The effects of foreign direct investment on domestic firms:

The case of Vietnam

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Abstract

Thanks to the economic reform after the launch of “Doi moi” in 1986, Vietnam has made significant gains and has transformed from an economically poor country in the 1980-90s towards a middle-income country by the 2010s. A dynamic market deeply integrated into the global economy has helped pave the way for foreign investment inflows to Vietnam. While it is clear that foreign direct investment plays a crucial role in the economy as a whole, the debate continues on whether foreign direct investment has positive or negative effects on domestic firms. In developing countries, foreign investment can be supportive to local enterprises where the former provides technological advantages that are beneficial. However, there are examples of where foreign presence negatively impacts on the development of local firms if they do not have adequate resources to absorb spillovers. This thesis examines whether the presence of foreign direct investment contributes to the development of Vietnamese firms from different angles including productivity, export activity, R&D and innovation and investment during the 2010-15 period. The thesis comprises four papers.

The first paper examines the impacts of foreign presence on domestic enterprise productivity within and between industries through horizontal and vertical channels. Panel data models are employed to investigate the linkage between foreign investment and local firm total factor productivity. The results indicate the presence of positive spillovers from foreign investment in downstream sectors to domestic firm productivity in upstream sectors through backward linkages, while a negative impact is found in the same sectors through horizontal linkages.

In the second paper, Heckman selection estimation is employed to investigate whether foreign investment has any influence on the exporting activity of domestic firms. The results suggest that while foreign investment in downstream sectors is found to encourage the export decision of local firms in the same and upstream sectors through horizontal and backward

linkages, the export intensity of local firms only benefits from backward linkages. The linkages between exporting activity of local firms and the presence of foreign investment appears to be different when comparing low- and high-tech firms.

While it is argued that foreign investment in a host country can encourage domestic firms to invest in R&D and innovation, there are few studies that consider the case of Vietnam. The third paper of the thesis fills this gap. The results suggest that there is a weak positive association between foreign investment and local firms R&D activity and innovation through forward linkages, while there is no significant evidence to support the view that multinational enterprises help improve local firms R&D behaviour through horizontal and backward linkages.

The final paper in this thesis investigates the possibility of crowding-effects from foreign investment to local investment. System General Method of Moments estimation is employed to a sector-level balanced panel dataset to account for dynamic effects. The results indicate that foreign investment significantly encourages domestic investment, and export-oriented sectors appear to be more sensitive to the impact from multinational investment.

Notes on publications

A number of publications, working and conference papers have been produced from this thesis. Some of them are under review for possible publications as follow:

Chapter 3 is currently under review

Ha, Van., Holmes, Mark. J., & Hassan, Gazi. Productivity spillover from foreign investment on domestic firms: Evidence from a developing country. *Journal of the Asian Pacific Economy*, paper under review.

Paper presented at the *Australian Conference of Economists (2019*), Melbourne, Australia, 14-16 July 2019.

Chapter 4 is published as

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Paper presented at the *Western Economic Association International (WEAI)*, 15th International conference, Keio University, Japan, 21-24 March 2019.

Chapter 5 is currently submitted as

Ha, Van., Holmes, Mark. J., & Hassan, Gazi. Foreign direct investment and R&D activities in domestic firms: Evidence from an emerging economy. *International Journal of Emerging Markets*, paper under review.

Chapter 6 is currently under review

Ha, Van., Holmes, Mark. J., & Hassan, Gazi. Does foreign presence crowd-in or crowd-out domestic investment? *Economic Change and Restructuring*, paper under review.

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Table of Contents

List of Tables

List of Figures

List of Appendices

Abbreviations

ASEAN	Association of Southeast Asian Nations
CIEM	Central Institute for Economic Management
EU	European Union
FDI	Foreign Direct Investment
FE	Fixed Effects
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GSO	General Statistics Office
GVSC	Global Value Supply Chain
HHI	Herfindahl-Hirschman Index
MPI	Ministry of Planning and Investment
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
PCI	Provincial Competitiveness Index
PPI	Producer Price Index
R&D	Research and Development
RE	Random Effects
SME	Small and Medium Enterprise
SOEs	State-owned Enterprises
TFP	Total Factor Productivity
TCS	Technology and Competitiveness Survey
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International Development
USD	US Dollar
VA	Value Added
VCCI	Vietnam Chamber of Commerce and Industry
VES	Vietnam Enterprise Survey
VND	Vietnamese Dong
VSIC	Vietnam Standard Industrial Classification
WB	World Bank
WTO	World Trade Organization

CHAPTER 1. INTRODUCTION

1.1. Overview

Foreign direct investment (FDI) refers to cross-border investment in which companies or individuals in one country establish residence for their business in another country, either by establishing business operations or acquiring business assets there, such as ownership or a controlling interest in a foreign company (OECD, 2020). FDI differs from portfolio investments, where an investor merely purchases equity in foreign-based companies. The key feature of FDI is that it is an investment that establishes either effective control of the decision-making of a foreign business or at least substantial influence over it (Carkovic & Levine, 2005).

Neo-classical economic growth theory (Solow-Swan growth model), or exogenous growth theory, argues that capital accumulation is one of the main drivers of economic growth (Solow, 1956, 1957). In an integrated world, the capital stock is accumulated by both domestic and foreign investment, where FDI play a crucial role to this process, especially for developing countries. Moreover, FDI also brings new inputs and advanced technologies to the production function of the host country that can also promote the efficiency of the investment in the host country. Through the views of the neo-classical growth model, FDI can impact economic growth of the host country directly via capital accumulation of the inclusion of new technologies and input that can help enhance the production efficiency of the host country. Endogenous growth theory assumes that there are two main factors that drive economic growth: human capital and technological change (Romer, 1986), in which FDI can contribute indirectly by generating spillover effects. Both endogenous and exogenous growth models suggest that FDI can help boost domestic economic growth via direct or indirect channels.

FDI is widely recognized as an important factor in the economy of the host country and affects its economy through direct and indirect channels. The direct effects occur when foreign firms create outputs and jobs by operating a business in the host country, whereas indirect channels may be considered as the means of spillover effects from foreign to local firms. Within the scope of this research, there is focus on indirect impacts from FDI to domestic firm's activities. Anwar and Nguyen (Anwar & Nguyen, 2011) argue that foreign investment provides a resource for improving and expanding the domestic enterprises of host countries. Knowledge and technology brought by foreign firms may spill over to local firms and raise their productivity, employment, and exports (Kokko, 1996).

There are two ways through which FDI influences domestic enterprises - through horizontal and vertical linkages. Whereas a horizontal linkage refers to the relationship between foreign and domestic firms in the same industry, a vertical linkage occurs between foreign and local plants across industries, where domestic enterprises are the suppliers or customers of FDI firms (Blomström, 1986).

Moreover, the influence of foreign investment on domestic firms may be direct or indirect. Domestic firms may benefit directly from foreign investment through vertical linkages, where domestic firms supply inputs for FDI firms or buy materials or technology from foreign firms. In horizontal linkages, domestic firms may experience positive or negative effects because of the increased competition that arises when FDI firms enter the market. Other domestic firms, which do not directly interact with foreign firms, may still be affected when competition increases with the presence of FDI in those industries. Effects may occur when FDI influences domestic firms' productivity (B. Aitken, Hanson, & Harrison, 1997; Blomstrom & Kokko, 2003; Blomström, Kokko, & Globerman, 2001; Blomström & Persson, 1983; Combs, Liu, Hall, & Ketchen, 2006; Driffield & Taylor, 2006; Lipsey & Sjöholm, 2004; Newman, Rand, Talbot, & Tarp, 2015), exports (B. Aitken et al., 1997; Anwar & Nguyen,

2011; Goswami & Saikia, 2012; Kneller & Pisu, 2007; Sun, 2009a), research and development activity (Ben Hassine, Boudier, & Mathieu, 2017; Castellani, Montresor, Schubert, & Vezzani, 2017; Hu, Jefferson, & Jinchang, 2005; Li & Hu, 2013; Qu, Huang, Zhang, & Zhao, 2013; Sasidharan & Kathuria, 2011) and investment (B. J. Aitken & Harrison, 1999b; Burke, Görg, & Hanley, 2008; Djankov & Hoekman, 2000; Ferragina, Pittiglio, & Reganati, 2009; Haddad & Harrison, 1993; Kokko & Thang, 2014). FDI can have a positive, negative or neutral impact on domestic firms' activities, depending mostly on the characteristics of FDI and local firms, the nature of the industries involved, the government policies of the host countries or other factors as well (B. J. Aitken & Harrison, 1999b; Blomström & Persson, 1983; Caves, 1974; Fujimori & Sato, 2015; Javorcik, 2004; Newman, Rand, Talbot, et al., 2015)

1.2. Problem statement

FDI has brought excellent gains to Vietnam's economy in terms of growth, jobs, and exports. It contributed positively to GDP of 13% in 2000 and over 18% in the 2010-2015 period, accounting for 30% of employment and 70% of total exports in 2016 (World Bank, 2017e). The key priority for Vietnam in this period was boosting productivity growth, especially that of the domestic private sector, and FDI was expected to be one of the main levers for this. However, as reported by the World Bank, the efficiency of Vietnamese firms is stagnating, raising concerns about Vietnam's competitiveness (World Bank, 2017e). Firstly, Vietnamese firms' total factor productivity (TFP) experienced a downward trend during the period, from 6.32 points in 2006 to 2.96 points in 2011 (T. T. A. Nguyen, 2016). While technology accounts for 65% of the change in the TFP of foreign firms, the rate for domestic firms is about 44% (T. T. A. Nguyen, 2016). This suggests that FDI may introduce more advanced technology than domestic firms, showing that the latter may have the opportunity to gain from technology spillovers from FDI. Besides, a decline in productivity has been observed in firms of all sizes,

including large firms[1] (World Bank, 2017b). While FDI firms appear to be more productive than local firms, it is important to investigate productivity spillovers passing to domestic firms during the period.

Secondly, export activity increased rapidly after Vietnam joined the World Trade Organization (WTO) in 2007. The total export volume of goods and services increased from 44.945 billion USD in 2006 to 69.725 billion USD, jumping to 143.186 billion USD in 2013, then rising to 189.697 billion USD in 2016 (World Bank, 2017b). Foreign firms account for a large volume of Vietnam's total exports. As reported by the General Statistics Office, before 2001, the domestic sector accounted for 54.8% of total exports while FDI accounted for the remaining 45.2%, including raw fuel. In 2010, the export volume percentage generated by the FDI sector increased to 54.2%, climbing to 70.9% in 2015, while domestic sectors accounted for decreasing percentages of 45.8% and 29.1% respectively (World Bank, 2017e). It is becoming increasingly important to investigate how FDI has become the major contributor to Vietnam's export activities and why the domestic sector seems to be less active than the foreign sector. It is also necessary to examine whether the increase in FDI inflow affects the international market share of domestic firms, as well as their decision to export.

Thirdly, research and development (R&D) activity is one of the crucial factors that allow firms to improve their productivity but this has not received sufficient attention in the existing literature concerning Vietnam. As reported by the Vietnam General Statistics Office (GSO), approximately 0.5% of the domestic firms in the sample invested in R&D activities in 2015, a very small proportion. Total expenditure for R&D accounted for only 1.6% of firms' annual sales on average, which is a lower level than Lao (14.5%), the Philippines (3.6%), Malaysia (2.6%) and Cambodia (1.9%) (World Bank, 2017e). There is theoretical and empirical evidence that domestic firms can be encouraged to invest in R&D activities with the

[1] More details are provided in Chapter 2.

support of foreign firms, or even in competition with them. There has been an increase in the number of firms investing in R&D recently, apparently concurrently with an increase in total foreign investment in Vietnam, but empirical studies are needed to determine whether FDI promotes R&D activity in Vietnamese firms.

Lastly, the number of domestic firms in Vietnam and their total investment has changed over time. The GSO reports that approximately 110,100 businesses were established in 2016, representing a 16.2% increase over the 94,754 firms in 2015. In 2016, following a declining trend, 73,000 domestic firms ceased trading in comparison with 80,858 firms in 2015. While most of these were small- to medium-sized firms with a total capital value of less than 500,000 USD, the decline in the number of firms resulted in fluctuating domestic investment. With the higher total foreign investment inflow into Vietnam's economy, it is important to examine whether the presence of FDI in the domestic market has encouraged or crowded out domestic private investment in Vietnam in recent years.

1.3. Objectives and Research questions

The motivation for this thesis is to elucidate the role of foreign direct investment in promoting the performance of local enterprises. As foreign investment is expected to serve as one of the key drivers boosting the domestic sector, it is important to investigate whether it benefits local enterprises. The objectives of the thesis are to provide a snapshot of the impact of FDI on Vietnamese firms from different aspects, detailed as follows:

i. To examine the linkages by which Vietnamese firms may gain productivity spillovers from FDI;
ii. To estimate the impact of FDI on local firms' export activity through horizontal and vertical linkages;

iii. To investigate whether FDI plays a role in encouraging domestic firms to undertake R&D and innovation activity;

iv. To discover the influence of FDI on domestic private investment.

To achieve these objectives, the thesis aims to address four general research questions that include a number of sub-questions, as below.

i. Does foreign investment affect the productivity of domestic Vietnamese firms?

- To what extent does foreign investment influence productivity spillovers to domestic enterprises?
- What is the channel through which local firms can gain the most benefit from foreign investment and, therefore, what linkages need to be promoted from a policy point of view?
- Does labour absorptive capacity play a role in productivity spillovers?
- To what extent are the key findings affected by firm characteristics, such as location, ownership and the state of technology in production?

ii. How does FDI affect the export activity of domestic Vietnamese firms?

- Does the presence of foreign firms affect the export decisions and export intensity of local firms, and if so, how and to what extent?
- What are the channels of influence and how do they make themselves felt?
- Is the export behaviour of domestic manufacturing and service firms influenced by the presence of foreign investment?
- Do high-tech manufacturing firms gain greater advantages from export spillovers than do low-tech firms?

iii. Is there any link between FDI and R&D expenditure and innovation by domestic firms?

- What factors drive firms' decision to invest in R&D?

- Does FDI influence domestic firms' R&D activity in Vietnam and, if so, in what ways?
- Is there any FDI spillover on firms' innovation activity in Vietnam?

iv. What is the relationship between FDI and domestic private investment?

- Does FDI crowd out or encourage domestic private investment?
- Do other types of investment, including state-owned and joint-venture investment, also affect domestic private investment?
- Do sectors benefit more if they have stronger linkages with foreign presence through various channels?
- Are sectors more engaged in exporting likely to be more influenced by FDI than those that are not?

1.4. Significance of the research

Several studies have examined the indirect impact, known as "spillover effects", of FDI on Vietnamese firms. However, existing research has not elucidated all aspects of the influence of foreign firms on Vietnamese firms over the past decade. Most such research deals with productivity spillovers in technology transfer in the period from 2000-2012. Thus, this research aims to fill the gap by providing more empirical evidence of the effects of FDI on local enterprises that may enable better evaluation of the contribution of FDI to the economy as a whole, an investigation that should be helpful for policymakers and governors.

Firstly, this research provides additional empirical evidence about the way FDI currently influences the productivity of Vietnamese firms. Earlier studies about productivity spillovers have focused on the channel the presence of FDI promotes domestic firms' total output, but there is a lack of research dealing with other aspects of productivity, such as total factor productivity (TFP). This study considers the influence on TFP in Vietnam from both

horizontal and vertical linkages. Since only limited research has taken into account the more recent changes in Vietnam's policy stance, this study not only investigates the effects on TFP through linkages but also examines interactions between linkages and the year 2014 to control for change in the country's context. Furthermore, the research takes into account the role of the labour absorptive capacity of domestic enterprises that might affect productivity spillovers. The thesis also highlights the way that foreign presence influences total factor productivity of local enterprises between low-and high-technology groups and types of ownership, and also across regions.

Secondly, this work is among the first studies to take into account export spillovers in the manufacturing and service sectors, in this way drawing a bigger picture of the impact of foreign investment on local firms in Vietnam, and adding to a limited number of studies focusing on export spillovers in developing countries. Using Vietnam as a case study, this analysis examines the way foreign investment influences the exporting behaviour of local firms. With a sharp decrease in the percentage of exports by domestic enterprises, the facts indicate a declining trend in more recent years. Since the existing literature has shown that FDI can have a positive or negative impact on local firms, depending on economic conditions, government policies, the channels through which the effects can occur, etc., it is important to carry out an updated investigation of the issue. The results of this research will reveal what has happened in Vietnam and how domestic firms appear to be influenced in their export activity by multinationals.

Thirdly, this study is among the first to investigate the effect of FDI on the R&D and innovation activity of Vietnamese firms. While it remains controversial whether FDI encourages local firms to engage more in R&D and innovation, especially in emerging economies, there is a need to investigate the issue in the case of Vietnam. Thus, the empirical results of this research may determine whether FDI promotes R&D expenditure by Vietnamese

firms, and in this way should be a valuable contribution to the literature. The study also provides significant evidence whether Vietnam has reached its target of attracting inflows of foreign investment over the decades to improve the R&D abilities of domestic firms.

This research also studies the influence of foreign presence on total domestic investment. The aim is to examine whether the presence of FDI forces domestic investment to leave the market at sector level. The crowding effects remain unclear in the literature: Whereas some evidence suggests that FDI may encourage domestic investment and other studies find the opposite, little evidence has been adduced in Vietnam's case. It is important, therefore, to conduct further research to determine whether FDI has positive effects on sectoral domestic investment in Vietnam, a topic addressed in this research. In contrast with existing studies, this thesis provides an empirical analysis of crowding effects at industry level.

This study is aligned with the Government's strategic priorities to improve the efficiency of the private domestic sector. These priorities are emphasized in the *Vietnam Vision 2035* report (World Bank, 2016), which underlines the importance of strengthening competitiveness, especially in the domestic private sector. The conclusions from this research will contribute to the design and support of the implementation of the government's key policies and programs that target the strengthening of the domestic private sector in the near future.

1.5. Research method and data sources

1.5.1. Research method

There are four papers in this study and in each case, the empirical investigation is based on the econometric analysis of secondary data at firm and industry levels. R and Stata statistic software are used to clean and analyse the data. The thesis applies different estimation strategies. To measure productivity, thereby addressing the first question concerning total

factor productivity, an estimation of production function by using Wooldridge Generalized Method of Moments (GMM) estimation is conducted that allows the calculation of total factor productivity. The linkages between FDI and local firms through horizontal and vertical channels are calculated by using the IO2012 table. Productivity spillover through these channels is then estimated using fixed effect and random effect models for panel data. Additional insights are also provided, dealing with firm ownership, location, and the state of technology in which the various spillovers occur.

The second question examines the effects of foreign investment on the decision and intensity of a domestic firm's exports in the Vietnamese manufacturing and service sectors. This is addressed by applying the Heckman selection model to a panel dataset and involves two stages. The first employs a probit model to examine how FDI affects a local firm's decision to export. The second stage applies a Tobit model to investigate the FDI spillover on a local firm's export intensity for firms engaged in exporting. An extended estimation on a sub-sample clustered by firm technology level indicates that the presence of foreign firms has differing effects on the exporting activities of low- versus high-tech firms in the manufacturing sector.

