $i$, $j$ is sector $j$, and $t$ is time $t$. Also, $y$ is the output of a domestic firm, which is presented by labour productivity (sale revenue/worker); $k$ is the capital per worker of the domestic firm and hc is the human capital per worker. Spill is FDI spillovers and includes four measurements: horizontal labour effect, horizontal competition effect (Horizontal_labour and Horizontal_comp), backward labour linkage, and backward competition linkage (Backward_labour and Backward_comp). The first hypothesis will be tested by estimating Equation 4.

The interaction term is created to examine the mediating role of absorptive capacity (AC) in the link between FDI and domestic firms. $X$ is the set of other control variables; $y$, $k$, and $hc$ are in logarithm transformation and $\alpha$ is an intercept. Constructions of absorptive capacity have followed the methodology of Vu (Vu 2020), as follows:

$$\mathrm{AC}_{ijt} = \frac{\mathrm{DPE}_{ijt}}{\overline{\mathrm{FPE}_j}} \times 100 \quad (5)$$

$\mathrm{AC}_{ijt}$ represents the absorptive capacity of domestic firm $i$ in industry $j$ at time $t$, and $\mathrm{DPE}_{ijt}$ is the persistent efficiency of domestic firm $i$ in industry $j$ in time $t$. Persistent efficiency is a component of technical efficiency. Technical efficiency is decomposed into latent heterogeneity, persistent efficiency, random shock and time-varying inefficiency. These components are estimated by following the approach of Kumbhakar et al. (2014). $\overline{\mathrm{FPE}_j}$ is the mean value of persistent efficiency for foreign firms in sector $j$ over the years.

There are two common issues in panel data empirical research on the topic of productivity, which are the correlation between the fixed-effect and explanatory variables and the endogeneity of the explanatory variables (Caselli et al. 1996; Elmawazini and Saleeby 2018). To overcome the problem, we apply the GMM Arellano-Bover/Blundell-Bond system estimator with the dynamic panel data. The estimator is suitable for datasets with long panels and short periods. This means that Equation 4 becomes as follows:

$$y_{ijt} = \alpha + \alpha_i + \emptyset y_{ijt-1} + \beta_1 k_{ijt} + \beta_2 hc_{ijt} + \beta_3 \mathrm{spill}_{jt} + \beta_4 \mathrm{spill}_{jt} \times \mathrm{AC}_{ijt} + \beta_5 \mathrm{AC}_{ijt} + \beta_6 X_{ijt} + \varepsilon_{ijt} \quad (6)$$

We have chosen the two-step system GMM to avoid the problem of weak instruments and provide more asymptotic efficiency. Additionally, there is potential endogeneity among explanatory variables, as follows: first, firms may choose the optional level of inputs, including labour and capital. Therefore, there may be a correlation between inputs and unobserved firm- and sector-specific productivity processes, and this can lead to simultaneity and endogeneity (Levinsohn and Petrin 2003). Secondly, the spillover effects variables can be endogenous, as FDI firms may choose sectors with high levels of productivity. Therefore, in the two-step GMM, *k*, *hc*, and spill are considered endogenous variables, and the instruments are their lagged values. $\alpha_i$ captures the firm-specific and sector-specific fixed effects, which will be eliminated after finding the first difference.

Then, the second hypothesis is tested by applying the dynamic panel data threshold effects model with endogenous regressors as follows:

$$\begin{aligned} y_{ijt} = {} & \alpha + \alpha_i + + \emptyset y_{ijt-1} + \beta_1 k_{ijt} + \beta_2 hc_{ijt} \\ & + \beta_3 \text{spill}_{jt} + \theta_1 \text{spill}_{jt} I\left(\text{AC}_{ijt} < \gamma_1\right) \\ & + \theta_2 \text{spill}_{jt} I\left(\text{AC}_{ijt} \geq \gamma_1\right) + \beta_5 X_{ijt} + \varepsilon_{ijt} \end{aligned} \tag{7}$$

where $I(\cdot)$is the indicator function and AC is absorptive capacity. The paper is based on the estimation method of Kremer et al. (2013), in which GMM is used to control for endogeneity in the dynamic panel data. As in Equation 6, the endogenous variables are *k*, *hc*, and spill. The results show whether there are thresholds for absorptive capacity among domestic firms. If so, the results show the estimated level of absorptive capacity that allows domestic firms to benefit from the spillovers of Japanese firms.