Two techniques are applied to address the third question. First, a Heckman selection model that corrects selection bias is employed to investigate how FDI affects a local firm's R&D activity. Not all firms are engaged in R&D, as this depends on their characteristics and strategies, and so firms are self-selected into these activities. A two-step Heckman selection correction is used on a panel dataset to deal with the issue of selection bias and to determine which factors have a significant effect on the decision to participate in R&D and how many R&D projects are carried out. Second, as innovation is a dummy variable, probit estimation is applied to panel datasets to investigate how FDI influences a local firm's innovation.

To address the last question about the way FDI affects local investment, System GMM estimation was applied to a strong balanced dataset at industry level over the 2010-2015 period.

This was aimed at gaining new insight into the influence of foreign presence in one sector on the annual investment of that sector through horizontal linkages, and also on other sectors through vertical linkages. Since sectoral investment this year may correlate with sectoral investment last year for both domestic investment and FDI, the relationship is dynamic and application of the GMM technique is called for. Extended models take a closer look at the sectors that have tighter linkages with FDI through horizontal and vertical channels to ascertain if they benefit more from FDI than other sectors. Investigation into export-oriented sectors is also carried out to determine if these sectors appear to be more responsive to the presence of foreign investment in both upstream and downstream sectors through vertical linkages.

1.5.2. Data

This research predominantly uses data at firm-level and industry-level obtained from the Vietnam Enterprise Survey (VES). The VES is conducted by Vietnam's General Statistics Office for all industries on 1 March each year and gathers balance sheets and other information about firm activities. The survey questionnaires are mailed to all firms, which are legally required under Vietnamese law to complete the questionnaires and return them to the Provincial Statistics Office. Any firms that do not reply are contacted by the provincial officer by mail, phone or personal visit. All data collected are checked by the General Statistics Office for internal consistency and crosschecked with administrative provincial data before being made available for publication.

The general objectives of the survey are: (1) to collect the business information needed to calculate national accounts; (2) to gather updated information on business registrations and (3) to build a statistical database of firms. This survey includes all known active enterprises each year, nationwide. The majority of enterprises in the dataset can be found in the list of Vietnam Standard Industrial Classification (VSIC) codes, which includes 88 sectors at the two-digit level. The ownership of firms is also reported in this dataset. The firms in this survey may

be domestic firms (private or state-owned) or foreign (100% foreign capital firms or joint venture firms). Each firm is given a unique enterprise code, which can be used together with their province code to identify the firm, and which can link it to other datasets at industry level (input-output table) to construct a panel dataset. The main annual attributes of firms are reported in this survey, including gross output, value-added per unit of labour, total revenue, total employees, and total assets.

Although the VES survey is the most comprehensive survey about enterprise's activities in Vietnam, it has some limitations. Firstly, some of the important inputs are missing from the survey, for example, intermediate materials or consumption of energy, which may be useful to estimate production function of firm. Secondly, although the survey starts from 2001, some important figures, such as export and import, were included only from 2010 and continued to be surveyed for the following years. Thirdly, the VES survey does not offer much information on technology and innovation of firms during the whole period, which leads to difficulty in dealing with the technology and innovation spillover effects.

This research defines domestic firms as domestic private firms and state-owned firms. FDI firms are defined as foreign firms with 100% capital from foreign investors, and joint-venture firms are characterised by both domestic and foreign investment. While some firms are established each year, others close or cease trading for various reasons, so the dataset employed consists of unbalanced panel data over the years.

This study also uses a VES sub-survey, the Technology and Competitiveness Survey (TCS), that focuses on technology and innovation. This survey is a collaboration of the Central Institute for Economic Management (CIEM), the General Statistics Office (GSO) and the University of Copenhagen (UoC) for the 2010-2015 period. While the VES covers all general information on firm performance, the TCS allows us to access data specifically on firm technology, innovation, and R&D activity.

The data used in this study focus mainly on the manufacturing and services sectors. The raw data contain the sector codes for each firm in the dataset. By linking these codes to the VSIC codes, we can see which sector each firm belongs to. The manufacturing and service sectors account for more than 50% of firms in the full sample. The focus of this study is the period from 2010 to 2015. There are a few changes in the questionnaires each year, depending on the GSO's purposes, resulting in some variation in the survey data, but the main data about firm performance remain unchanged from year to year.

Two types of factors may affect domestic firm performance - either internal factors within the domestic firms themselves or external factors deriving from the industry as a whole. In this research, both firm-level and industry-level data are used. "Firm-level factors" refer to information specific to each firm and which are mostly available in the VES. "Industry-level factor" refer to factors such as the presence of FDI in industries, market concentration, and competition. Weightings for some sectors are needed to calculate the impact of FDI linkages and these will be obtained from input-output (IO) tables, which are available for 2007 and 2012. Other data for Vietnam are sourced from the GSO annual report and the World Bank database.

1.6. Structure of the thesis

The rest of the thesis is organized as follows. Chapter 2 provides an overview of FDI and domestic firms in Vietnam and the mechanisms by which that FDI may influence the performance of local enterprises. This chapter directs readers' attention to the development of Vietnamese firms and their performance in productivity, exports, R&D, and investment, followed by the next section which reveals how FDI has grown over the years in Vietnam.

There is also a discussion of the mechanism through which FDI spillovers to local enterprises may occur.

The core part of the thesis spans from Chapter 3 to Chapter 6, and looks closely at the effects of FDI on local firm performance and industry investment. Chapter 3 investigates the linkages between FDI and local firm total factor productivity. Technology spillovers from foreign investment are captured through both horizontal and vertical linkages. Chapter 4 examines whether FDI influences the export activities of local enterprises through various channels. The influence of the decision to export and the export intensity of local firms are estimated in this chapter. Chapter 5 sheds light on R&D and innovation spillovers from FDI to local enterprises. It aims to determine if FDI encourages domestic firm R&D activity and also what factors contribute to local firm innovation. In contrast with previous chapters that use firm-level data, Chapter 6 draws on industry-level data to study the way FDI affects domestic private investment.

Chapter 7 summarises the key findings of the thesis and discusses some implications that derive from the main results. The conclusion and thesis limitations are also discussed in this final chapter and avenues for future research are suggested.

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CHAPTER 2. BACKGROUND TO DOMESTIC ENTERPRISES AND FOREIGN DIRECT INVESTMENT IN VIETNAM

2.1 The mechanism that FDI can affect local enterprises

The impacts of FDI on domestic firms are undeniable in the literature. From the endogenous economic growth theory point of view, at the country level, economic growth is driven endogenously by the improvement of labour force or technology. At the firm level, human capital and technology capacity could be enhanced through the linkages with FDI. FDI's effects on local enterprises can occur because of learning-by-doing, learning-by-watching, movement of labour from MNCs to domestic enterprises, and competition (Blalock & Gertler, 2008; Javorcik, 2002; Kugler, 2006). Researchers have long seen learning-by-doing and learning-by-watching as the main channels for technical change and productivity growth. With the presence of FDI, domestic firms can learn from the operations, actions, and techniques of foreign-investment enterprises. By imitating foreign firms, domestic enterprises can reduce the cost of their own learning experiences, and acquire more effective techniques, which improve their operational performance (J.-Y. Wang & Blomström, 1992). Learning-by-watching can also happen in exporting activities, where domestic enterprises imitate multinational companies. In collaboration with foreign firms, domestic enterprises can participate in distribution networks, and learn about consumer demand and legal regulations in order to penetrate new export markets (Görg & Greenaway, 2004).

Secondly, the mobility of skilled workers from FDI to domestic firms leads to spillovers. FDI firms with more advanced technology often have to invest in the training of local workers. These workers may later establish their own business or are employed by domestic enterprises (Fosfuri, Motta, & Rønde, 2001). This may cause indirect spillovers from FDI to domestic enterprises. To avoid the loss of intangible assets such as labour skills and

knowledge, FDI firms may have to pay higher compensation to their workers. This prevents direct spillovers from happening so frequently, however, indirect spillovers start because the local economy benefits from the higher incomes of foreign firms' local workers. Some researchers assert the importance of labour mobility in spreading positive effects from FDI. Fosfuri et al. (2001) insisted that the mobility of workers is the only way the superior technology of FDI firms can be transferred to domestic enterprises.

Thirdly, higher competition in the domestic markets caused by the presence of foreign investment firms, and improvements in the productivity and efficiency of local enterprises in coping with this competition are also seen as a form of FDI spillover. With more advanced technology, FDI forces domestic enterprises to upgrade their technology, reform their management practices and improve their performance. The presence of FDI can also reduce the productivity of domestic firms in the short term when domestic firms, with lower technology and management skill levels, are less productive than FDI firms (B. J. Aitken & Harrison, 1999b). The presence of FDI in an imperfectly competitive market will reduce production by domestic firms in the domestic market. In the long term, the higher level of competition forces domestic firms to innovate and become more productive (B. J. Aitken & Harrison, 1999b; Blomström & Persson, 1983). Indirect effects of FDI on domestic firms may occur when the presence of FDI improves the infrastructure of the industry. This subsequently benefits domestic firms later on, even when domestic firms and FDI firms have no connection. Competition is also considered as an indirect factor that affects domestic firms. With the presence of FDI in an industry, the increased competition forces domestic firms to innovate to be more productive.

There are two mechanisms by which FDI affects local firms: horizontal and vertical spillovers. While horizontal linkage is the link between FDI and domestic firms within sectors, vertical spillovers occur between industries. Horizontal spillover is generated within industry

because of the presence of foreign investors mostly through competition and labour mobility (Blomström & Kokko, 1996); (Meyer & Nguyen, 2005); (B. J. Aitken & Harrison, 1999b).

Vertical spillovers are generated across industries through backward or forward linkages generally through learning-by-doing, labour mobility or externalities. The linkage between FDI and domestic firms is called backward linkage if the former buy inputs from the latter and forward linkage if the former supply inputs to the later. Externalities from FDI to domestic firms seem to occur frequently through the vertical channel. Vertical externalities are desirable if the productivity gains exceed those internalized through arrangements between domestic and foreign firms. Backward spillovers happen when local firms in upstream sectors are influenced from the presence of FDI firms in downstream sectors (Javorcik, 2004); (Girma & Gong, 2008) through supportive or competitive channels (Larraín, Lopez-Calva, and Rodriguez-Clare (2000). Forward spillovers occur when the foreign firm in an upstream sector influences local firm performance in downstream sectors by either positive or negative way (Grossman & Helpman, 2003; Javorcik, 2004).

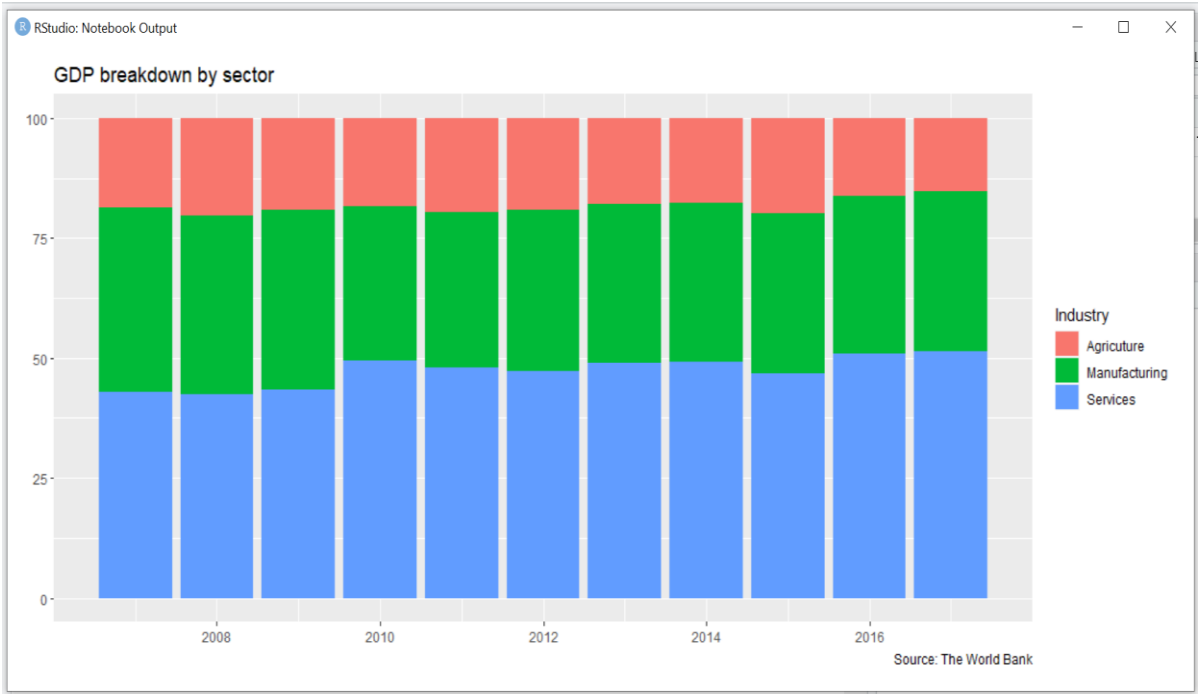
This chapter provides some general information about the development of Vietnamese firms and foreign investment in the last few decades, especially the last ten years. While the FDI inflows have been increasing recently, it remains unsure whether domestic sector benefits from FDI presence. In the next four chapters, the thesis will discover how foreign investment affect local firm productivity, investment, export and R&D activity.

2.2. Development of Vietnamese firms

Since the launch of *Doi moi* (economic reforms) in 1986, Vietnam's economy has been significantly transformed from a centrally planned to a market-oriented economy. This has allowed the country to achieve sustainable economic growth with an average of 6% during the last 10 years, one of the highest rates for any country over the last 35 years, second only to

China (World Bank, 2017c). In 2019, Vietnam's economic growth reached 7.02%, exceeding the set target (6.8%) and among the top high-growth countries in the region and the world. Inflation has been controlled at the low level of 2.79%, the lowest in the past 3 years. The import-export scale reached its highest point, 517 billion USD, with a trade surplus of over 9.9 billion USD (Ministry of Planning and Investment, 2019). The manufacturing and service sectors have dominated the distribution of Vietnamese gross domestic output (GDP) over the last 10 years, with an average of 34.24% and 47.32%, respectively, during the 2007-2017 period. While the service sector has shown an increase in its contribution to GDP, the manufacturing sector is still one of the main driving factors for economic growth. Figure 2.1 shows the details.

Figure 2.1. GDP breakdown by sector

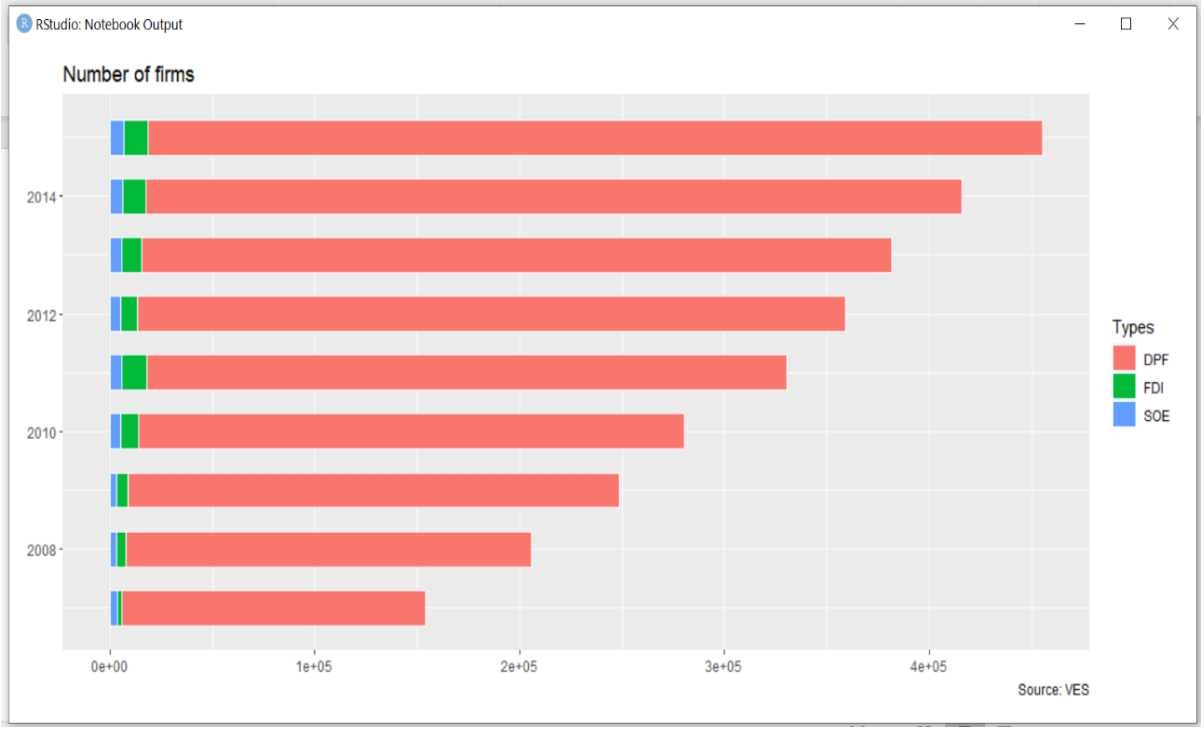


Notes: Author's calculation from the World Bank report.

This economic achievement represents the contribution of both foreign and domestic enterprises. In the early 1990s, Vietnam began opening for FDI, reforming the state-owned sector and encouraging the domestic private sector in order to strengthen the economy. As a

result, over the past three decades, the country has experienced a sharp increase in the number of FDI and domestic private firms (DPF), while the number of state-owned enterprises (SOE) has remained stable, especially in the last decade, as shown in Figure 2.2 below.

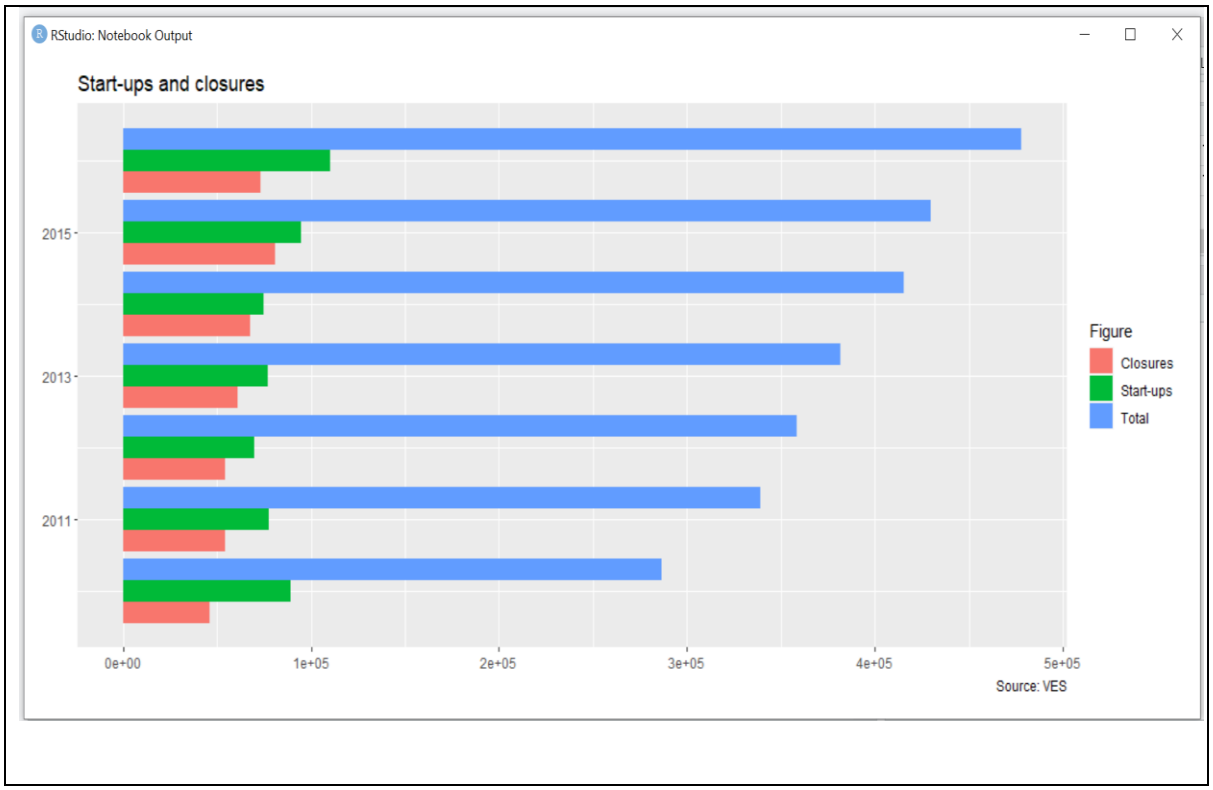
Figure 2.2. Number of firms during 2007-2015



Notes: Author's calculation from the VES.