## Data

The paper exploits the panel data from 2005 to 2018, which were constructed using the Vietnamese Annual Survey. The survey is conducted yearly by the General Statistics Office of Vietnam. It is an official database at the firm level for Vietnam. The survey includes information about revenue, labour, fixed capital, year of establishment, sector, ownership, location, wages, and other financial indicators. As the threshold model requires strongly balanced panel data, there are 2383 repeated observations every year, including 115 Japanese firms and 2268 domestic firms.

In Equations 1 and 3, *y* is the output of a domestic firm, which is measured by the logarithm of total revenue per worker; *k* is the logarithm of fixed capital for a domestic firm per worker; and *hc* is human capital, which is measured using the logarithm of wages per worker. Spill is FDI spillovers which are measured as follows based on the methodology of Javorcik (2004):

$$\text{Horizontal}_{jt} = \frac{\sum_{i \in j} \text{Foreign share}_{it} \times A_{it}}{\sum_{i \in j} A_{it}} \tag{8}$$

where $A_{it}$ is the revenue of firm *i* in industry *j* or the total labour of firm *i* in industry *j*. As the foreign share of FDI firms is not available, $\sum_{i \in j} \text{Foreign share}_{it} \times A_{it}$ is replaced by $\sum_{i \in j} a_{it}$, where $a_{it}$ is the revenue or total labour of foreign firm *i* in industry *j*. We examine the horizontal effect by using both revenue and labour to create Horizontal_labour and Horizontal_comp. The first proxies for the labour turnover horizontal effect, and the second proxies for the competition horizontal effect.

$$\text{Backward}_{jt} = \sum_{k \neq j} a_{jk} \times \text{Horizontal}_{kt} \tag{9}$$

$a_{jk}$ is the proportion of industry *j*'s output consumed by industry *k*. Note that $k \neq j$. This coefficient is collected from the Input–Output in Vietnam in 2012. It is assumed that this coefficient does not change from 2005 to 2018. As there are two measurements of the horizontal effect, there are two equivalent backward variables: Backward_labour and Backward_comp. Note that we do not consider the forward linkage, because in the case of Vietnam, it is unlikely that foreign firms act as input

**Table 1**
**Variable description**

| Variable | | Unit | Mean | SD | Min | Max |
|---|---|---|---|---|---|---|
| *y* | Log of revenue per worker | % | 5.7 | 1.4 | −0.8 | 13.1 |
| *k* | Log of Capital per worker | % | 4.2 | 1.5 | −4.8 | 10.7 |
| *hc* | Log of Wage per worker | % | 3.6 | 0.9 | −3 | 9 |
| pci | Institutions | index | 60.6 | 5.5 | 36.4 | 77.2 |
| age | Age | year | 12.7 | 6 | 1 | 24 |
| size | Log of total assets | % | 10 | 1.9 | 0 | 17.3 |
| Horizontal_labour | Horizontal_labour | % | 8.3 | 12.4 | 0.6 | 91.6 |
| Backward_labour | Backward_labour | % | 5.3 | 9.7 | 0.1 | 58.9 |
| Horizontal_comp | Horizontal_comp | % | 10.2 | 13.5 | 1.3 | 95.1 |
| backward_comp | Backward_comp | % | 5.8 | 10.1 | 0.1 | 63.1 |
| AC | Absorptive capacity | % | 91.1 | 22.2 | 0.6 | 315.6 |

**Source:** Author.

providers for Vietnamese manufacturing firms (Khanh and Binh 2023). In Vietnam, backward participation is much more common than forward participation (OECD 2021).