The number of registered domestic private firms has increased rapidly, from 148,259 in 2007 to nearly double that in 2011, jumping to 436,767 in 2015 and nearly 800,000 plants in 2019. At the same time, FDI firms also increased in number over the period, from 4,018 plants in 2007 to more than double that number in 2010, with 8,939 firms, then climbing to 11,925 firms in 2015. In the meantime, the number of new businesses continued to increase during the period, from 89,187 start-ups in 2010 to 110,100 in 2016. Figure 2.3 provides more detail.

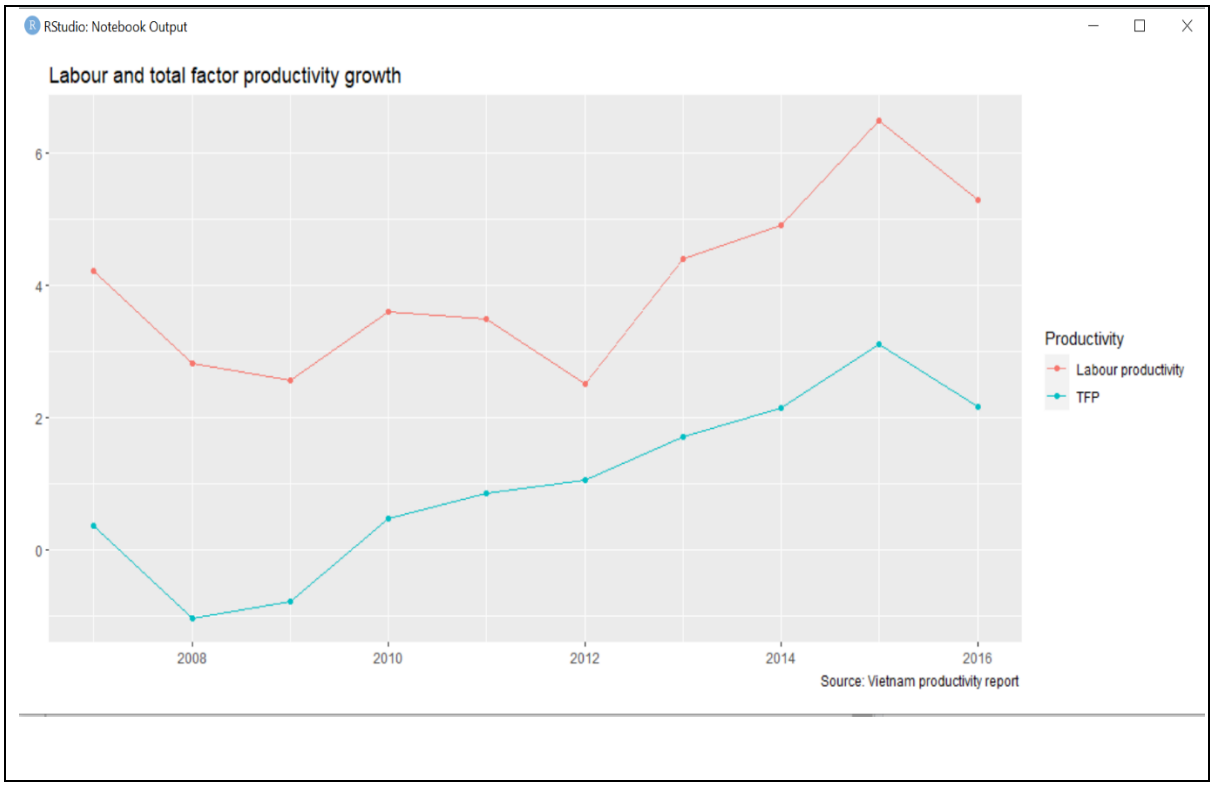
Figure 2.3. Start-ups and closures during 2010-2016



Notes: Author's calculation from the Vietnam Enterprise Survey (GSO)

Although the number of firms grew during the period, domestic firm productivity did not appear to increase noticeably. While total factor productivity (TFP) experienced a stable, low growth rate, labour productivity growth witnessed a fluctuation at higher rates during the period (Figure 2.4).

Figure 2.4. Labour productivity and TFP growth



Notes: Author's calculation from the Vietnam productivity report (2018)

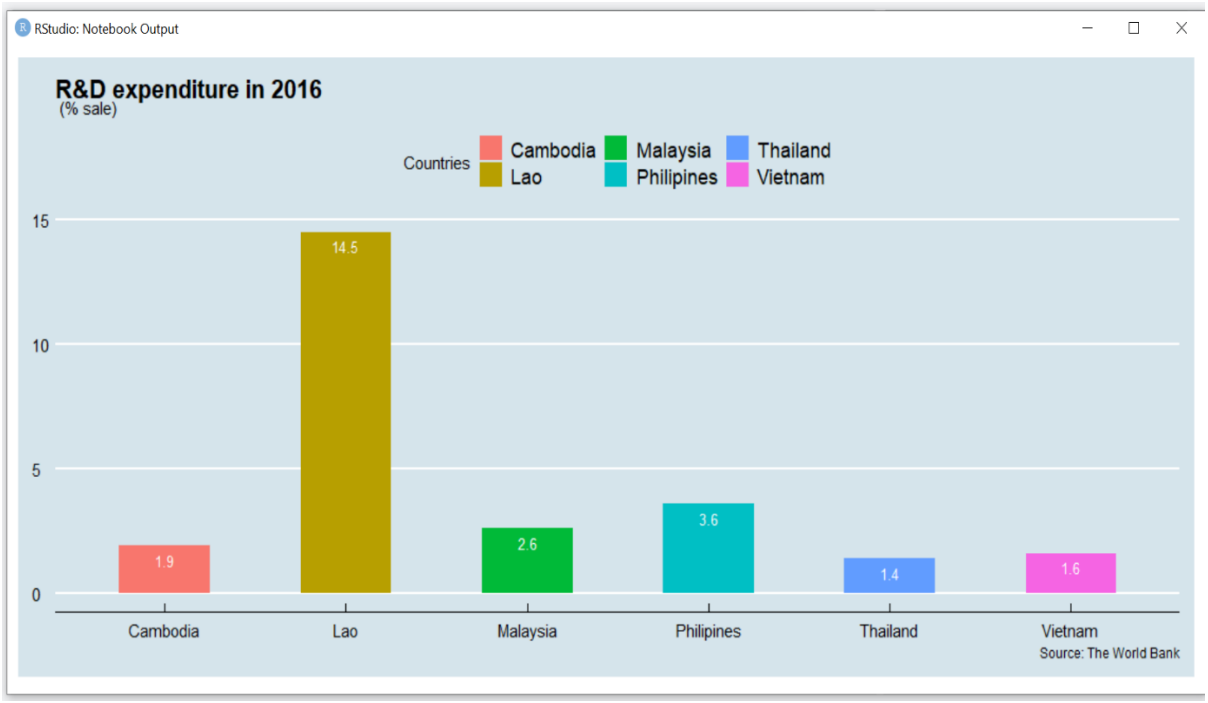
During 2008-2009, with the impact of the international financial crisis, TFP growth was actually negative while labour productivity began to decline. TFP growth is low compared with labour productivity growth, and we saw an average increase of 0.6% and 2.9% respectively during the period. From our production function estimation results for Vietnamese firms using the VES survey, we find that labour plays a more important role in firm productivity than other factors do. Although total factor productivity appears to be more significant in the manufacturing sector, labour seems to be the most important source for firm production[2].

With respect to firms' R&D activity, the Technology and Competitiveness Survey (TCS) reports that a very small number of domestic firms carried on R&D projects (only around 300 domestic firms each year reported doing so, from an average of 6,000 firms in the TCS)[3].

[2] Details are provided in Chapter 3.
[3] A detailed discussion of this point is presented in Chapter 5.

Whereas investing in initial R&D projects appears to be costly and risky, Vietnamese firms are more likely to take technology adoption and modification as a preferred option (Carol, John, Finn, Neda, & Nguyen Tue, 2015). At country level, according to the World Bank report (World Bank, 2016), only 1.6% of total sales was spent on R&D in 2016, a low figure compared with that of other Asian countries in the region (Figure 2.5). More detailed estimations and discussion of firm R&D engagement are provided in Chapter 5.

Figure 2.5. R&D expenditure (% sale) in 2016



Notes: Author's calculation from the World Bank report - Vietnam 2035

This section provides brief information about domestic firm development and performance in the period. The focus of this thesis, however, is only on domestic firms in the manufacturing and service sectors, where there is a dominant foreign presence.

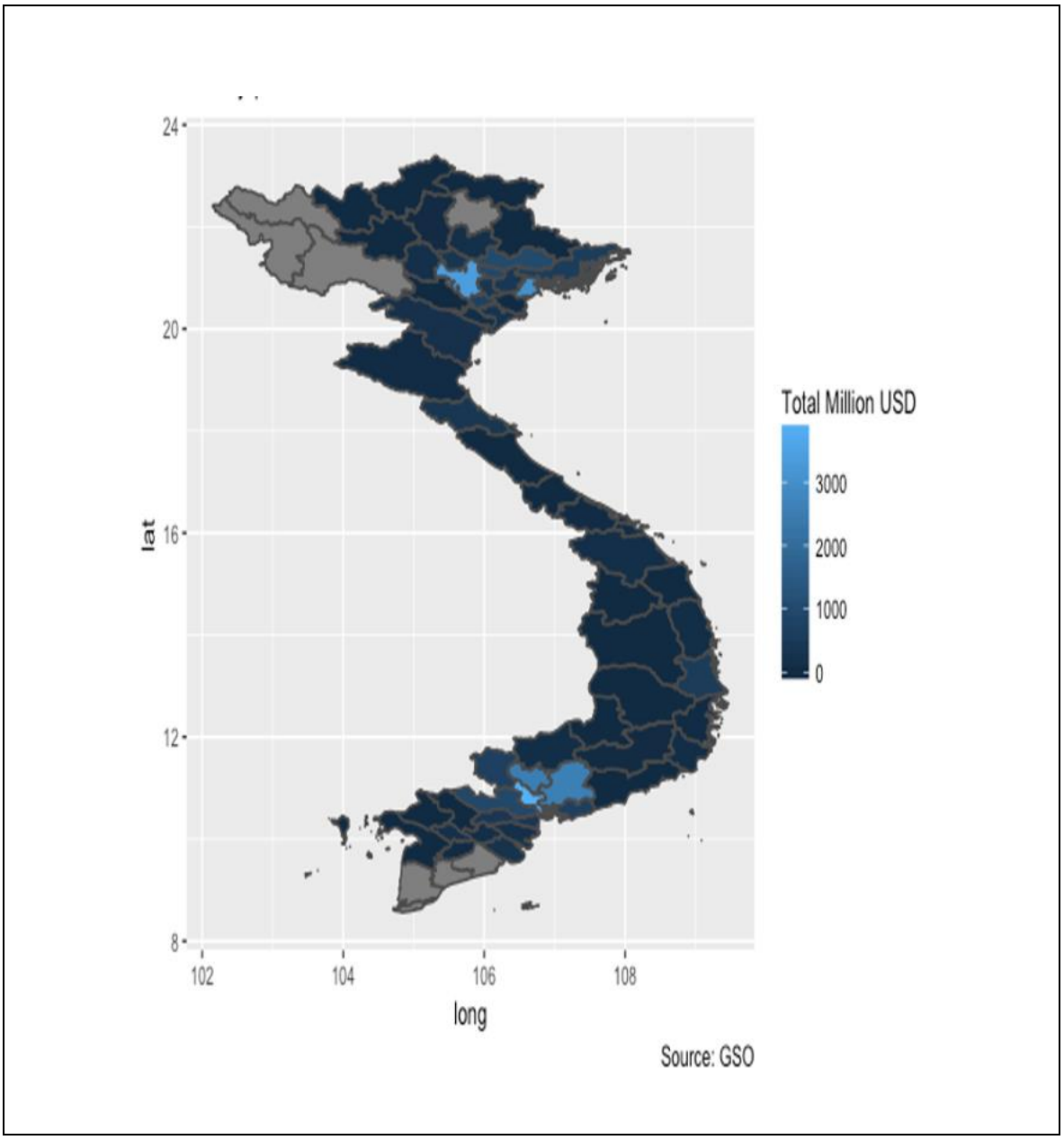
2.2. Foreign direct investment in Vietnam

As in many developing countries, there has been a significant increase in FDI inflows into Vietnam, especially after accession to the World Trade Organization (WTO). FDI capital in

Vietnam's economy rose from 2.5 billion USD in 2006 to approximately 6.8 billion USD in 2007, increasing to nearly 12 billion USD in 2015, 15.5 billion USD in 2018, and in 2019 totalling over 20 billion USD (World Bank, 2017a), the highest figure ever. FDI has contributed nearly 20% to GDP and is an important additional source of development investment capital for Vietnam (FDI accounts for approximately 23.7% of total social investment capital). The share of FDI in GDP increased 20 times over 30 years, from 2.1% in 1989 to around 21% in 2019. The proportion of state budget revenue from the foreign investment sector also increased significantly, from 1.8 billion USD in the 1994-2000 period to 23.7 billion USD in 2011-2015, accounting for nearly 14% of total state budget revenue. In 2018, FDI contributed nearly 298 trillion VND, accounting for 20.9% of total state budget revenue. FDI enterprises have created about 4.51 million jobs directly and 5-6 million indirectly during the period (Ministry of Planning and Investment, 2019).

In 2017, the General Statistics Office (GSO) reported that foreign investors invested in 19 out of 21 sectors in the Vietnamese economy, the manufacturing sector accounted for the highest proportion with a total of 175.57 billion USD (59.3% of total foreign investment). The real estate sector came second with 52.58 billion USD (17.48%), and production and distribution in the electricity and gas sector ranked third, with 12.9 billion USD (4.29%). Foreign investment has been available in all 63 provinces and cities nationwide. Ho Chi Minh City remains the leader in attracting FDI, with USD 45.66 billion (accounting for 15.1% of total foreign investment), followed by Binh Duong with USD 28.2 billion (9.4%), and Ba Ria-Vung Tau with 27.2 USD billion (9%), these cities together forming the most attractive area in the South while Hanoi is the leader in the North (light blue in the map) (General Statistic Office, 2017). Figure 2.6 shows the details.

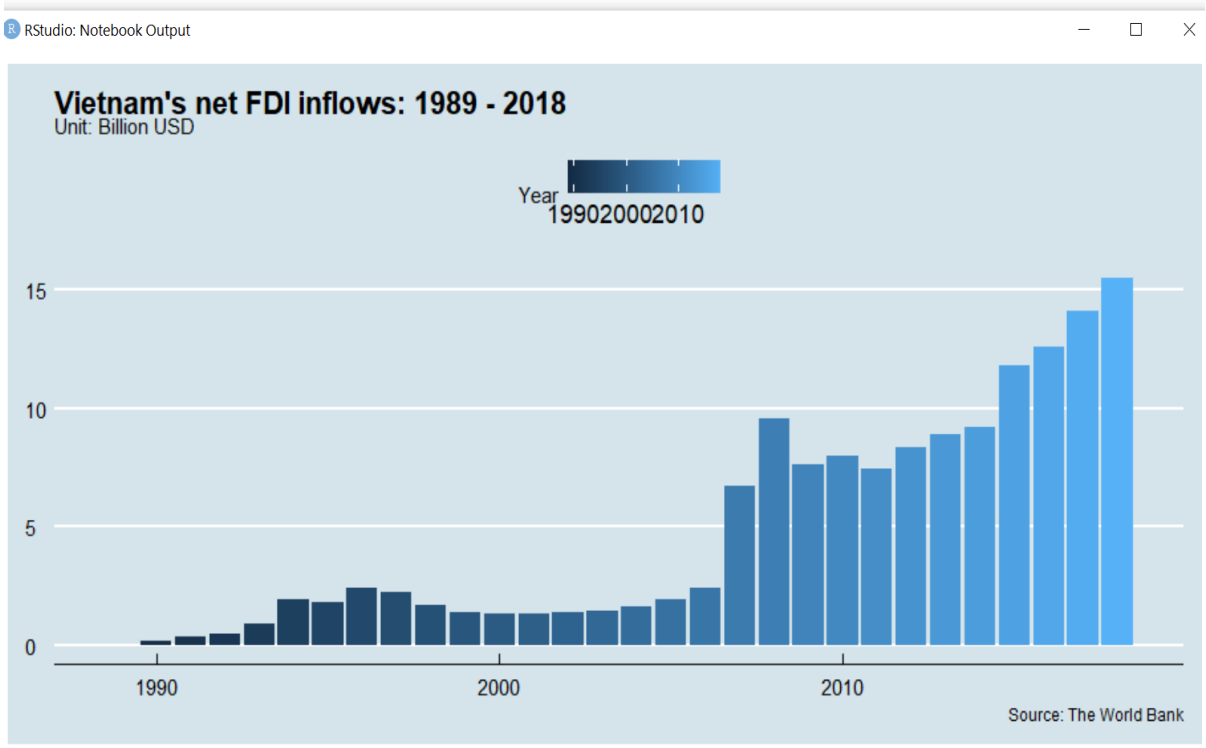
Figure 2.6. FDI by province in Vietnam in 2016.



Notes: Author's calculation from GSO data.

In the1990s, FDI inflows into the country totalled about 1.3 billion USD on average, increasing slowly to 4.33 billion USD during the 2000s and approximately 12 billion USD on average since 2010-2018. Vietnam became one of the most attractive countries for FDI in Asia in the 2010s (World Bank, 2017a), as shown in Figure 2.7 below.

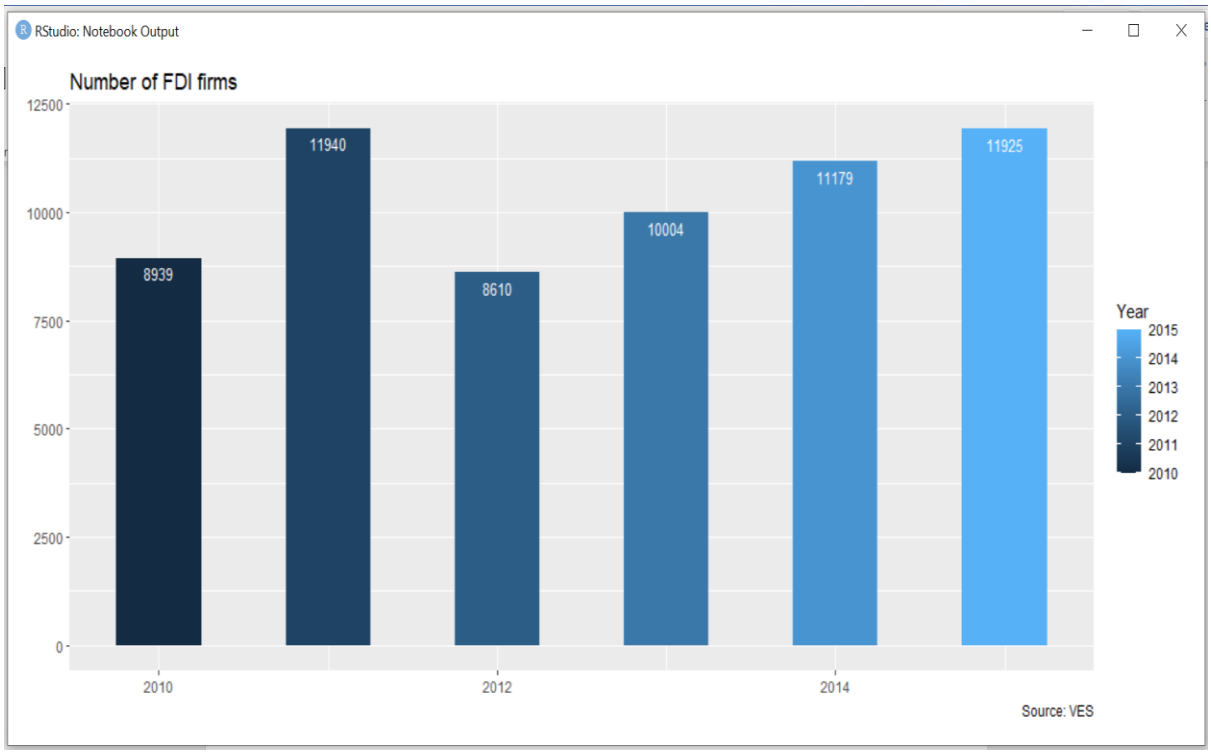
Figure 2.7. *FDI inflows (billion USD)*



Notes: Author's calculation from the World Bank database

Since WTO accession in 2007, Vietnam has attracted a large amount of FDI inflow into the economy, doubling after 10 years from 6.7 billion USD in 2007 to 14.1 billion USD in 2017. It is noteworthy that the previous period (2000-2006) experienced an average of 1.63 billion USD in inflows each year, but this number jumped to an annual 9.98 billion USD on average in the next period (2007-2018). During this period, FDI accounts for an average of 6.5% of the GDP in Vietnam. Meanwhile, the number of FDI firms followed a slightly increasing trend, with an average of 10,432 firms each year, detailed in Figure 2.8 below.

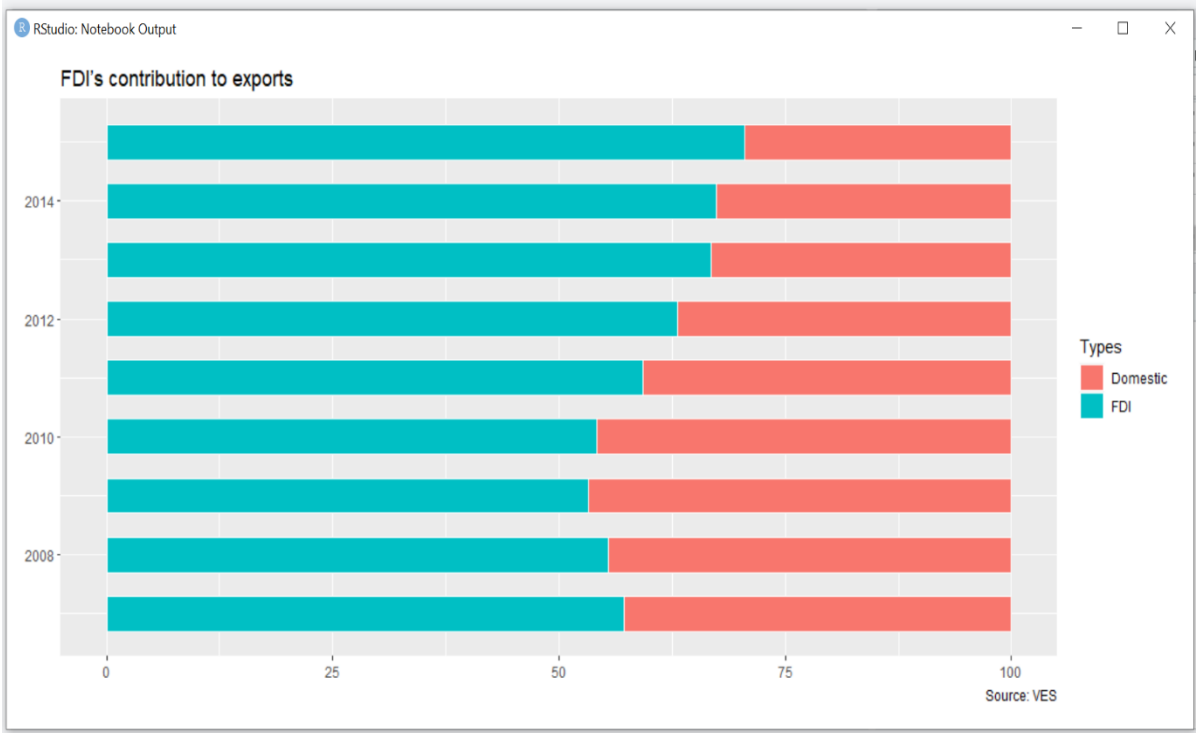
Figure 2.8. *Number of FDI firms*



Notes: Authors' calculation from the VES

Furthermore, FDI is the main impetus for export activity in Vietnam, accounting for about 70% of export earnings in 2015, and has become a crucial driving factor for Vietnam's industrialization, with around 60% of FDI investment going into the manufacturing sector and helping to lift the economy. Figure 2.9 shows the contribution of FDI to Vietnamese exports during the 2007-2015 period.

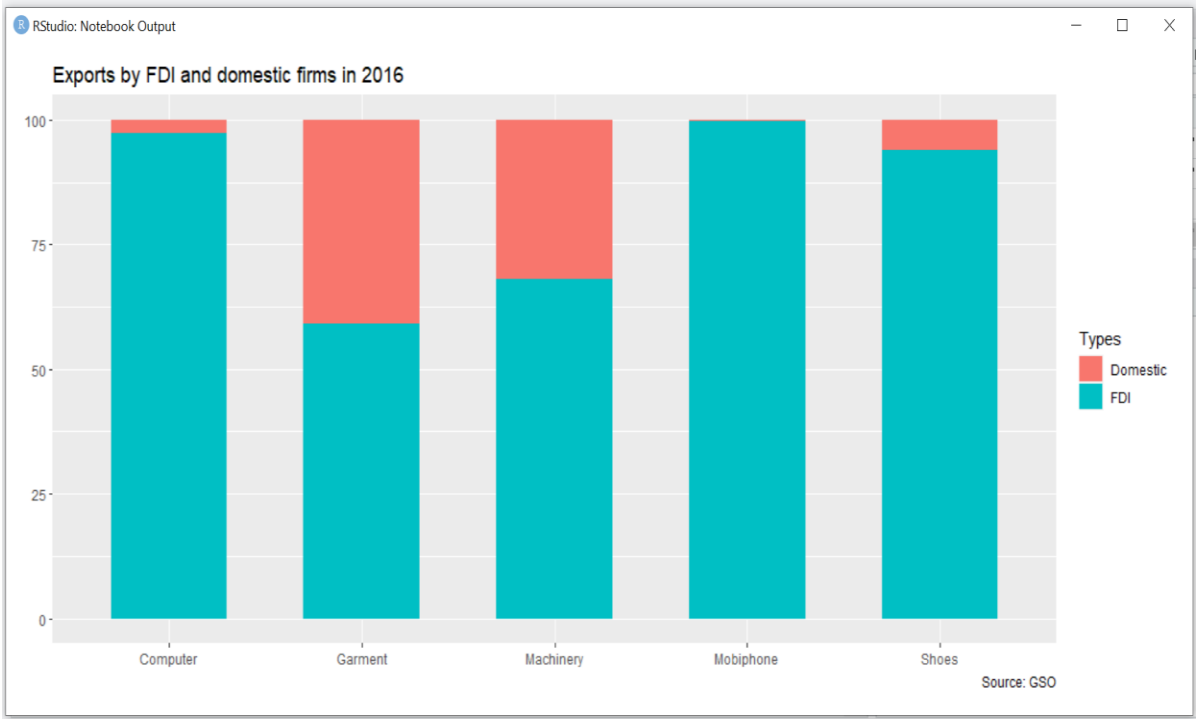
Figure 2.9. *FDI's contribution to exports*



Notes: Author's calculation from the VES

In the manufacturing sector, the production of mobile phones and computers has been a major contributor to export earnings and has been heavily dominated by FDI, accounting for more than 97% of export earnings in these sectors. Similarly, FDI dominates 94% of the export volume in the manufacture of shoes. Other sectors, which also see more than half of their export share contributed by FDI firms, are the manufacture of garments (59.1%) and machinery (68%). Figure 2.10 provides more detail.

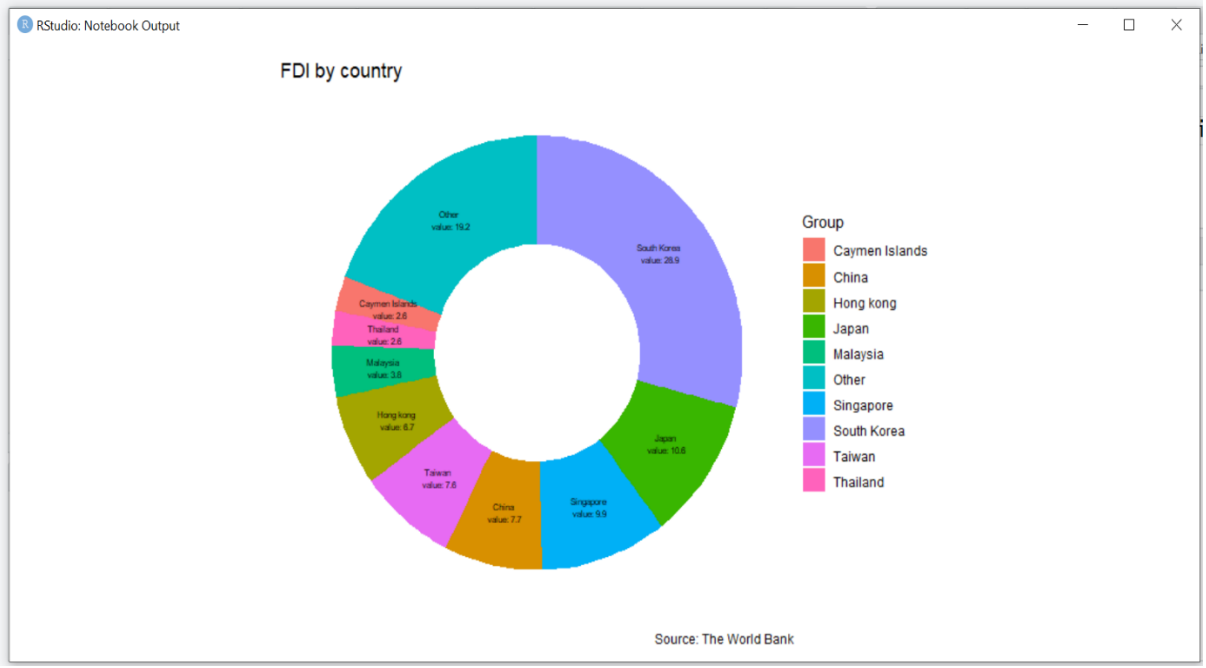
Figure 2.10. *Exports by FDI and domestic firms in some manufacturing sectors in 2016*



Notes: Author's calculations from GSO data.

By the end of 2019, 116 countries and territories had an investment in Vietnam. South Korea is the biggest investor in Vietnam. Its giant electronics company, Samsung, has a location in Vietnam where it assembles 50% of its total international volume of mobile phones, which it then exports all over the world. By the end of 2016, South Korea had directly invested USD 51.6 billion in Vietnam, attracted by the country's low labour costs, common cultural understanding and political and social stability, all of which benefit their business. South Korea invests heavily in the manufacture of mobile phones and computers in large industrial zones in the north of the country, accounting for nearly 30% of total FDI inflow into Vietnam. Other Asian investors, from Taiwan, Japan, Singapore, and China, also contributed an average of 9%-10% of total foreign investment. Figure 2.11 provides more information.

Figure 2.11. *FDI by country in 2016*



Notes. Author's calculation from Ministry of Planning and Investment.

Foreign investment now constitutes an important sector of the economy since initial significant investment in Vietnam three decades ago. With more FDI inflows and more jobs created, it benefits the economy in a variety of ways and the Vietnamese government's strategy is to continue to welcome FDI into the economy, especially in the manufacturing and service sectors, helping to boost economic growth.

2.3. Government strategies on foreign and domestic investment

The Vietnamese government's investment strategy is to actively and selectively attract more foreign investment. More effort needs to be made in the selection process, taking quality, efficiency, technology, and environmental protection as the main evaluation criteria for projects and investors. Projects with advanced, new, or future technology, green projects, modern management, high value-added content, spillover effects, and supply chain connectivity should be prioritized. FDI businesses have the role and responsibility to create sustainable development, links and cooperation with domestic enterprises, supporting each

other for mutual development in order to strengthen the linkages between the foreign and domestic sectors (Ministry of Planning and Investment, 2019).

The government has made significant effort in creating a stable, solid business environment and encouraging entrepreneurship. The focus of these efforts is the government's resolutions on the business environment and business development, including Resolution 19 issued annually from 2014 to 2018, Resolution 02 of 2019 (replacing Resolution 19). The government has also closely directed ministries, sectors and localities to take concrete action to improve scores and improve rankings in environmental indicators, national competitiveness and innovation. The government's policy places the expectation on corporations, large enterprises, and foreign-invested enterprises to promote their pioneering and leading roles in investing, selecting new technologies, and implementing new, innovative business models to move forward. This will create markets and opportunities for small and medium-sized businesses to participate in the production and supply of intermediary products and ancillary services (Ministry of Planning and Investment, 2019).

Furthermore, over the last three decades, the Vietnamese government has adjusted the investment law, giving more freedom and support to both domestic and foreign enterprises. In the early 1990s, state-owned enterprises were warmly encouraged, whereas private and foreign investment was scrutinised carefully, evaluated as part of the nation's acceptance of a market-oriented economy. During this time, establishing and operating a business run by private owners was not easy, since steps had to be taken to get licenses and sublicenses from provincial committees, which took significant time. Furthermore, private firms faced difficulties in credit and trading rights, had less access to land and received heavier tax treatment compared with state-owned businesses (World Bank, 2016).

In 2005, the government launched its Law on Investment and Law on Enterprise, which implemented substantial improvements in the business environment and made it much easier

for private firms to register and operate their businesses. These laws also allowed private enterprises to enter sectors that were previously reserved for state-owned firms and encouraged more existing businesses to operate officially. These laws also provided greater freedom to attract and boost foreign investment by easing the varying legal requirements concerning ownership (World Bank, 2016). The 2005 Investment Law also reduced paperwork and the time spent on registration for all types of ownership. These two laws were finally replaced by the 2014 Enterprise Law, which removed the overlap in the two previous laws and made it easier for enterprises to follow. This change allowed firms to simplify the steps necessary to obtain a business license, allowed online registration, and established regulations for corporate finance that were closer to international practice (World Bank, 2016)

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CHAPTER 3. DOES FOREIGN INVESTMENT IMPROVE DOMESTIC FIRM PRODUCTIVITY? EVIDENCE FROM A DEVELOPING COUNTRY

3.1. Introduction

Foreign investment is regarded as having significant effects on host countries, and so one of the policy priorities in the developing countries is to attract more investment inflows from overseas. Foreign investment is claimed to not only create jobs and enrich the capital resources, but also bring new technologies and innovation that may positively influence the host country's economy in both direct and indirect ways. While direct impacts from foreign investment occur when it contributes to the host country's gross domestic product, capital accumulation, export capacity, jobs and so on, indirect effects also arise through spillover effects where foreign presence can promote local enterprise productivity. In particular, this may occur through different channels regarded as horizontal, backward and forward spillovers. While horizontal linkages refer to the links between foreign and local enterprises within sectors, vertical linkages are the linkages between local suppliers and foreign customers (backward linkages) and foreign suppliers and domestic producers (forward linkages) (B. J. Aitken & Harrison, 1999b; Fujimori & Sato, 2015; Iwasaki & Tokunaga, 2016; Javorcik, 2004; Konings, 2001; Newman, Rand, Talbot, et al., 2015).

Identifying effects of foreign investment on local enterprise productivity may depend on the spillovers channel, the country context, the estimation method applied or the data used and so on (Gorg and Strobl (2001). While existing evidence shows that multinational enterprises have a generally positive impact on local plant productivity (Caves, 1974; Fujimori & Sato, 2015; Globerman & Meredith, 1984; Liu, Siler, Wang, & Wei, 2000; Reganati & Sica, 2007), there is still uncertainty over the type of effects when specific channels are taken into

account (B. J. Aitken & Harrison, 1999b; Kugler, 2006; Malik, 2015; Newman, Rand, Talbot, et al., 2015).

Previous studies of Vietnam find that foreign investment can promote the productivity of domestic plants through backward linkages (Newman, Rand, Talbot, et al., 2015), or positively through backward and forward linkages but negatively through horizontal linkages (Le & Pomfret, 2011). However, these studies focus on study periods that cover the 2000-12 period. More recently, the Vietnamese economy has undertaken a significant change in policy stance towards favouring foreign investment through providing more tax and land use incentives that large firms can benefit more compared with small and medium ones, as part of the Enterprises Law passed in 2014. Furthermore, recent years have seen Vietnamese firms face a slow-down in productivity due to a decrease in both labour and capital capacity (World Bank, 2017e). Together with a recent sharp increase in foreign investment inflows, improving the linkages between local and multinational enterprises is regarded as one of the key ways to promote the productivity of domestic firms (World Bank, 2017e). With this in mind, an investigation into how the foreign enterprise presence has recently affected local firm productivity recently is warranted. In doing so, a consideration of what particular linkage should be a priority for attention.