*X* is the set of other control variables, including institutions, age, and firm size. Institutions is proxied by the Provincial Comptitiveness Index (PCI index), which is widely used in the case of Vietnam (Vu and Le 2017; Vu 2020). The index is constructed via three steps: gathering data from business surveys and published sources; computing nine sub-indices and normalising them to a 10-point scale and establishing the composite PCI by calibrating it as the weighted average of the nine sub-indices, with a maximum achievable score of 100 points.[4] The size of a firm is measured by using the logarithm of the total assets of the firm. The year and sector dummy variables are also added to control for the effect over the years and across sectors. The variable description can be seen in Table 1:

## Estimation results and discussion

### Spillover effects and the role of absorptive capacity

The Arellano–Bond test shows that there is no autocorrelation between the first differenced errors (Appendix A). Therefore, the GMM with dynamic panel data is not mis-specified. Model 1 shows that the labour productivity of domestic firms is positively affected by the previous level of labour productivity, size, capital, human capital, and absorptive capacity of domestic firms.

More importantly, Model 1, in Table 2, shows the impact of the spillover effects of Japanese firms on the productivity of Vietnamese manufacturing firms from 2005 to 2018. The paper calculates two horizontal effects, which are based on labour and revenue. The first presents the labour turnover effect, while the second presents the competition effect of Japanese firms. The labour turnover effect occurs when workers in Japanese firms move to local firms and increase these local firms' productivity. The competition effect occurs when the appearance of Japanese firms generates competition pressure on domestic firms, and in that case, the domestic firms must improve their productivity. The paper examines the impact of both horizontal effects. There are two measures of backward linkages: based on competition and based on labour turnover. Note that a forward impact is unlikely to occur because Japanese firms are rarely providers for Vietnamese manufacturing firms; therefore, we do not consider forward linkage in our models. Model 1 finds

[4] For further detail, please look at http://eng.pcivietnam.org/.

**Table 2**
**Estimation results**

| Dependent: Productivity | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| L.Productivity | 0.2182*** | 0.1987*** | 0.2180*** | 0.1966*** |
| | (0.0146) | (0.0133) | (0.0062) | (0.0133) |
| Size | 0.1178*** | 0.1099*** | 0.1177*** | 0.1107*** |
| | (0.0204) | (0.0207) | (0.0087) | (0.0208) |
| Capital | 0.2281*** | 0.2522*** | 0.2274*** | 0.2515*** |
| | (0.0179) | (0.0180) | (0.0074) | (0.0180) |
| Human capital | 0.2011*** | 0.1851*** | 0.1970*** | 0.1916*** |
| | (0.0345) | (0.0344) | (0.0150) | (0.0345) |
| Institutions | −0.0001 | 0.0020 | 0.0001 | 0.0020 |
| | (0.0015) | (0.0014) | (0.0008) | (0.0014) |
| Absorptive capacity | 0.0245*** | 0.0298*** | 0.0243*** | 0.0298*** |
| | (0.0006) | (0.0005) | (0.0003) | (0.0005) |
| Age | −0.0016+ | −0.0018* | −0.0018*** | −0.0017+ |
| | (0.0009) | (0.0009) | (0.0005) | (0.0009) |
| Horizontal_labour | 0.0100*** | 0.0137*** | 0.0085*** | 0.0130*** |
| | (0.0023) | (0.0025) | (0.0015) | (0.0025) |
| Horizontal_comp | −0.0025 | −0.0064** | −0.0028*** | −0.0057** |
| | (0.0020) | (0.0022) | (0.0007) | (0.0022) |
| Backward_labour | −0.0247*** | 0.0444*** | −0.0243*** | −0.0194*** |
| | (0.0041) | (0.0046) | (0.0022) | (0.0041) |
| Backward_comp | 0.0147*** | 0.0069+ | 0.0145*** | 0.0613*** |
| | (0.0038) | (0.0036) | (0.0019) | (0.0043) |
| AC × Backward_labour | | −0.0005*** | | |
| | | (0.0000) | | |
| AC × Horizontal_labour | | | 0.0003*** | |
| | | | (0.0000) | |
| AC × Backward_comp | | | | −0.0005*** |
| | | | | (0.0000) |
| Constant | −0.3649 | −0.8374*** | −0.0067 | −0.8469*** |
| | (0.2452) | (0.2426) | (0.1384) | (0.2427) |
| Observation | 29,484 | 29,484 | 29,484 | 29,484 |
| Year dummy | Yes | Yes | Yes | Yes |
| Sector dummy | Yes | Yes | Yes | Yes |