The paper investigates the impacts of foreign investment on the total factor productivity (TFP) of local enterprises though horizontal and vertical linkages using a panel dataset for the 2010-15 period at firm level within manufacturing industry in Vietnam. We use data obtained from the annual Vietnamese Enterprise Survey, which covers around an average of 45,000 manufacturing firms. The study focuses on four main research questions. First, to what extent does foreign investment affect productivity spillovers to domestic enterprises? Second, what is the channel through which local firms can gain the most benefit from foreign investment and therefore, which linkages need to be promoted from a policy point of view? Third, does labour

absorptive capacity play a role in productivity spillovers? Fourth, to what extent are the key findings affected by firm characteristics such as location, ownership and the state of technology in production? In doing so, we analyse the productivity of manufacturing industry through two stages. In the first step, we estimate the TFP of local enterprises, which leads to the second step, that is to explore the linkage between the local firm TFP and foreign investment through both the horizontal and vertical channels.

This research adds significant value to the existing literature on a number of fronts. First, this paper provides a much-needed updated study and in doing so, employs a rich dataset covering almost every firm in 24 manufacturing sectors. Using the Wooldridge GMM approach, we estimate TFP and control for unobservable factors in the first stage. This is an approach rarely followed in the Vietnamese literature. Second, there is limited research that considers the impacts of FDI on TFP through both horizontal and vertical linkages in Vietnam, but there is no work that considers the more recent change in Vietnam's policy stance in 2014. Moreover, our study not only investigates the impacts through these linkages, but also considers interaction between these linkages with the year 2014. Third, in contrast to existing studies, the research takes into account the role of the labour absorptive capacity of domestic enterprises which might affect the spillovers, as has been highlighted by Harris and Li (2008) and Fu (2008). Finally, the study also highlights the impacts varies between low and high-technology-level group; type of ownership and also across the regions which gives a considerable picture of the impacts from foreign presence on local enterprises total factor productivity.

The rest of the study is structured as follows. The next section summarises the theoretical background, followed by the third section that discusses empirical evidence. The fourth section describes the methodology and data used in this study. The fifth section provides the results and analysis. Conclusions are presented in the final section.

3.2. Literature review

3.2.1. Theoretical background

From the endogenous growth theory point of view, there are two main elements that drive economic growth: human resources and technological change (Romer, 1986), where the later can be contributed by the technology diffusion from FDI via knowledge improvement and innovation that leads to productivity spillovers in the host country (De Mello, 1999). The spillover effects on local enterprises from multinationals can occur because of factors such as learning-by-watching, the movement of labour, and competition occurring through several channels (B. J. Aitken & Harrison, 1999b; Blalock & Gertler, 2008; Görg & Greenaway, 2004; Javorcik, 2004; Kugler, 2006). Blomström and Persson (1983) claim that foreign enterprises may encourage a technology improvement in domestic enterprises through technological transfer. When a multinational firm enters a host economy, it generally brings capital, technology and human resources to start up its business. Domestic enterprises now are its competitors, suppliers or customers. Though this process, there are three different ways that foreign direct investment can affect local firm's productivity namely, horizontal, backward and forward spillovers (the latter two are recognized as vertical linkages) (B. J. Aitken & Harrison, 1999b; Fujimori & Sato, 2015; Gorodnichenko, Svejnar, & Terrell, 2014; Javorcik, 2004; Newman, Rand, Talbot, et al., 2015).

Horizontal productivity spillovers occur where the entry of foreign firms leads to productivity transfer to local firms through learning by doing, labour mobility and competition. A positive horizontal productivity spillover can be generated through several ways. If local firms make direct contact with multinational enterprises, information is potentially diffused, the risk is limited and the chance of adoption increases (Blomström & Kokko, 1996). Within the same industry, labour mobility may facilitate technology spillovers. In doing so, foreign firm technology is accessed by domestic firms as those workers trained or employed by foreign

firms could potentially leave the foreign firms to start their own business, or be hired by local enterprises later competing in the same industries. Horizontal spillovers arise from competition brought by the foreign investment. If foreign firms have advantages over local enterprises in technology, labour skill, managerial skill and so on, then greater competitive pressure on local enterprises may force the latter to produce new products or new technology themselves in order to maintain their market share and adopt new managerial methods and so improve their productivity. In contrast, foreign firms naturally may want to encourage skilled-employees to stay by offering better remuneration packages than the domestic standard. Labour productivity spillovers can also be low in countries where foreign firms have substantial advantages over local enterprises (Meyer & Nguyen, 2005). Furthermore, multinational enterprises may attract demand away from local enterprises or/and increase competition, thus result in a reduction in the output and productivity of local enterprises or in some cases, lead to even worse, exiting the market (B. J. Aitken & Harrison, 1999b). These considerations lead to negative horizontal productivity spillovers.

Vertical spillovers are generated among industries through backward linkages where foreign enterprises buy inputs from local suppliers, and through forward linkages if the former supply inputs to the latter. Positive backward spillovers are generated when local firms in upstream sectors that supply intermediates to foreign enterprises in downstream sectors gain productivity improvements. This spillover may occur through several ways, the most likely being knowledge transfer from multinational enterprises to domestic input suppliers. There is another possibility that up-stream local enterprises that are not directly linked with downstream foreign enterprises might obtain productivity development through externalities. This could be due to scale economies reflecting greater demand for domestically-produced intermediates (Javorcik, 2004). By contrast, it is also possible that foreign presence will bring negative effects to local enterprises. For example, if multinational enterprises are directly linked with local input

suppliers then there may be a possibility that multinationals have more power during contract negotiations that will lead to lower profits for local firms, which is considered as a loss in the measured productivity of local firms (Girma & Gong, 2008). It can also be argued that local enterprises may experience negative influences on productivity if they attempt to supply inputs that are not suited for production (Larraín et al., 2000).

Forward spillovers are generated when foreign firms in upstream industries influence the productivity of downstream local enterprises. Forward linkages are generated where domestic enterprises in upstream sectors are customers of multinationals in downstream sectors. Spillovers are generated if intermediate goods provided by foreign enterprises are new well-developed technologies from which local enterprises can learn from (Grossman & Helpman, 2003). Therefore, it is possible for positive externalities to occur through forward linkages. There is also a chance that intermediates supplied by foreign enterprises may be accompanied by services or other forms of support that influences the productivity of local users (Javorcik, 2004). This type of foreign investment spillover will only occur through direct linkages between foreign-input suppliers and local producers. Meanwhile, positive forward spillovers can occur if an increase in foreign presence in upstream sectors raises competitive pressures thereby encouraging local input suppliers in those industries to reduce inefficiencies in the production process. Therefore, downstream local enterprises that use inputs from these industries may enjoy productivity improvements due to more efficiently produced inputs supplied by upstream firms. By contrast, there is also the existence of negative forward spillovers. The presence of foreign enterprises in upstream industries may raise competition if foreign firms account for a significant market share. If local firms in upstream sectors can no longer compete, enterprises in downstream sectors may have to pay higher prices for their intermediate goods (or even experience lower quality inputs), which may result in a productivity reduction in the local firms in downstream sectors. An inadequate labour capacity

on the part of local buyers may also be a factor that which leads to negative forward spillovers. Here, local firms in downstream sectors may not have sufficient skilled labour in order to operate machinery or inputs purchased from foreign enterprises in upstream industries effectively (B. J. Aitken & Harrison, 1999b).

3.2.2. Empirical evidence

Numerous studies have investigated the effects of foreign investment on the productivity of local enterprises in the host country. Positive effects can be found in both horizontal and vertical linkages and can be different across countries. Early studies that used industry-level data, such as Caves (1974) for Australia and Globerman and Meredith (1984) for Canada, show that the presence of multinational firms has positive effects on the productivity of local enterprises. Other studies conducted by Blomström and Persson (1983) for Mexico, Blomström and Sjöholm (1999) for Indonesia; Haskel, Pereira, and Slaughter (2007) and Harris and Robinson (2003) for the UK, also find positive linkages between local enterprises' productivity and foreign presence in manufacturing industries. Liu et al. (2000) for industries in the UK and (Liu, Parker, Vaidya, & Wei, 2001)) for China, also find positive influences from foreign to local enterprises. Reganati and Sica (2007) investigating Italy and do not find significant evidence of productivity spillovers through horizontal channel. S. J. Chang, Chung, and Xu (2007) for China; Sönmez and Pamukçu (2013) for Turkey; Dua, Goldar, and Behera (2011) and Behera, Dua, and Goldar (2012) for India; Fernandes and Paunov (2012) for Chile; Tantratananuwat (2016) for Thailand; and Fujimori and Sato (2015) for Indonesia, also find horizontal spillovers from foreign investment to local enterprise productivity.

Kugler (2006) for Colombia, finds that vertical productivity spillovers from foreign investment are primarily inter- rather than intra-industry based. Blalock and Gertler (2002), using firm-level data from Indonesia, find evidence of positive influences through backward linkages. Schoors and Van Der Tol (2002) find positive and significant impacts of backward

linkages in Hungary. Reganati and Sica (2007) indicate significant evidence of knowledge transfers from the foreign investment in upstream industries to downstream domestic enterprises in Italy. Managi and Bwalya (2010) find the foreign investment presence impacts local enterprises through both vertical and horizontal channels in Zimbabwe and Kenya. Jude (2012b) finds positive backward spillovers from foreign customers to domestic suppliers, Malik (2015) examining India, confirms a significant positive vertical spillover from foreign to local enterprises in high-technology industries and less significant spillovers in low-technology industries.

While much of the evidence supports a positive linkage between foreign and local enterprise productivity, some studies find contrary results. In case of Morocco, Haddad and Harrison (1993) do not find any evidence of spillovers from foreign to local enterprises, and local firms seemed to be pushed into the low-level technology sector of the industry as the result of competition. B. Aitken et al. (1997) show that in Venezuela, an increased foreign presence in an industry influences the productivity of local enterprises in a negative way because they are forced to reduce their production. Similar results are also reported for Indonesia by these authors. Girma, Greenaway, and Wakelin (2001), in the case of the UK, find no evidence of productivity spillovers from foreign to local plants. Konings (2001) examines the linkages in some European countries and finds negative spillovers from foreign to local enterprises in Bulgaria and Romania, and insignificant spillovers in Poland. Djankov and Hoekman (2000), looking at the Czech Republic also finds negative impacts from spillovers on local plants. Hu and Jefferson (2002) find negative spillovers in the electronics industry, but not so for the textile industry in China. Schoors and Van Der Tol (2002) conclude that foreign-invested enterprises are associated negatively with local plant productivity through forward linkages generating negative effects in Hungary. Damijan, Knell, Majcen, and Rojec (2003) find no evidence of spillovers in ten host countries in Eastern Europe. Haskel et al.

(2007) suggest that foreign firms coming from the United States or France are positively linked with local plant productivity, but a foreign firm from Japan generates negative impacts on domestic enterprise productivity in the UK. Research focused on transition economies have on occasion find no or negative spillover effects. In a recent study, Jude (2012b) also confirms negative forward linkage between foreign firms and domestic clients in Romania.

For Vietnam, a number of studies examine productivity spillovers from foreign to local enterprises. Some of these focus on local enterprise total factor productivity (TFP). Applying a two-stage model to a panel of 22 manufacturing sectors at industry level during 1995-2005, Anwar and Nguyen (2010a) indicate that the presence of multinationals has significant positive influences on the manufacturing sector's growth through vertical backward linkages. In a more recent study, Anwar and Nguyen (2014) examine the impacts on domestic firm total factor productivity for the period of 2000-2005 and find that the effects vary across regions with strong positive spillovers on TFP through backward linkages. Ni, Spatareanu, Manole, Otsuki, and Yamada (2015) using a panel dataset for the period of 2002 -2011 at firm level, find that Vietnamese suppliers' productivity in upstream sectors have positive linkage with the foreign customers from Asia in downstream sectors, but no significant association with foreign firms from Europe and North American. In further research, Ni and Kato (2017) use firm-level data to investigate whether foreign Asian enterprises in downstream industries affect Vietnamese enterprise's TFP in upstream industries. These results reveal that the middle group has the strongest positive effects on domestic enterprises TFP in upstream sectors for the period of 2002-211. Newman, Rand, Talbot, et al. (2015) examine spillovers by using a specially designed survey of more than 4,000 manufacturing enterprises. Their findings show that significant linkages with foreign firms are more likely to occur through vertical rather than horizontal linkages. Positive linkages are often generated through backward linkages while forward linkages generally create negative impacts on local enterprises TFP.

Other studies in Vietnam focus on how foreign firms affect local enterprise output or labour productivity rather than TFP (Le & Pomfret, 2011; Newman, Rand, Tarp, & Trifkovic, 2015; C. D. Nguyen, Simpson, Saal, Nguyen, & Pham, 2008; Thuy, 2005; Van Thanh & Hoang, 2010). L. P. Nguyen (2008); Van Thanh and Hoang (2010); Kien (2008) and Le (2007) find positive impacts from foreign investment on Vietnamese firm labour productivity. Le and Pomfret (2011) investigate the linkages on local firm labour wages and find significant positive evidence from the presence of multinationals and average wages in local private companies. They also point out that average labour income in local private companies is found to be higher in those industries with a larger presence of foreign investment. Thang, Pham, and Barnes (2016) examine the role of geographical proximity in labour productivity spillover effects and find that productivity spillovers diminish as the distances between foreign and local companies increase.

The existing literature has not reached a consensus insofar as the impact from multinational presence on local firms' productivity is positive or negative through either horizontal or vertical linkages. While these linkages have also been considered for the case of Vietnam, this study employs a much more comprehensive dataset covering most manufacturing firms in Vietnam. Furthermore, it is important to investigate spillovers on TFP and through horizontal and vertical linkages for an updated period that includes important changes in Vietnamese enterprise law providing more incentives for firms in term of taxation and land use (Vietnamese Gov, 2013, 2014), encouraging them to expand their business and take advantage of lower income tax rates and lower land rents over a longer time period. This is important because these changes may have benefited not only domestic firms, but also foreign enterprises too. While multinationals have already advantages over local firms, these changes may have created a larger gap between them and inhibited potential spillovers from the former to the latter.

3.3. Methodology and data

3.3.1. Methodology

Following the earlier work by Newman, Rand, Talbot, et al. (2015), Fujimori and Sato (2015), Anwar and Nguyen (2011), Ni et al. (2015), our model to examine the productivity spillovers is as follows

$$tfp_{ijt} = \beta_0 + \beta_1 Horizontal_{jt} + \beta_2 Backward_{jt} + \beta_3 Forward_{jt} + \beta_4 HHI_{jt} + \beta_5 scale_{ijt} + \beta_6 wage_{ijt} + \beta_7 expint_{ijt} + \beta_8 impint_{ijt} + \beta_9 rd_{ijt} + \beta_{10} loc_{ijt} + u_{ijt} \quad (3.1)$$

where tfp_{ijt} is total factor productivity of enterprise *i* in sector *j* at time *t*. $Horizontal_{jt}$, $Backward_{jt}$, $Forward_{jt}$ are horizontal, backward and forward linkages between foreign investment and local enterprises, respectively. We might expect to see negative impacts from horizontal linkages and positive effects from backward and forward linkages. HHI_{jt} denotes the Hirschman-Herfindahl index of industry *j*, which measures the concentration of that market. HHI may either exert a positive or negative on influence on firm productivity. All these variables are at industry level.

The remaining variables in equation (3.1) are control variables at firm level. $scale_{ijt}$ is the scale of firm *i* in the sector *j* which is computed by dividing the sales of firms *i* by the average sales of industry *j*. As most of Vietnamese firms are small and medium-sized perhaps characterised by non-decreasing returns to scale, we expect that scale positively affects firm productivity. $wage_{ijt}$ is the average wage of the worker that received from firm i. I assume that firms pay higher wages may acquire higher-skilled workers, which then enhances productivity. *Wage* is expected to have positive linkage with firm's *tfp*. In terms of other variables, $expint_{ijt}$ – the ratio of export volume out of total sales and $impint_{ijt}$ - ratio of import volume out of sales - denote the intensity of exports and imports of firm *i*, respectively. As exports might have a positive impact on productivity (Arnold & Hussinger, 2005; Newman, Rand, Tarp, & Nguyen, 2016; Wagner, 2002, 2007), the more export-intensive a firm is, then

the more productive that firm might be. Meanwhile, the impact of imports on productivity is unclear in that it could be positive or negative depending on the type and quality of import products. These are assumed to have positive influences on local enterprises productivity, rd_{ijt} is a dummy variable referring the research and development (R&D) expenditure status of firm *i* being equal to zero if firm *i* has no R&D expenditure and one if firm *i* has spent an amount of money on R&D during that year. I assume that enterprises, which are more innovative, are more productive than those enterprises that do not engage in R&D. I also employ the dummy variable, loc_{ijt} to capture the location of firm, which receive the value of one if the enterprise is located in an industrial zone and zero otherwise. Firms located in an industrial zone can benefit from a better infrastructure associated with lower production costs thereby facilitating higher productivity[4].

To estimate equation (3.1) our approach proceeds in three steps. First, I measure the TFP of domestic firms followed by the second step, which is to measure the linkages. The final step is to estimate the impacts of foreign investment on domestic enterprise TFP.

The estimation of total factor productivity for each domestic enterprise in our sample is based on the Cobb-Douglas production function. This approach has previously been employed in studies of Vietnamese firms (Newman, Rand, Talbot, et al., 2015; Newman, Rand, Tarp, et al., 2015; Ni & Kato, 2017). In the estimation of the production function, common issues include endogeneity and multicollinearity. These issues can be caused by the correlation between observed variables (labour, capital) and unobserved inputs or productivity shocks (managerial ability, quality of land, materials, etc.), or selection bias (firms with low productivity exiting sooner), or other factors (measurement error, etc.). Such correlation potentially creates bias in the estimation of production functions. Labour and capital inputs are

[4] A description of these variables is provided in the chapter appendix Table A3.5.

typically highly correlated which can lead to problems related to multicollinearity (Aguirregabiria, 2009).

A number of approaches can address these potential problems through using input prices as an instrumental variable (IV), fixed effects estimation, or control functions (Aguirregabiria (2009). A problem with IV estimation is that input prices, which potentially act as a good instrumental variable, is not available at firm-level. Fixed effects estimation requires the very strong assumption that labour and capital are strictly exogenous, which is unrealistic in most cases. I therefore follow the approach of controlling for unobservables in estimating production function that was first introduced by Olley and Pakes (1992) (OP) and then extended by Levinsohn and Petrin (2003) (LP) then later modified by (Ackerberg, Caves, & Frazer, 2006) (ACF).