**Note:** The dependent variable (Productivity) is revenue per worker. The models are estimated by the two-step GMM with endogeneity. + significant at the 10 per cent level, * significant at the 5 per cent level, ** significant at 1 per cent level, *** significant at 0.1 per cent level. Robust standard errors in the parenthesis are adjusted for heteroskedasticity and region cluster.
**Source:** Author.

positive and significant impacts on the part of Horizontal_labour and Backward_comp. This implies that labour movement from Japanese firms to domestic firms in the same sector has a positive impact on the productivity of the latter (Horizontal_labour). At the same time, the appearance of Japanese firms also creates a positive competition effect for domestic firms in other sectors (Backward_comp). Note that the competition does not stem directly from Japanese firms, as in backward linkage; rather, the local firms are providers for Japanese firms. The competition stems from other local firms or foreign firms competing with one another to be providers for Japanese firms. The horizontal labour effect is slightly lower than the backward competition effect (0.01 compared to 0.0147). A 1 per cent increase in the horizontal competition effect and backward competition effect of Japanese firms leads to a 0.01 and 0.0147 per cent increase in the productivity of domestic firms. However, Model 1 finds a negative impact for the horizontal competition effect and

backward labour effect, but only that for the backward labour effect is statistically significant. Therefore, it is possible to say that the operation of Japanese firms generates a negative backward labour effect on domestic firms in other sectors. This situation may arise when employees transitioning from Japanese companies to Vietnamese manufacturing firms underperform but still receive higher salaries as compared to their counterparts. The results show that labour movement from Japanese firms to Vietnamese manufacturing firms when the latter are providers for the former, has a negative effect on the productivity of local firms.

Models 2, 3, and 4, in Table 2, examine the role of absorptive capacity in the link from spillovers to the productivity of domestic firms. The interaction terms between absorptive capacity and the three spillover variables that are statistically significant in Model 1 are generated. The coefficient of the interaction term in Model 2 is negative and statistically significant, which implies that absorptive capacity reduces the negative impact of the backward labour effect of Japanese firms. Note that in Model 1, backward labour is negative. Therefore, the absorptive capacity of domestic firms may lessen the negative impact of backward labour. More specifically, the main effect of backward labour for firms with a medium level of absorptive capacity is $91.04 \times (-0.0005) + (0.044) = -0.0015$. This means that for domestic firms with a medium level of absorptive capacity, a 1 per cent increase in the backward labour effect only leads to a 0.0015 per cent decrease in productivity, which is less than the 0.025 per cent indicated in Model 1. Furthermore, absorptive capacity helps boost the positive impact of the horizontal labour effect in Model 3. The coefficient of the interaction term is positive and statistically significant. A 1 per cent increase in the horizontal labour effect leads to a 0.035 per cent increase ($91.04 \times (0.0003) + (0.0085) = 0.035$) in the productivity of firms that have an average level of absorptive capacity.

Interestingly, Model 4 shows that the absorptive capacity of domestic firms has a negative impact on the link between the backward competition effect and the productivity of domestic firms. The coefficient of the interaction terms in Model 4 is negative and statistically significant. This result means that if firms have a higher level of absorptive capacity, the benefit from backward competition is lower. The backward effect occurs when Vietnamese manufacturing firms are the suppliers for Japanese firms in other sectors. Therefore, the backward competition effect can be understood as the competition with other domestic firms or foreign firms to be suppliers for Japanese firms. In this case, the negative impact of absorptive capacity indicates that when domestic firms have good absorptive capacity, they have a higher chance of being a supplier to Japanese firms. Consequently, they face less competition from other firms. The positive pressure from competition is lower for them, and as a result, they benefit less from the backward competition effect.