Starting with a log-linearised Cobb-Douglas production function, we may write:

$$y_{ijt} = \beta_k k_{ijt} + \beta_l l_{ijt} + \omega_{ijt} + e_{ijt} \quad (3.2)$$

where: y_{ijt} is total output, k_{ijt} is capital stock, l_{ijt} is labour of enterprise *i* in sector *j* at time *t*, in log form. ω_{ijt} is unobserved productivity which refers for total factor productivity (Newman, Rand, Talbot, et al., 2015) and e_{ijt} is random error term. With the OP assumption that capital at time t is determined by investment at time t-1, we then have

$$k_{ijt} = (1-\delta)k_{ijt-1} + i_{ijt-1} \quad (3.3)$$

where i_{ijt-1} is the lag of investment. Following the OP assumption[5], investment is a function of the unobservable (ω) and the observable variable (capital)

$$i_{ijt} = I_t(k_{ijt}, \omega_{ijt}) \quad (3.4)$$

I may substitute for ω in equation (2) to obtain:

[5]The use of intermediate goods/materials or investment and its lags can be used as an IV to control for unobservables, but the former are not available for the whole sample throughout the period so we use lag of investment as an IV instead.

$$y_{ijt} = \beta_k k_{ijt} + \beta_l l_{ijt} + f(k_{ijt}, i_{ijt}) + e_{ijt} \quad (3.5)$$

The OP approach provides the estimate $\widehat{\beta_l}$ in the first step then allows the second step to estimate $\widehat{\beta_k}$ given $\widehat{\beta_l}$ based on equation (3.5). However, following Newman, Rand, Talbot, et al. (2015), I employ the one-step GMM Wooldridge (Jeffrey M Wooldridge, 2009) based on the OP approach taking into account the lag of investment as the instrumental variable, which is a more efficient estimator than the standard two-step OP estimator (Newman, Rand, Talbot, et al., 2015), to estimate $\widehat{\beta_k}$ and $\widehat{\beta_l}$. These results then, allow us to obtain TFP (say, ω_{ijt}) based on equation (3.2):

$$\widehat{\omega_{ijt}} = y_{ijt} - \widehat{\beta_k} k_{ijt} - \widehat{\beta_l} l_{ijt} \quad (3.6)$$

The second step is to measure foreign investment linkages. Following Newman, Rand, Talbot, et al. (2015), Fujimori and Sato (2015), Javorcik (2004) and Jude (2012b), spillovers are calculated as follows.

$$Horizontal_{jt} = \sum_{j=1}^{n} FIsales_{jt} / \sum_{j=1}^{N} sales_{jt} \quad (3.7)$$

where $Horizontal_{jt}$ represents the ratio of total sales of the foreign enterprises in sector *j* in time *t* to the total sales of enterprises in sector *j* in time *t*. $FIsales_{jt}$ denotes the total sales of foreign enterprises in sector *j*; $sales_{jt}$ is total sales of sector *j*.

Backward and forward spillovers are considered to occur from the presence of multinational companies in downstream and upstream industries.

$$Backward_{jt} = \sum_{j \neq k} \alpha_{kt} * Horizontal_{kt} \quad (3.8)$$

where $Backward_{jt}$ measures the linkage between domestic suppliers in upstream sector *j* and their foreign customers in downstream sector *k*. $\alpha(kt), k \neq j$ is the share of sector *j* output supplied to sector *k*.

$$Forward_{jt} = \sum_{j \neq h} \sigma_{ht} * Horizontal_{ht} \quad (3.9)$$

$Forward_{jt}$ represents the linkages between foreign suppliers in downstream sectors and their domestic customers in upstream sectors. $\sigma(ht)$ is calculated as the total intermediate goods from sector *h* to sector *j* divided by the total input sold to sector *k*. Following Newman, Rand, Talbot, et al. (2015) and Le and Pomfret (2011), *HHI* is calculated as

$$HHIjt = \sum(\frac{xijt}{Xjt})^2 \quad (3.10)$$

where $xijt$ is the output of enterprise *i* in sector *j* at time *t*; Xjt is total output of sector *j*.

Once we have estimation results for TPF, horizontal, backward and forward linkages, we then can proceed to step 3, which is to estimate the impacts of FDI's presence on domestic firms' TFP in equation (3.1). We allow for the possibility that the change in the investment law in 2014 may have had a significant effect in the spillovers. With this in mind, we also employ interaction dummies with the spillover variables. The main equation (3.1) now becomes

$$tfp_{ijt} = \beta_0 + \beta_1 Horizontal_{jt} + \beta_2 Backward_{jt} + \beta_3 Forward_{jt} + \beta_4 HHI_{jt} + \beta_5 scale_{ijt} + \beta_6 wage_{ijt} + \beta_7 expint_{ijt} + \beta_8 impint_{ijt} + \beta_9 rd_{ijt} + \beta_{10} loc_{ijt} + \beta_{11} Horizontal_{jt} * Year2014 + \beta_{12} Backward_{jt} * Year2014 + \beta_{13} Forward_{jt} * Year2014 + u_{ijt} \quad (3.11)$$

Our estimation technique using fixed effects (FE) and random effects (RE) estimation commonly used for panel data. I include industry fixed effects to some way take care of potential confounding factors (Newman, Rand, Talbot, et al., 2015) that might occur in our model in equation (3.11). I also control for the changes in the economy's context by including year dummies into the model. Our standard errors are bootstrapped with 2000 replications. One may be concerned that our model (3.11) includes control variables that are potentially endogenous. To account for this, I also run regressions using the first lag of the control variables instead. However, to avoid the loss of observations caused by using the lag (which is around 30-35% of the total samples), I choose not to report these as the main results given that there are significant similarities in terms of the impact from foreign investment on local firm total

factor productivity across the two models[6]. In a further test of robustness, I also estimate equation (3.11) in first difference estimation form and the results are reported in the appendix[7].

3.3.2. Data

I employ a panel dataset of domestic enterprises constructed from the Vietnam enterprise survey (VES), which has been gathered annually by Vietnamese General Statistical Office (GSO) since 2001. The survey collects all the information of active enterprises throughout the sectors and regions in the country. Enterprises are legally required to cooperate with the GSO and complete the survey under the Statistics law, which then provides general information of firms and firms' characteristics. The data then are checked by the GSO for internal consistency and cross-checked with administrative provincial data before being made available for publication. All the enterprises included have a sector code, which allows the user to link it with the sector code in of the Vietnam Standard Industrial Classification (VSIC), which includes 88 sectors at two-digit level. The ownership of firms is also reported in this dataset. The firms in this survey are recognized as domestic enterprises (private or state-owned enterprises) or foreign direct investment firms (100 percent foreign capital firms) or joint venture firms.

Regarding the production function estimation, the production function for each sector at 2-digit level is estimated over the 2010-15 study period. There are 24 two-digit sectors in the Vietnamese manufacturing industry, which are coded from 10 to 33 in VSIC 2007. The output variable used in our production function estimation is calculated by the value-added approach. Capital is calculated as the deflated value of assets, and labour is measured as total employees at the end of the year. Investment is calculated as the change in the total assets over the year. Table 3.1 presents some of the data description for those main variables, where I use

[6] We proceed equation (3.11) with lag 1 of the variables at firm level: *scale, wage, expint, impint, rd* and *loc.*
[7] We take the first difference of the *tfp* as the dependent variable and the first difference of all other independent variables.

gross output as the dependent variable, labour and capital (in log form) as the main independent variables and investment as the control variable at firm level to estimate the production function.

Table 3.1. Summary statistics for production function estimation variables

	Min	Mean	Max	SD
Ln-GO	0.1	7.921	18.849	2.145
Ln-Capital	0	8.581	18.311	1.565
Ln-Labour	0	2.57	9.622	1.323

Notes: Authors' calculations based on the Vietnam Enterprise survey 2010-2015. Labour units are measured in number of employees, other units are measured in million Vietnamese dong

The calculation of the linkages is obtained from the VES dataset combining with the Input-Output (IO) table. First of all, horizontal linkages are computed following equation (3.7) using VES dataset, which then allow us to obtain vertical linkages. Backward and forward linkages are measured by combining the VES data with the IO tables. We use the inverse IO-2012- table, which is a square matrix of 164 sectors. The IO table contains the input values of each sector that is supplied from all the other sectors in the columns, along with the inputs that each sector supplies to all other sectors in the rows (Van Ha, Mark Holmes, Tinh Doan, & Gazi Hassan, 2019). That allows us to obtain α and σ and then proceed to equations (3.8) and (3.9) and calculate the backward and forward linkages.

A brief description of the data is shown in Table 3.2, which reports some summary statistics of those variables for the whole manufacturing sector over the period of 2010-15.

Table 3.2. Summary statistics for the estimation of productivity spillover

Variables	Min	Mean	Max	SD
Horizontal	0	0.39	0.99	0.22
Backward	0	0.66	1.5	0.25
Forward	0	1.62	8.0	2.25
HHI	0.003	0.045	0.84	0.22
Scale	8.94e-08	0.59	98.71	5.34
Wage	0.25	48.94	432.00	71.15
Expint	0	0.025	0.9	0.13
Impint	0	0.014	0.9	0.08

Notes: Authors' calculations based on the Vietnam Enterprise survey 2010-2015

The whole sample comprises 222,249 observations, which includes only domestic firms. 100% foreign-invested and joint-venture firms are excluded from the sample. As I look closer into firm ownership, technology level and region, the main dataset can be divided into sub-samples. Based on firm type, I create a sub-sample for the state-owned group of 7,166 observations (firm type code ranges from 1 to 5) and private group of 215,083 observations (firm type code ranges from 6 to 10). Technology-level clusters are generated by using the industry coding at 2-digit level following a technology-level classification with 127,789 observations in the low-tech group and 94,460 observations in the medium-and-high-tech group. Regional groups include the North (81,444 observations), Central (32,024 observations) and the South (108,781 observations) where the whole sample division is based on province code. A test for the correlation among the variables is reported in Table 3.3 below.

Table 3.3. Correlation table

	tfp	Horizontal	Backward	Forward	HHI	scale	wage	expint	impint
tfp	1								
Horizontal	-0.0387	1							
Backward	0.0839	0.288	1						
Forward	0.1409	-0.0798	-0.0281	1					
HHI	-0.0079	-0.1068	-0.0849	-0.0955	1				
scale	0.1421	-0.0283	-0.0194	0.0022	0.0049	1			
wage	0.0704	-0.0016	0.0175	0.0018	-0.0036	0.0318	1		
expint	0.0641	0.017	-0.0036	-0.077	-0.0112	0.0736	0.0066	1	
impint	0.125	0.058	0-0.01	0.0101	-0.0025	0.118	0.02	0.2099	1

Notes: Authors' calculation from VES

3.4. Results

3.4.1. Productivity estimation

As discussed above, we employ the GMM estimator advocated by Woolridge. Lagged investment is used as an instrument to control for unobservables. Table 3.4 reports our findings based on the Woolridge GMM, OP and OLS estimation.

Table 3.4. Production estimation.

	Wooldridge GMM	OP	OLS	Sector in VSIC	Wooldridge GMM	OP	OLS
VSIC10				**VSIC11**			
l	0.67***	0.67***	0.64***	l	1.21***	1.07***	1.16***
	(0.011)	(0.017)	(0.007)		(0.02)	(0.02)	(0.02)
k	0.35***	0.38***	0.71***	k	0.05*	0.11***	0.32***
	(0.0147)	(0.013)	(0.008)		(0.021)	(0.02)	(0.02)
Observations	10,932	17,594	27,341	Observations	3,946	6,452	9,982
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC12				**VSIC13**			
l	0.52***	0.48**	0.38***	l	0.58***	0.55***	0.58***
	(0.09)	(0.19)	(0.07)		(0.015)	(0.012)	(0.011)
k	0.56**	0.68***	0.72***	k	0.37***	0.39***	0.63***
	(0.23)	(0.44)	(0.08)		(0.021)	(0.15)	(0.01)
Observations	78	104	109	Observations	4,295	7,052	8,520
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC14				**VSIC15**			
l	0.67***	0.62***	0.63***	l	0.61***	0.59***	0.63***
	(0.009)	(0.009)	(0.007)		(0.015)	(0.01)	(0.01)
k	0.25***	0.28***	0.48***	k	0.09***	0.13***	0.39***
	(0.014)	(0.083)	(0.008)		(0.025)	(0.01)	(0.01)
Observations	8,227	13,623	21,657	Observations	2,147	3,606	5,449
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC16				**VSIC17**			
l	0.69***	0.69***	0.7***	l	0.77***	0.74***	0.76***
	(0.013)	(0.016)	(0.009)		(0.02)	(0.02)	(0.01)
k	0.34***	0.37***	0.61***	k	0.22***	0.26***	0.52***
	(0.016)	(0.007)	(0.007)		(0.02)	(0.008)	(0.01)
Observations	7,757	12,887	20,434	Observations	4,537	7,080	10,095
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC18				**VSIC19**			
l	0.83***	0.74***	0.80***	l	0.87***	0.66***	0.7 ***
	(0.016)	(0.023)	(0.011)		(0.144)	(0.11)	(0.08)
k	0.16***	0.22***	0.46***	k	0.23***	0.30***	0.68***
	(0.017)	(0.018)	(0.01)		(0.118)	(0.09)	(0.05)
Observations	8,171	13,500	21,693	Observations	150	263	432
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC 20				**VSIC 21**			
l	0.88***	0.87***	0.91***	l	0.9***	0.78***	0.78***
	(0.02)	(0.041)	(0.015)		(0.046)	(0.046)	(0.040)
k	0.26***	0.27***	0.53***	k	0.37***	0.57***	0.57***
	(0.02)	(0.113)	(0.012)		(0.049)	(0.067)	(0.033)
Observations	3,960	6,518	10,467	Observations	805	1,224	1,740
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC22				**VSIC23**			
l	0.71***	0.65***	0.67***	l	0.63***	0.64***	0.67***
	(0.016)	(0.014)	(0.01)		(0.012)	(0.008)	(0.009)
k	0.27***	0.32***	0.59***	k	0.28***	0.30***	0.58***
	(0.02)	(0.021)	(0.01)		(0.026)	(0.022)	(0.007)
Observations	7,381	11,681	16,922	Observations	8,184	12,551	18,669

Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC24				**VSIC25**			
l	0.54***	0.63***	0.69***	l	0.85***	0.76***	0.81***
	(0.029)	(0.03)	(0.02)		(0.012)	(0.011)	(0.008)
k	0.31***	0.30***	0.59***	k	0.22***	0.28***	0.52***
	(0.035)	(0.04)	(0.017)		(0.012)	(0.01)	(0.006)
Observations	2,065	3,318	4,736	Observations	17,139	28,516	44,366
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC26				**VSIC27**			
l	0.85***	0.84***	0.83***	l	0.69***	0.68***	0.69***
	(0.038)	(0.038)	(0.03)		(0.028	(0.023)	(0.023)
k	0.28*	0.38***	0.44***	k	0.26***	0.32***	0.63***
	(0.048)	(0.007)	(0.02)		(0.035)	(0.045)	(0.018)
Observations	700	1,292	2,245	Observations	1,825	3,030	4,604
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC 28				**VSIC29**			
l	0.75***	0.67***	0.72***	l	0.66***	0.73***	0.67***
	(0.027)	(0.024)	(0.019)		(0.059)	(0.074)	(0.044)
k	0.28***	0.31***	0.48***	k	0.33***	0.36***	0.61***
	(0.029)	(0.019)	(0.016)		(0.067)	(0.049)	(0.035)
Observations	2,454	4,072	5,938	Observations	429	738	882
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC30				**VSIC31**			
l	0.63***	0.67***	0.69***	l	0.85***	0.78***	0.78***
	(0.043)	(0.043)	(0.029)		(0.013)	(0.018)	(0.009)
k	0.36***	0.54***	0.47***	k	0.28***	0.32***	0.48***
	(0.054)	(0.11)	(0.022)		(0.018)	(0.049)	(0.009)
Observations	877	1,052	2,327	Observations	6,225	10,309	15,918
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	
VSIC 32				**VSIC 33**			
l	0.76***	0.67***	0.7***	l	0.69***	0.63***	0.69***
	(0.028)	(0.025)	(0.021)		(0.036)	(0.025)	(0.02)
k	0.26***	0.31***	0.49***	k	0.24***	0.29***	0.47***
	(0.031)	(0.029)	(0.018)		(0.033)	(0.017)	(0.017)
Observations	1,565	2,887	4,903	Observations	1,900	3,668	6,682
Instrument	Lag-invest	Lag-invest		Instrument	Lag-invest	Lag-invest	

Notes: Production function estimation of labour and capital on gross output. The Wooldridge GMM approach is applied for the 2010-15 study period. VSIC10 – VSIC33 are the industry codes. All the codes follow The Industrial Classification list provided by the government. Please refer to Anwar and Nguyen (2011), for more detailed.

The results obtained from GMM and OP estimation are similar across sectors. In general, the sum of the coefficients on labour and capital are close to unity suggesting constant return to scale. Other sectors with decreasing returns to scale are those sectors that typically have low-skilled workers, for example, the manufacture of textiles (VSIC13), manufacture of leather (VSIC15) and manufacture of basis metal (VSIC25). Sectors with increasing returns to scale are typically those that have a higher level of skilled labour and technology. These sectors

include the manufacture of chemical and chemical products (VSIC20), manufacture of pharmaceuticals, medical, chemical and botanical products (VSIC21), manufacture of computer, electronics and optical products (VSIC26).

The contribution of labour in most cases is higher than that of capital. This is consistent with previous work (Newman, Rand, Talbot, et al., 2015; World Bank, 2017e). Over the decades, the Vietnamese economy has benefitted from an increased size of labour force, which has also been a key factor in the attraction of foreign investment. By contrast, the lack of capital resources has driven the low contribution from capital in almost every sector. This is a similar situation to what has occurred in many developing countries. Because of the advantages of GMM over the other estimators discussed previously, we proceed to use the estimation of production function GMM-based results to calculate the total factor productivity of domestic firms.

3.4.2. Foreign investment spillovers

The paper first conducts estimation for the whole sample to see the general picture for the spillovers, then takes a closer look at the role of labour absorptive capacity in the process. As it is assumed that there may be differences in the effects that occur across different firm types, technology and location, we also examine sub-samples for groups of ownership, technology level and regions. Year and industry dummies are included and standard errors are bootstrapped with 2000 replications in all regressions. Fixed effects (FE), random effect (RE) and ordinary least squares (OLS) results are reported. Although the Hausman test (reported in the appendix table A3.1) shows the propriety of fixed effects estimation, the results from FE and RE are almost similar in term of the signs on our main coefficients of interest.

3.4.2.1. Overall spillovers

The results from FE, RE and OLS estimation for the whole sample are reported in Table 3.5[8]. We include industry dummies to account for industry specifics and year dummies to account for the unobservables in the country context. The standard errors are bootstrapped with 2000 replications in all regressions[9]. In general, the study finds significant impacts from the presence of foreign investment on domestic firm productivity across the linkages.

There is evidence that multinational enterprises have a negative effect on the TFP of local enterprises operating in the same industry as we find a significant negative influence through horizontal linkages. This is consistent with a foreign presence that increases competition between firms in the same industry, leading the less productive domestic firms (B. J. Aitken & Harrison, 1999b). In the case of Vietnam, local firms are mostly smaller and less productive compared with foreign firms, which makes them less competitive than the multinationals. Unlike existing studies (Anwar & Nguyen, 2010a; Le & Pomfret, 2011), this is consistent with the results that (Newman, Rand, Talbot, et al., 2015) find in their research of Vietnamese manufacturing industry for the earlier period of 2006-12. Furthermore, this result is also consistent with previous studies for both developing and developed countries[10] (Behera, 2012; Behera et al., 2012; S. J. Chang et al., 2007; Dua et al., 2011; Fujimori & Sato, 2015; Sönmez & Pamukçu, 2013)

[8] The paper also estimates the baseline model in equation (3.11) using first difference estimation technique and results are presented in the appendix table A3.2.
[9] Since TFP is estimated in the first step using Production function estimation, before it is used in the second step as the dependent variable, standard errors are bootstrapped. Estimation of equation (3.11) using lag 1 of the control variable is reported in the appendix table A3.3.
[10] A robustness check using IV estimation is also provided in the Appendix table A3.4.