Generally, the results confirm the role of the absorptive capacity of domestic firms in the link from Japanese spillovers to the productivity of domestic firms. More specifically, absorptive capacity helps reduce the negative impact of the backward labour effect and increase the positive impact of the horizontal labour effect. However, the results also show that absorptive capacity may reduce the positive impact of the backward competition effect. Next, the paper points out the thresholds, if possible, for absorptive capacity at which both domestic and Japanese firms can decide to cooperate.

## The threshold for absorptive capacity

Table 3 shows the results of the threshold models. The threshold variable is absorptive capacity, and the threshold-dependent variables are Horizontal_labour, Backward_labour, and Backward_comp, which are statistically significant in the previous models. The results in Table 3 detect the threshold for absorptive capacity that can affect the impact of spillovers on the performance of domestic firms. All coefficients of the spillover variables

below and above the threshold are statistically significant in Models 5, 6, and 7.

Model 5 shows the threshold for absorptive capacity for domestic firms, which is 84.91. Domestic firms can be divided into two subgroups based on their absorptive capacity, and each group receives a different level of impact from Japanese horizontal labour linkage. Note that the main effect of horizontal labour is 0.01 in Model 1 and Model 5, showing that if domestic firms have a higher level of absorptive capacity, the positive impact is 0.0124, and if domestic firms have a lower level of absorptive capacity, the impact is only 0.0088. In this case, the presence of the threshold can be interpreted in the following way. Japanese firms generate a positive horizontal labour effect and all domestic firms can enjoy the associated externalities. However, firms with higher absorptive capacity, meaning above the threshold of 84.91, enjoy greater benefits than firms with lower absorptive capacity. This may be not a bad thing, but it can lead to changes in the productivity of domestic firms in the future. The situation is different in Model 7 when the impacts of Backward_labour below and above the threshold of absorptive capacity are both negative. However, as the main effect of Backward_labour is negative in Model 1, the result of the threshold model can be interpreted as follows. The absorptive capacity of domestic firms cannot turn the negative impact of the backward labour effect into a positive one, but firms with an absorptive capacity of more than 75.07 suffer less than firms with lower absorptive capacity. The negative impact of backward labour can be lessened for domestic firms with higher levels of absorptive capacity.

The threshold effect of absorptive capacity can be seen most clearly in Model 6. The threshold for absorptive capacity here is 75.07, and if domestic firms have lower absorptive capacity, Japanese firms may have a negative backward competition effect. Firms with a higher level of absorptive capacity can enjoy the benefits of the backward competition effect. Notably, the absolute value of the coefficient of Backward_comp <75.07 is higher than that of Backward_comp >75.07 (0.0214 and 0.186), and this implies that if domestic firms do not reach a certain level of absorptive capacity, the negative impact is larger.

## Discussion

Generally, this paper shows that the Japanese horizontal and backward spillover effect impacts the productivity of domestic firms. Additionally, the paper also shows that there are thresholds for absorptive capacity, with which the impact of spillovers varying on either side.

In terms of the horizontal effect, the paper only finds a positive and significant impact. This implies that domestic firms that operate in the same sector as Japanese firms can enjoy the benefits of labour movement. Such benefits accrue when workers from Japanese firms who have been trained to a higher degree or have higher skills than domestic workers move to domestic firms and, consequently, help improve productivity. However, it is important to point out that the positive impact of horizontal labour varies based on the absorptive capacity of domestic firms. If the absorptive capacity of domestic firms is higher than 84.91, they can enjoy more benefits from labour movement from Japanese firms. If this value is less than 84.91, the positive impact is also less.