Table 3.5. The effects of foreign investment on domestic firms' productivity

VARIABLES	(1) FE	(2) RE	(3) OLS
Horizontal	-0.0536*	-0.133***	-0.34***
	(0.021)	(0.019)	(0.017)
Backward	0.122***	0.379	0.11***
	(0.027)	(0.023)	(0.0145)
Forward	0.0244***	0.067***	0.1092***
	(0.003)	(0.0039)	(0.0015)
HHI	-0.0021	-0.016*	-0.0243
	(0.858)	(0.0075)	(0.0114)
scale	0.019*	0.025*	0.029***
	(0.015)	(0.012)	(0.0063)
wage	0.00036*	0.00043*	0.00063***
	(0.00028)	(0.00024)	(0.00027)
expint	0.921	0.236	0.4966
	(0.0198)	(0.0192)	(0.013)
impint	-0.179	0.59	1.483
	(0.0328)	(0.029)	(0.032)
loc	0.034**	0.207***	0.379***
	(0.0123)	(0.0139)	(0.0157)
rd	0.0021	0.013	0.043*
	(0.019)	(0.019)	(0.0323)
Hy2014	0.081**	0.035**	0.031***
	(0.02)	(0.0193)	(0.0332)
By2014	0.016	-0.039	-0.013*
	(0.0173)	(0.017)	(0.0282)
Fy2014	-0.0089***	-0.013***	-0.0279***
	(0.0019)	(0.0018)	(0.0029)
Year dummies	Yes	Yes	Yes
Industry dummies	-	Yes	Yes
Constant	3.59***	3.24***	3.506***
	(0.026)	(0.024)	(0.0172)
Observations	210,812	210,812	210,812
R-squared			0.071
Number of id	77,525	77,525	77,525

*Notes: The estimation of the effects of foreign investment on domestic firm TFP over the period of 2010-15 is by fixed effects (FE), random effects (RE) and ordinary least square (OLS). Year dummies are included. Robust standard errors given in parentheses are bootstrapped with 2000 replications. *** p<0.01, ** p<0.05, * p<0.1.*

The results provide evidence that vertical linkages constitute an important mechanism of productivity spillovers from foreign to local enterprises. There is significant evidence

suggesting that foreign presence promotes domestic firm productivity through the backward linkage channel. When buying inputs from local firms, foreign enterprises may ask for a high standard quality that forces domestic firms to be more productive if they want to be a part of the value chain. Furthermore, foreign firms may be motivated to transfer their technology and know-how to domestic suppliers in order to allow the latter to produce high quality inputs that meet their criteria. This finding is consistent with previous studies of Vietnam (Le & Pomfret, 2011; Newman, Rand, Talbot, et al., 2015; Ni & Kato, 2017) and in studies of other countries (Blalock & Gertler, 2008; Javorcik, 2004; Jude, 2012b; Kugler, 2006).

While earlier studies find evidence of negative forward linkages (Newman, Rand, Talbot, et al., 2015; Schoors & Van Der Tol, 2002), or no evidence of forward linkage at all (Anwar & Nguyen, 2010a; Le & Pomfret, 2011; L. P. Nguyen, 2008), the paper finds significant positive forward spillovers but with a smaller magnitude compared with backward linkages. This is consistent with local customers having a direct relationship with foreign suppliers and benefitting from the high-quality inputs bought from them. It should be emphasised that domestic firms total factor productivity in downstream sectors benefit from the intermediates supplied by foreign enterprises in upstream industries where they are widely recognized to be of good quality and more advanced, especially in terms of technology. That may be the main mechanism that creates positive forward spillovers on TFP, where technology plays a significant role together with labour and capital.

As has been discussed earlier, the study period includes some changes in terms of investment law in 2014 that may affect the investment behaviour in both domestic and foreign firms. To allow for this change, the chapter takes into account interactions between year 2014 and the linkages to see if foreign investment appears in 2014 makes any differences in the spillovers to domestic enterprises productivity. The results in Table 3.5 show that year 2014 has impacts on the spillovers where we find that the interaction terms are significant across the

linkages. The results indicate that foreign investment from 2014 onwards creates additional significant positive linkages through the competition channel, and additional negative or moderating impacts to local buyers through forward linkages.

In terms of the control variables, the paper does find evidence to suggest that firm specifics have significant influences on productivity. Based on estimations in Table 3.5, *scale* and *wage* also affects the productivity of firms positively. The *location* of domestic firms is found to be important insofar as firms located in an industrial zone with a better infrastructure system and networking facilities are more productive than firms locate elsewhere. These findings are along the lines of previous studies (Anwar & Nguyen, 2014; Le & Pomfret, 2011; Newman, Rand, Talbot, et al., 2015; Zhou, Li, & Tse, 2002). By contrast, the argument that export-oriented and large-scale firms are more productive is not supported here. I also find no evidence to suggest that firms with R&D expenditure over the period are more productive than those firms who do not. This is likely due to the lack of R&D investment by domestic firms and even for those firms who have spent on R&D, it is a too small an amount to make a significant difference. I do not find that concentration at industry level *(HHI)* and export, import proportion out of total sales *(expint, impint)* to have a significant influence on local firms TFP either.

3.4.2.2. The role of labour absorptive capacity

There is the possibility that enterprises with different levels of skilled-labour can benefit from different productivity spillovers. With this in mind, I extend the analysis to take into account the role of absorptive capacity in both the direct and indirect linkages with foreign firms. This allows us to test whether firms with more skilled workers gain more productivity spillovers through horizontal and vertical linkages. For this purpose, the addition of interaction terms between the average wage of domestic firms with the linkages *(wageH, wageB* and *wageF*) can be added to equation (3.11). Exploring the absorptive capacity of local enterprises and the

spillovers that may exist through horizontal and vertical linkages offers new insights. The results are presented in Table 3.6.

Table 3.6. Productivity spillover and absorptive capacity

VARIABLES	(1) FE	(2) RE	(3) OLS
Horizontal	-0.123*	-0.0804	-0.0131
	(0.0902)	(0.0812)	(0.107)
Backward	0.215***	0.0705	-0.0114
	(0.0607)	(0.0498)	(0.0648)
Forward	0.0114**	0.0325***	0.105***
	(0.00516)	(0.00732)	(0.0105)
HHI	-0.00262	-0.00642	-0.0252**
	(0.00773)	(0.00764)	(0.0125)
scale	0.0190	0.0256**	0.0302***
	(0.0172)	(0.0128)	(0.00681)
wage	0.00126**	0.00131**	0.00169**
	(0.000494)	(0.000511)	(0.000692)
expint	-1.424	-1.558	-2.212
	(1.514)	(2.000)	(2.339)
impint	0.193	0.678	1.628
	(0.0256)	(0.0306)	(0.0484)
wageH	0.00141	0.000845	0.000501
	(0.00191)	(0.00170)	(0.00223)
wageB	-0.00202*	-0.00166*	-0.00172
	(0.000908)	(0.000838)	(0.00123)
wageF	0.000236***	9.84e-05	4.93e-05
	(7.11e-05)	(0.000117)	(0.000176)
loc	0.0327**	0.228***	0.401***
	(0.0140)	(0.0141)	(0.0135)
rd	0.00424	0.0158	0.0430
	(0.0208)	(0.0204)	(0.0300)
Hy2014	0.0898***	0.0822***	0.0359
	(0.0224)	(0.0211)	(0.0320)
By2014	0.00363	-0.00510	-0.0244
	(0.0207)	(0.0195)	(0.0293)
Fy2014	-0.00825***	-0.0137***	-0.0277***
	(0.00194)	(0.00192)	(0.00272)
Year dummies	Yes	Yes	Yes
Industry dummies	-	Yes	Yes
Constant	3.570***	3.295***	3.502***
	(0.0318)	(0.0313)	(0.0343)
Observations	210,812	210,812	210,812
R-squared	0.020	-	0.169
Number of id	77,525	77,525	77,525

*Notes: In these regressions, the role of labour absorptive capacity takes into account the interactions between labour productivity and the linkages using the same approach as in Table 4. Year dummies are included. Robust standard errors given in parentheses are bootstrapped with 2000 replications. *** p<0.01, ** p<0.05, * p<0.1*

Examining the coefficients on linkages, it turns out that there is a weak significant evidence of negative horizontal spillovers, but there are still strong positive backward and forward spillovers. However, based on FE estimation, the positive effects are now larger than the previous results for the case of backward spillovers but weaker in the case of forward linkages. This latter finding is contrast to Newman, Rand, Talbot, et al. (2015), who find no evidence to suggest that foreign firms generate negative impacts on domestic competitors in the same sector. The results are consistent with the idea that multinationals having better technologies and being much more productive than local firms, as well as having better management skills that crowd nascent domestic competitors out of the market in general, even when control for labour absorptive capacity. According to a World Bank's report (World Bank, 2017e), Vietnamese manufacturing firms remain disadvantaged due to weak management skills, low-level technology and lack of skilled workforce and financial. Furthermore, limited information about the market and also their competitors is also a critical constraint that domestic firms are facing.

The findings concerning backward and forward spillovers here once again confirm the positive linkage between local and foreign firms through vertical linkages. Although there are difficulties related to the lack of information and skilled workers that prevent domestic firms from utilising foreign firm sourcing strategies, as well as building connections and linkages with foreign customers (World Bank, 2017e), our results confirm that domestic enterprises still can benefit from the presence of foreign enterprises. A relatively quick way for Vietnamese manufacturing firms to join global value chains (GVCs) is through the connections with foreign enterprises. Such connections have potential to include both types of spillovers from foreign enterprises and the absorptive capacities of local enterprises. However, only domestic suppliers who have a direct relationship with foreign customers can gain backward spillovers (Newman, Rand, Talbot, et al., 2015; World Bank, 2017e). Foreign firms may aim to prevent technology

and know-how leaking to domestic competitors, and so require local suppliers to keep such technology knowledge secret, thereby allowing only direct suppliers to absorb the spillover advantages from multinationals.

On the other hand, our results reveal negative spillovers through horizontal linkages that are not significant for those firms with more skilled workers. Domestic firms paying higher labour wages tend to have less negative impact on TFP, while the coefficient on the interaction term between labour wages and horizontal linkage is positive but not significant, compared with negative impact in general. In terms of the interaction term between labour wages and forward linkages across industries, we find evidence of a positive linkage suggesting that domestic firms in downstream sectors with more skilled workers receive positive impacts from foreign investment in the upstream sectors. Our results find little significant evidence to support that the possibility that backward linkages are weaker for those domestic suppliers who pay higher wages to their employees that are above the average wage in upstream sectors. These results do not show that labour absorptive capacity plays a crucial role in the spillovers process that may contradict the existing literature. However, our study faces some difficulties in measuring the variable where our data do not offer details about the labour force such as labours' skills, education or experiences.[11]

Overall, our findings indicate that foreign firms have negative impacts on domestic competitors horizontally in the same sectors, while having a positive effect on local suppliers in upstream sectors where the linkages become more significant when the absorptive capacity of domestic enterprises is also taken into account. We also find evidence supporting a view that foreign enterprises can boost the local enterprises TFP in the downstream sectors. This suggests

[11] There is another survey that looks deeper into this conducted by the World Bank, but for only small and medium selected firms which is about a thousand firms a year. In employing the VES data that features a much larger number of firms, we are not able to obtain more.

that although foreign firms have remained disconnected from domestic firms, the latter can still benefit from the former.

3.4.2.3. Productivity spillovers by ownership and technology level

It is possible that domestic private and state-owned enterprises, and enterprises that are characterized by different levels of technology may be impacted differently by the foreign investment presence. With this in mind, I investigate any such differential impacts by examining appropriate sub-samples of the data. The results for this are reported in Table 3.7. We first look at how ownership affects productivity spillovers by estimating equation (3.11) on two different sub-datasets: private and state-owned firms. All firms that have the code from 1 to 5 are treated as state-owned firms, and from 6 to 10 are private firms. The study considers whether private firms are more active and benefit more from foreign investment presence than state-owned enterprises. In addition, the paper investigates the impact of foreign investment on local firms based on two different technology groupings. There is limited available data on the technology level of firms, but domestic firms can be divided into two broad groups: (i) low-tech and (ii) medium & high- tech based on previous research (Anwar & Nguyen, 2011). We hypothesize that the medium & high-tech firms might gain more productivity spillovers than low-tech-firms. This is because the technology level and management skills are closer to that of foreign firms. Under such a scenario, medium & high-tech firms might benefit from an easier transfer of technical know-how.

Table 3.7. Foreign productivity spillover by ownership and technology level.

VARIABLES	(1) Private	(2) State-owned	(3) Low-tech	(4) Med&high-tech
Horizontal	-0.123*	0.0678	0.0171	-0.127
	(0.0925)	(0.131)	(0.0617)	(0.132)
Backward	0.206***	-0.0671	0.129**	0.182*
	(0.0631)	(0.207)	(0.0600)	(0.110)
Forward	0.0116**	0.00744	-0.128***	0.0122*
	(0.00522)	(0.0331)	(0.0234)	(0.00779)
HHI	-0.00229	-0.000709	-0.0114	-0.00976
	(0.00832)	(0.0284)	(0.175)	(0.00857)
scale	0.0202	0.0164***	0.0444***	0.00875
	(0.0402)	(0.00558)	(0.0150)	(0.0269)
wage	0.00123**	0.000334	0.00123***	0.00233***
	(0.000513)	(0.00252)	(0.000475)	(0.000648)
expint	-1.837	-0.448	-1.881	-4.192
	(2.462)	(1.200)	(2.262)	(4.397)
impint	0.189	0.336	0.129	0.241
	(0.0293)	(0.104)	(0.0388)	(0.0384)
wageH	0.00141	-0.00167	-0.00109	0.00187
	(0.00194)	(0.00209)	(0.00131)	(0.00258)
wageB	-0.00199**	0.00323	-0.000425	-0.00389*
	(0.000978)	(0.00293)	(0.000645)	(0.00211)
wageF	0.000238***	0.000204	0.00127***	0.000339***
	(7.65e-05)	(0.000410)	(0.000355)	(0.000116)
loc	0.0321**	0.0294	0.0493**	0.0148
	(0.0140)	(0.0537)	(0.0192)	(0.0186)
rd	0.00551	0.0321	-0.0106	0.00317
	(0.0215)	(0.0523)	(0.0269)	(0.0288)
Hy2014	0.0829***	0.309***	0.0672***	0.0860**
	(0.0237)	(0.106)	(0.0238)	(0.0431)
By2014	0.0100	-0.107	-0.0667***	0.107***
	(0.0207)	(0.0915)	(0.0234)	(0.0343)
Fy2014	-0.00811***	-0.00709	-0.0770***	-0.00259
	(0.00210)	(0.0136)	(0.0119)	(0.00264)
Year dummies	Yes	Yes	Yes	Yes
Constant	3.582***	3.448***	3.524***	3.699***
	(0.0363)	(0.157)	(0.0487)	(0.0458)
Observations	204,054	6,758	120,047	90,765
R-squared	0.019	0.065	0.032	0.026
Number of id	76,321	2,307	46,242	33,143

*Notes: In these regressions, we run the main equation (11) on different sub-samples. Column (1) is for private domestic firms and (2) for state-owned firms. Columns (3) and (4) are for low-tech and the medium and high-tech groups respectively. Year dummies are included. Robust standard errors given in parentheses are bootstrapped with 2000 replications. *** p<0.01, ** p<0.05, * p<0.1*

The study finds significant differences between the spillovers linked to private and state-owned firms in the column (1) and (2) in Table 3.7. Private domestic firms' productivity appears to have strongly positive linkages with foreign investment through backward and forward linkages while there is weak evidence of positive backward linkages for state-owned enterprises. Compared with state-owned enterprises, private enterprises are the more active in the supporting industries and therefore linked more closely with multinationals in terms of being their suppliers. However, private firms are negatively affected from the competition raised by the presence of foreign investment in the same sectors while there is no evidence to support so in the case of state-owned firms. This finding may suggest tighter connections between private domestic and foreign enterprises across the linkages, while state-owned firms appear to stay disconnected.

The results for the two technology groups do not support the idea that medium- and high-tech enterprises significantly benefit more than low-tech enterprises from the foreign investment through the linkages. In general, the coefficients on backward linkages (*Blinkage)* and its interactions with year 2014 (*By2014)* in column (3) and (4) in Table 3.7 show that while productivity spillover occurs through backward linkages to the low-tech group, there is only evidence to confirm so in the case of the medium- and high-tech clusters from 2014 onwards. Low-tech local enterprises in upstream sectors that supply inputs to foreign enterprises in downstream sectors are encouraged to improve their productivity due to the high requirement for the inputs from their foreign customers. In contrast, looking at the *Flinkage* coefficients in column (3) and (4) we can see that medium - and high-tech firms in downstream sectors are positively linked with the foreign firms' presence in upstream industries while the low-tech group appears to experience the negative effects. It is reasonable to expect that high-tech firms have more adequate technology to absorb high quality inputs supplied by foreign enterprises through forward linkages and so be more productive. The study does not find the horizontal

spillovers in both cases generally, but it appears to create positive linkages in 2014 where we can see the interactions between horizontal linkages and year 2014 (*Hy2014*) are significantly positive.

3.4.2.4.Productivity spillovers across regions

The paper further considers the possibility that domestic firms in the North and South of Vietnam benefit from more advanced infrastructure with a more active business environment together incorporating a higher intensity of multinationals activity, are in a strong competitive position and so able to derive more benefit from foreign investment. We estimate equation (11) for the northern, central and southern regions of Vietnam based on firm province code.

The results reported in Table 3.8 are generally consistent with our previous results. Overall, evidence of positive effects through backward and forward linkages in all cases (*Blinkages* and *Flinkages*) is found for the North, Central and the South regions.

Positive backward and forward linkages occur through all the regions with the Central firms seem to enjoy the positive vertical spillovers the most (coefficients on both *Blinkage* and *Flinkage* are largest in column (2)). The presence of foreign enterprises in upstream and downstream sectors has positive linkages with local firm productivity through backward and forward linkages throughout the country, which is consistent with the earlier estimations. The changes in 2014 (*By2014* and *Fy2014*) seems to affect the vertical spillovers in the North and the Central, but not so in the South.