The backward effect occurs when domestic firms cooperate with Japanese firms as providers. In other words, Japanese firms use the products or services of domestic firms as inputs for their production or services. The paper examines the backward competition and backward labour effects and finds a positive impact for the former and a negative impact for the latter. Both coefficients are statistically significant. When cooperating with Japanese firms in other sectors, Vietnamese manufacturing firms can benefit from competition pressure (Backward_comp), but at the same time, they may suffer due to labour movement (Backward_labour). However, if domestic firms can reach a certain level of absorptive capacity, then the negative impact

**Table 3**
**Threshold model results**

| Dependent: Productivity | Model 5 | Model 6 | Model 7 |
|---|---|---|---|
| L.Productivity | 0.1889*** | 0.2926*** | 0.2951*** |
| | (0.0251) | (0.0219) | (0.0221) |
| Size | −0.1160 | 0.0082 | 0.0128 |
| | (0.0751) | (0.0351) | (0.0352) |
| Capital | 0.1404*** | 0.1052*** | 0.0985*** |
| | (0.0418) | (0.0224) | (0.0223) |
| Human capital | 0.5112*** | 0.3094*** | 0.3057*** |
| | (0.0693) | (0.0425) | (0.0420) |
| Institutions | 0.0122 | 0.0066 | 0.0071 |
| | (0.0105) | (0.0098) | (0.0098) |
| Age | 0.0070 | 0.0213*** | 0.0217*** |
| | (0.0079) | (0.0049) | (0.0049) |
| Horizontal_comp | −0.0107*** | −0.0036 | −0.0035 |
| | (0.0026) | (0.0027) | (0.0027) |
| Backward_comp | 0.0021 | | 0.0147* |
| | (0.0044) | | (0.0072) |
| Backward_labour | 0.0044 | −0.0349*** | |
| | (0.0069) | (0.0096) | |
| Horizontal_labour | | 0.0055+ | 0.0055+ |
| | | (0.0031) | (0.0031) |
| Horizontal_labour < 84.91 | 0.0088** | | |
| | (0.0031) | | |
| Horizontal_labour > 84.91 | 0.0124*** | | |
| | (0.0033) | | |
| Backward_comp < 75.07 | | −0.0214* | |
| | | (0.0104) | |
| Backward_comp > 75.07 | | 0.0186* | |
| | | (0.0073) | |
| Backward_labour < 74.67 | | | −0.0694*** |
| | | | (0.0137) |
| Backward_labour > 74.67 | | | −0.0288** |
| | | | (0.0095) |
| Constant | 2.4866** | 1.8227** | 1.7550** |
| | (0.8254) | (0.6056) | (0.6037) |
| Year_dummy | Yes | Yes | Yes |
| Sector dummy | Yes | Yes | Yes |
| Observation | 29,484 | 29,484 | 29,484 |
| Threshold variable | AC | AC | AC |

**Note:** The dependent variable (Productivity) is revenue per worker. The models are estimated by the two-step GMM with endogeneity. + significant at the 10 per cent level, * significant at the 5 per cent level, ** significant at 1 per cent level, *** significant at 0.1 per cent level. Robust standard errors in the parenthesis are adjusted for heteroskedasticity and region cluster.
**Source:** Author.

of backward labour will be reduced, and they can benefit more significantly from the backward competition effect. However, if they fail to reach the absorptive capacity threshold, they will be negatively impacted by both the backward competition and labour effects. Therefore, it is not a question of how to become involved in the production chain of Japanese firms but of how to benefit from this cooperation. If domestic firms are unable to improve themselves and increase their absorptive capacity, joining the production chain can be a bad decision. Note that the absorptive capacity of any domestic firm can be estimated from the production function, and in such cases, it can be a good indicator

**Table 4**
**Robustness check**

| | Full sample | Exports | Non-exports | Red River Delta | Mekong River Delta | The rest |
|---|---|---|---|---|---|---|
| L.Productivity | 0.2926*** | 0.232*** | 0.240*** | 0.328*** | 0.290*** | 0.263*** |
| | (0.0219) | (0.042) | (0.028) | (0.029) | (0.029) | (0.032) |
| Size | 0.0082 | 0.064 | −0.100* | 0.041 | −0.035 | 0.028 |
| | (0.0351) | (0.066) | (0.043) | (0.048) | (0.037) | (0.051) |
| Capital | 0.1052*** | 0.033* | 0.124*** | 0.133*** | 0.095*** | 0.081* |
| | (0.0224) | (0.038) | (0.026) | (0.027) | (0.025) | (0.035) |
| Human capital | 0.3094*** | 0.278*** | 0.354*** | 0.300*** | 0.132** | 0.299*** |
| | (0.0425) | (0.063) | (0.050) | (0.046) | (0.051) | (0.056) |
| Institutions | 0.0066 | −0.001 | 0.006 | 0.014 | −0.025** | 0.041** |
| | (0.0098) | (0.017) | (0.010) | (0.010) | (0.009) | (0.013) |
| Age | 0.0213*** | 0.011 | 0.005 | 0.002 | 0.040*** | 0.004 |
| | (0.0049) | (0.008) | (0.004) | (0.005) | (0.007) | (0.006) |
| Horizontal_comp | −0.0036 | −0.005 | −0.003 | −0.010* | 0.003 | 0.009+ |
| | (0.0027) | (0.007) | (0.005) | (0.004) | (0.003) | (0.005) |
| Horizontal_labour | 0.0055+ | 0.011 | 0.006 | 0.010* | −0.001 | −0.01 |
| | (0.0031) | (0.008) | (0.005) | (0.005) | (0.003) | (0.007) |
| Backward_labour | −0.0349*** | −0.032** | −0.012 | −0.020** | −0.014* | −0.012 |
| | (0.0096) | (0.011) | (0.009) | (0.007) | (0.006) | (0.009) |
| Backward_comp < | −0.0214* | −0.040** | −0.032** | −0.041*** | −0.021* | −0.018* |
| threshold level | (0.0104) | (0.015) | (0.012) | (0.011) | (0.010) | (0.009) |
| Backward_comp > | 0.0186* | 0.019* | 0.003 | 0.022*** | 0.016* | 0.009 |
| threshold level | (0.0073) | (0.009) | (0.007) | (0.006) | (0.006) | (0.007) |
| Constant | 1.8227** | 2.533* | 3.335*** | 0.965* | 4.830*** | −0.103 |
| | (0.6056) | (1.276) | (0.527) | (0.402) | (0.753) | (0.685) |
| Year_dummy | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector dummy | Yes | Yes | Yes | Yes | Yes | Yes |
| Observation | 29,484 | 6774 | 16,399 | 7176 | 10,968 | 11,340 |
| Threshold level | 75.07 | 75.339 | 72.703 | 75.261 | 72.978 | 77.401 |
| Threshold variable | AC | AC | AC | AC | AC | AC |

**Note:** The dependent variable (Productivity) is revenue per worker. + significant at the 10 per cent level, * significant at the 5 per cent level, ** significant at 1 per cent level, *** significant at 0.1 per cent level. Robust standard errors in the parenthesis are adjusted for heteroskedasticity.

that both domestic firms and Japanese firms should decide to cooperate.

Therefore, the threshold for absorptive capacity may be a practical criterion for both domestic firms and Japanese firms. Domestic firms must acquire some level of absorptive capacity before considering cooperation with Japanese firms because if they are not able to absorb the associated spillovers, they will be hampered by them. For Japanese firms, the threshold for the absorptive capacity of Vietnamese manufacturing firms is important as well. They may want to cooperate with local firms with absorptive capacity higher than the threshold. Firstly, absorptive capacity can be an indicator of the overall capacity of a potential partner. Secondly, when domestic firms reach the threshold for absorptive capacity, they can enjoy the spillover effects from Japanese firms and the cooperation can become more solid. Japanese firms can take advantage of local knowledge and a network of local partners to improve their operations.

Moreover, the spillovers and absorptive capacity threshold are important for policymakers. The threshold exists at the sectoral level, and it can be a basis for creating industrial policies. The authorities can pay more attention to sectors with better absorptive capacity, which allows them to make use

of the spillovers from FDI firms. From other perspectives, the threshold can be an indicator that local and central governments can use to improve the absorptive capacity of domestic sectors and thus not only maximise positive spillover effects but also minimise the negative externalities of FDI spillovers.

### Robustness check

For the robustness check, the paper tests the robustness of the regression results from the perspective of export activity and geography. This section only shows the results for Backward_competition, as it shows the most obvious threshold effect. The results for Backward_comp and Horizontal_labour can be sent upon request to avoid unnecessarily lengthening the paper.

Firstly, we consider the impact of the threshold for absorptive capacity on domestic firms with and without export activities. The full sample is divided into two sub-samples, and the results are shown in columns 2 and 3 in Table 4. For both groups, firms with absorptive capacity levels below the threshold suffer from Backward_comp, while firms with absorptive capacity levels above the threshold enjoy a positive impact due to Backward_comp. However, the coefficient of Backward_comp > threshold level in the non-exports model is not statistically significant.

Secondly, columns 4, 5, and 6 show the regression results for the specific regions in Vietnam. There are six regions in Vietnam, with the Red River Delta and Mekong River Delta having the most firms. Therefore, this paper examines the threshold impact in the Red River Delta, the Mekong River Delta and the remainder of the country. Again, the results are similar to those of the full-sample model. It implies that firms with low absorptive capacity across regions suffer from the backward competition of Japanese firms, while firms with a high absorptive capacity can benefit from it. Almost all coefficients of backward competition are consistent with that of the full-sample model and statistically significant. Generally, given the impacts of export activity and geography, the threshold impact for absorptive capacity is still visible; however, the level of the threshold for absorptive capacity varies accordingly. Therefore, it is essential to identify the correct threshold for absorptive capacity in each case.

## Conclusion

Japanese firms have played an important role in the development of the manufacturing sector in Vietnam. Therefore, in this paper, we examine the spillover effects of Japanese firms from 2005 to 2018 in Vietnam and the role of absorptive capacity in this regard. Firstly, we find a positive horizontal labour effect and backward competition effect. However, we also find a negative effect for the backward labour linkage. Secondly, absorptive capacity can help to reduce the negative impact of the backward labour effect and increase the horizontal labour effect on domestic firms. Finally, there are thresholds for the absorptive capacity of domestic firms, with spillover effects varying above and below the threshold. More specifically, in the case of the horizontal labour effect and the backward competition effect, if domestic firms cannot reach an absorptive capacity threshold, they will suffer from negative impacts. However, if they reach the threshold for absorptive capacity, they can enjoy the benefits derived from Japanese firms. Generally, the results of the paper show that the appearance of Japanese firms can have either negative or positive spillover effects. Essentially, if domestic firms have good absorptive capacity, which means a higher level than the threshold, they can receive the positive impact and, at the same time, reduce negative impacts. Therefore, the threshold for absorptive capacity should be a signal indicator for both Vietnamese and Japanese firms. Vietnamese manufacturing firms should evaluate their absorptive capacity before deciding whether to cooperate with Japanese firms. If their absorptive capacity is low, they should improve themselves first to avoid negative impacts from FDI spillover

during cooperation or competition. Japanese firms can choose local partners based on their absorptive capacity. If domestic firms can benefit from spillovers, they can provide better inputs, and Japanese firms can enjoy the knowledge and experience of their local counterparts. For future research, it is necessary to differentiate direct spillovers and indirect spillovers of Japanese firms before examining the threshold for absorptive capacity for domestic firms.

The main limitation of the paper is that it uses only the 2012 Input–Output table when calculating spillover effects. It assumes that the coefficients do not change over the years. Therefore, it would be better to use the Input–Output table for each year to calculate spillovers. Additionally, as the paper uses strongly balanced data, it is not possible to examine the impact of new firms and exiting firms on the spillover effect and absorptive capacity.

## Author contributions

**Vu Hoang Duong:** Conceptualization; methodology; software; data curation; investigation; validation; formal analysis; writing – original draft; visualization; resources. **Tuong Phi Vinh:** Supervision.

### Data availability statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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# Appendix A

## Arellano–Bond test for zero autocorrelation in first-differenced errors

| H0: No autocorrelation | | |
|---|---|---|
| Order | $z$ | Prob > $z$ |
| 1 | −14.729 | 0.0000 |
| 2 | −0.06119 | 0.9512 |