Table 3.8. Productivity spillovers across regions

VARIABLES	(1) North	(2) Central	(3) South
Horizontal	0.233**	-0.244**	-0.0576
	(0.111)	(0.115)	(0.0450)
Backward	0.194***	0.295**	0.149***
	(0.0633)	(0.127)	(0.0456)
Forward	0.00446*	0.0368***	0.0135**
	(0.00962)	(0.0129)	(0.00585)
HHI	0.00636	-0.0123	-0.0170
	(0.0116)	(0.0150)	(0.0147)
scale	0.0595***	0.133***	0.0124
	(0.0207)	(0.0177)	(0.0163)
wage	0.00637***	0.00322**	0.00125***
	(0.000555)	(0.00131)	(0.000412)
expint	-5.566	-4.204*	-2.692
	(4.999)	(2.421)	(3.244)
impint	0.203	0.159	0.176
	(0.0466)	(0.109)	(0.0327)
wageH	-0.00683***	0.00514*	-0.000242
	(0.00253)	(0.00295)	(0.000595)
wageB	-0.00229***	-0.00537**	-0.000621
	(0.000889)	(0.00240)	(0.000516)
wageF	0.000142	4.08e-06	0.000274***
	(0.000147)	(0.000288)	(6.02e-05)
loc	0.0176	0.0562**	0.0335
	(0.0199)	(0.0257)	(0.0276)
rd	0.0284	-0.0380	0.0153
	(0.0334)	(0.0505)	(0.0290)
Hy2014	0.0173	0.0947	0.0362
	(0.0523)	(0.0661)	(0.0280)
By2014	0.107***	-0.125**	0.00242
	(0.0320)	(0.0524)	(0.0260)
Fy2014	-0.00622	-0.0231***	-0.00676**
	(0.00432)	(0.00519)	(0.00303)
Year dummies	Yes	Yes	Yes
Constant	3.299***	3.158***	3.729***
	(0.0459)	(0.0716)	(0.0402)
Observations	77,924	31,020	101,852
R-squared	0.044	0.045	0.026
Number of id	27,292	10,488	39,729

*Notes: For the regional breakdown, the province code is used to determine the regional location. This leads to 81,428 observations for the North, 32,024 for the Central and 108,781 for the South regions. Year dummies are included. Robust standard errors given in parentheses are bootstrapped with 2000 replications. *** p<0.01, ** p<0.05, * p<0.1.*

Positive horizontal spillovers (*Hlinkage*) is found for the North overall and from 2014 onwards when we find positive coefficient on the interaction (*Hy2014*). However, a significant negative impact is found for the Central and there is no significant evidence found for this linkage in the South region. Domestic firms in the North are positively influenced by foreign investment through horizontal linkages overall, especially from 2014 onwards, but this is not the case in the Central and the South regions. This is potentially driven by the regions, industries and/or firm characteristics. It may be the case that domestic firms in the North are more exposed to the presence of multinationals and react quicker with the changes than that is in the Central and the South. In general, there are common features in the results for the regional sub-samples as compared to the main results discussed earlier.

3.5. Conclusion

With an updated dataset covering most manufacturing firms throughout the country, the study explores the impacts of foreign investment on domestic enterprise TFP in the Vietnamese manufacturing sector. TFP is used as the dependent variable that is initially obtained from the Wooldridge-GMM approach for estimating a Cobb-Douglas production function. The analysis confirms that positive spillovers are likely to occur through both backward and forward linkages. The paper also finds evidence of negative productivity spillovers through horizontal linkages, highlighting that local firms are perhaps disadvantaged and may find it a challenge to compete with multinationals in the same sector. The study does not find that labour absorptive capacity plays a crucial role in the spillover process. The spillovers occur through different ways for private and state-owned firms, while there are similarities between technology groups. Regional specifics make a small difference insofar as firms in the Central region benefit a little more from spillovers compared with firms in other locations. A number of firms-specific factors are also found to have significant impacts on its productivity. In terms of policy implications, our findings suggest that fostering linkages between domestic and foreign

enterprises through vertical linkages should be a priority policy in order to gain more productivity spillovers. Targeted support could be considered for those local firms with direct linkages to foreign firms in the value chain. Such support could target those joint-venture or market-seeking foreign firms. Local firms also need to focus on product quality, innovation efforts and training of workers to improve their absorptive capacity. Given that our study identifies a number of interesting differences in results based on the location of firms and levels of technology employed, further exploration of these issues is warranted.

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Chapter Appendix

Table A3.1. Hausman test

VARIABLES	FE	RE	Difference	Sqrt S.E
Horizontal	-0.0536	-0.133	0.0794	0.00449
Backward	0.122	0.379	-0.257	0.00745
Forward	0.0244	0.067	-0.0426	.
HHI	-0.0021	-0.016	0.0139	0.0018
scale	0.019	0.025	-0.006	0.00047
wage	0.00036	0.00043	-0.00007	6.37e-06
expint	0.921	0.236	0.685	1.02e-06
impint	-0.179	0.59	-0.769	8.59e-08
loc	0.034	0.207	-0.173	0.874
rd	0.0021	0.013	-0.0109	0.0066
Hy2014	0.081	0.035	0.046	0.0054
By2014	0.016	-0.039	0.055	0.0044
Fy2014	-0.0089	-0.013	0.0041	0.0004
Chi2(16) =	2719.86			
Prob>chi2 =	0.0000			

Notes: Test: H0: difference in coefficients not systematic

Table A3.2. The impacts of foreign investment on local firm tfp – lag model

VARIABLES	(1) FE-lag	(2) RE-lag	(4) OLS-lag
Horizontal	-0.0689***	-0.0280	0.0698**
	(0.0248)	(0.0219)	(0.0272)
Backward	0.104***	-0.0519**	-0.124***
	(0.0330)	(0.0251)	(0.0262)
Forward	0.0191***	0.0356***	0.105***
	(0.00378)	(0.00446)	(0.00553)
HHI	-0.00761	-0.0101	-0.0321**
	(0.00725)	(0.00723)	(0.0135)
Hy2014	0.0844***	0.0844***	0.0545
	(0.0200)	(0.0198)	(0.0340)
By2014	0.0155	0.00238	-0.0314
	(0.0203)	(0.0196)	(0.0295)
Fy2014	-0.00710***	-0.0124***	-0.0259***
	(0.00213)	(0.00199)	(0.00329)
lscale	0.00414	0.0156*	0.0294***
	(0.00288)	(0.00838)	(0.00621)
lwage	-2.15e-05	2.94e-05	0.000225
	(5.21e-05)	(2.52e-05)	(0.000168)
lexpint	-1.62e-05	-7.99e-06	-4.83e-06
	(1.44e-05)	(1.13e-05)	(1.48e-05)
limpint	-3.41e-05	-2.99e-05	-6.11e-06
	(3.36e-05)	(3.14e-05)	(3.08e-05)
lrd	0.0206	0.0163	0.0316
	(0.0215)	(0.0210)	(0.0367)
loc	0.0139	0.244***	0.465***
	(0.0140)	(0.0144)	(0.0162)
Year dummies	Yes	Yes	Yes
Industry dummies	-	Yes	Yes
Constant	3.906***	3.619***	3.665***
	(0.0293)	(0.0261)	(0.0247)
Observations	153,353	153,353	153,353
R-squared	0.004		0.170
Number of id	56,985	56,985	

*Notes: Lag 1 values of control variables are used in this table. Robust standard errors given in parentheses are bootstrapped. *** p<0.01, ** p<0.05, * p<0.1.*

Table A3.3. First difference estimation

VARIABLES	(1)	(2)
dHorizontal	-0.0666***	-0.0928***
	(0.0185)	(0.0186)
dBackward	0.0590**	0.0571**
	(0.0260)	(0.0260)
dForward	0.0101***	0.00700**
	(0.00315)	(0.00316)
dHHI	0.00323	0.00230
	(0.00791)	(0.00790)
dscale	0.0342***	0.0339***
	(0.00117)	(0.00117)
dwage	0.000204***	0.000188***
	(1.18e-05)	(1.55e-05)
dexpint	0.0449**	0.0431**
	(0.0218)	(0.0218)
dimpint	0.153***	0.148***
	(0.0323)	(0.0323)
rddummy	-0.00419	-0.00530
	(0.0282)	(0.0281)
loc	0.00464	-0.00227
	(0.0109)	(0.0109)
Hy2014	0.125***	0.102***
	(0.0290)	(0.0290)
By2014	-0.0459*	-0.0284
	(0.0260)	(0.0259)
Fy2014	-0.0122***	-0.0133***
	(0.00313)	(0.00312)
wageH	-	0.00135***
		(0.000102)
wageB	-	-0.000892***
		(6.17e-05)
wageF	-	0.000292***
		(1.80e-05)
Year dummies	Yes	Yes
Industry dummies	Yes	Yes
Constant	0.103***	0.105***
	(0.0105)	(0.0105)
Observations	143,320	143,320
R-squared	0.016	0.018

*Notes. First difference estimation. Model (1) is based on equation (11) and model (2) added interactions between wage and the linkages. Robust standard errors given in parentheses are bootstrapped. *** p<0.01, ** p<0.05, * p<0.1.*

Table A3.4. IV estimation

VARIABLES	(1)	(2)	(3)
Horizontal	-0.00888	-0.284***	-0.481***
	(0.383)	(0.0376)	(0.0489)
Backward	0.553***	0.211*	0.664***
	(0.0917)	(0.118)	(0.0184)
Forward	0.0783***	0.0746***	0.0103
	(0.00532)	(0.00186)	(0.0401)
HHI	0.0991***	0.0395**	0.0128
	(0.0371)	(0.0173)	(0.0365)
scale	0.0410***	0.0403***	0.0403***
	(0.000908)	(0.000718)	(0.000721)
wage	0.00144***	0.000453**	0.00108***
	(0.000222)	(0.000224)	(0.000129)
expint	0.263	0.0383	-0.0501
	(1.007)	(0.990)	(0.994)
impint	1.840***	1.925***	1.878***
	(0.0637)	(0.0451)	(0.0446)
loc	0.0168	0.0532**	0.0362
	(0.0182)	(0.0268)	(0.0281)
rd	0.0292	-0.0361	0.0164
	(0.000523)	(0.000114)	(0.000419)
wageH	0.000100	0.000634***	0.00141***
	(0.000633)	(0.000104)	(0.000428)
wageB	-0.00175***	-0.000668**	-0.00229***
	(0.000144)	(0.000333)	(0.000312)
wageF	0.000265***	0.000272***	0.000657***
	(4.79e-05)	(2.18e-05)	(0.000222)
Constant	3.184***	3.529***	3.390***
	(0.0969)	(0.0662)	(0.0682)
Observations	157,131	157,131	157,131
R-squared	0.067	0.066	0.064

Notes: IV estimation, model (1) uses the first lag of Horizontal, model (2) uses the first lag of Backward and model (3) uses first lag of Forward as the instrument variable.

Table A3.5. Variable description

VARIABLES	DESCRIPTION
Horizontal	The presence of FDI in the same industry – horizontal linkages
Backward	The presence of FDI in downstream sector – backward linkages
Forward	The presence of FDI in upstream sector – forward linkages
HHI	Hirschman-Herfindahl index
Scale	Scale of firm
Wage	Labour's wage
expint	Export intensity
impint	Import intensity
loc	Location of firm (= 1 if a firm is located in an industrial zone)
rd	Research and development activity (= 1 if a firm has any R&D activity)
wageH	Interaction between wage and Horizontal linkages
WageB	Interaction between wage and Backward linkages
WageF	Interaction between wage and Forward linkages

CHAPTER 4. DOES FOREIGN INVESTMENT BENEFIT THE EXPORTING ACTIVITIES OF VIETNAMESE FIRMS?

4.1. Introduction

In recent years, many less-developed countries have experienced a significant increase in foreign investment. Given that the effect of foreign investment can manifest itself in many ways throughout the economy, it is important to gauge what the effect has been. The indirect effect of foreign investment on domestic enterprises through horizontal or vertical linkages has been confirmed in many studies (B. Aitken et al., 1997; B. J. Aitken & Harrison, 1999a; Greenaway, Sousa, & Wakelin, 2004; Kneller & Pisu, 2007; Sun, 2009b). While most of the existing research into foreign investment spillovers in developing countries focus on productivity spillovers, fewer studies have examined the effects of foreign firms on the exporting activities of local enterprises. Although there is considerable evidence in support of the view that foreign firms have positive export spillover effects on domestic firms in developing countries (B. Aitken et al., 1997; Greenaway & Kneller, 2008; Greenaway et al., 2004; Lutz, Talavera, & Park, 2008; D. T. H. Nguyen & Sun, 2012; Sun & Anwar, 2016), other studies find no or even negative effects (Barrios, Görg, & Strobl, 2003; Chakraborty, Mukherjee, Jaewook, & Ki-Dong, 2017; Estrin, Meyer, Wright, & Foliano, 2008; Meyer & Sinani, 2009).

Using a large Vietnamese firm-level dataset, the chapter addresses a number of questions about the relationship between foreign investment and the exporting activities of domestic firms. In particular, does the presence of foreign firms affect the export decisions of local firms and if so, how and to what extent? What are the channels of influence and how do they make themselves felt? Is domestic manufacturing and service firms' export behaviour

influenced differently by the presence of foreign investment? Do high-tech manufacturing firms receive more advantages over low-tech firms from export spillovers?

In the case of Vietnam, little research has investigated these issues. Anwar and Nguyen (2011) focus on the influence of foreign invested firms on the export activity of domestic enterprises on both export decisions and export performance using cross-sectional data for 2002. In contrast to Anwar and Nguyen (2011), this study analyses a richer updated panel dataset comprising 200,000 firms from the Vietnamese manufacturing sector and more than 500,000 firms in some selected service sectors over a 6-year period. While Anwar and Nguyen (2011) find positive horizontal and backward export spillovers from foreign investment to local firms on both the export decision and export share, our results reveal that foreign investment impact on domestic firms' exporting activity has changed in recent years. Going beyond Anwar and Nguyen's study through the employment of the Heckman selection model with an exclusion restriction and controlling for year and industry effects on an updated panel dataset, the paper finds evidence of significant spillovers on both the export decision and performance from multinationals to domestic firms. Although increased competition is introduced through an increase in foreign presence in the same industry, domestic firms are found to be more likely to start serving the international market. With respect to vertical linkages, we find evidence that foreign firms exert a significant positive effect on domestic firms' export activities in upstream sectors and a strongly significant negative effect on the export behaviour of domestic firms in downstream sectors. The study also finds evidence suggesting that low-tech firms export behaviour is more likely to be influenced by the presence of multinationals than for high-tech manufacturing firms.

Export spillovers from multinationals to local firms are the focus of this study, which analyses the channels through which such spillovers may occur. While the results from this research are broadly consistent with previous studies, the analysis makes a number of key

contributions to the existing literature. First, compared with existing studies on Vietnam, which are based on cross-sectional or pooled data, this chapter uses a richer panel dataset that enables us to incorporate time variation when assessing the effect of key drivers in domestic firms' exporting activities. The study's estimation strategy has advantages over the employment of the Heckman selection model based on cross sectional data. This is not only by employing Heckman selection corrections for panel data which has been done less often in the literature, but also by using an exclusion restriction at the first stage (Heckman, 1977b; Jeffrey M. Wooldridge, 1995). Secondly, our work is among the first studies, which take into account export spillovers in service sectors to draw a bigger picture of the impacts from foreign investment on local firms in Vietnam. Thirdly, the chapter adds to a limited number of studies focusing on export spillovers in developing countries. Using Vietnam as a case study, this analysis is among the first to examine the impact of foreign firms on the exporting behaviour of domestic firms. The fourth innovation of my work is bringing research up to date with recent developments when covers the recent period of 2010-2015.

The chapter is structured as follows. The following section discusses the relevant background literature on linkages with foreign firms. The third section sets out the Heckman-based methodological approach and Vietnamese data employed in this study. The discussion of results in the fourth section expands on our finding that foreign investment exerts a negative influence on the exporting activities of some domestic firms. The fifth section provides the conclusion and offers some pointers on policy.

4.2. Literature review

4.2.1. Theoretical base

Spillovers can occur either through horizontal linkages within an industry, or through vertical linkages across industries. Since information about export opportunities may spread across markets and industries, increasing business-to-business linkages between firms, the horizontal spillovers in exports may be stronger for those industries in which foreign firms are more concentrated (Anwar & Nguyen, 2011). Vertical spillovers are generated across industries through backward or forward linkages. The linkage between foreign and domestic firms is called a backward linkage if the former buys inputs from the latter, and a forward linkage occurs if the former supplies inputs to the latter. If the foreign firms are exporters, then upstream or downstream activity may also spur domestic firms to engage in exports (Anwar & Nguyen, 2011). These effects can occur for a number of reasons such as learning-by-doing, learning-by-watching, the movement of labour from foreign firms to domestic enterprises, or competition and information externalities (Blalock & Gertler, 2008; Kugler, 2006; Smarzynska Javorcik, 2004). The effects may involve both positive and negative spillovers. The learning-by-doing and labour mobility effects are facilitated by the vertical linkage, in which the presence of foreign investment may promote the efficiency of domestic firms by supporting domestic suppliers and customers, thereby enabling them to expand their business into international markets.

Learning about overseas markets or establishing new connections may directly increase the export capacity of domestic firms (Long & Hale, 2014). With respect to competition, which mostly occurs by virtue of the horizontal linkage, Blomstrom, Kokko, and Zejan (2000) argue that the entry of some multinational firms has resulted in a smaller market share for domestic firms because foreign firms establish subsidiaries and take advantage in the less competitive sectors. This has forced domestic firms to become more productive in order to survive and has

therefore encouraged them to begin exporting. On the other hand, higher competition brought about by the presence of foreign investment may harm domestic productivity and constrain it to serve overseas interests (B. J. Aitken & Harrison, 1999a). With larger scale capability, higher production and greater exporting experience, multinational firms have an advantage in competition over domestic firms in the global market, which may result in a decreasing export share for local firms (B. J. Aitken & Harrison, 1999a).

Information externalities provide another way by which export spillovers may occur through both horizontal and vertical linkages, as argued by B. Aitken et al. (1997). As has been shown both theoretically and empirically, exporting involves sunk costs (Bernard & Jensen, 2004; Helpman, Melitz, & Yeaple, 2003) which may include market research to obtain information about customers and market structure in foreign markets, product compliance and regulation, and the establishment of distribution and logistical channels. However, these sunk costs are probably lower for subsidiaries of foreign firms as they are part of an international production network and therefore already have information about foreign markets. Multinationals can promote the exports of domestic firms if they transfer knowledge about international markets to them. From the supply side, such transfer of knowledge may reduce sunk costs, so that a domestic marginal firm finds it profitable to start exporting or to increase its share of exports to the overseas market. From the demand side, it may increase awareness and demand for local firms' products in overseas markets, providing an incentive for domestic firms to export.

4.2.2. Empirical evidence

The existing literature has long paid attention to the linkage between the presence of foreign investment and domestic firms exporting activities in general. There is a debate about the role as some studies find positive and others find the negative spillovers. B. Aitken et al. (1997) were among the first researchers to consider the influence of foreign investment on export

spillovers to domestic firms. Taking the case of Mexico, they investigate the role of geographic and multinational spillovers from foreign firms in the export decisions of domestic firms for the period 1986-1990. Ruane and Sutherland (2004) focus on the export spillovers of foreign firms on Ireland's exports. Based on panel data from 1991 to 1998, they suggest that the activity of foreign firms in the Irish manufacturing sector enhance the probability of Irish domestic firms becoming exporters, leading to a higher market share for domestic firms.

Ma (2006) uses comprising firm-level Chinese data from 1993-2000 and finds that foreign firms from OECD countries have a positive influence on the decision of local firms to export, but the activities of overseas-based Chinese firms did not increase the probability of local firms exporting. Greenaway and Kneller (2008) evaluate the influence of foreign investment on the export performance of domestic firms in the UK by extending the model used by Aitken et al. (1997). Using firm-level data for 1992-1996 and applying a two-step Heckman selection model, they find that foreign investment has an effect on decisions to export but not on the export share of domestic firms. Making use of the Heckman selection model on pooled firm-level data in some manufacturing sectors in China from 2000 to 2003, Sun (2009b) finds that domestic firms located in Central China all benefit from the presence of foreign investment, while domestic firms located in Western China all have negative spillovers from foreign firms while Sun (2010) concludes that FDI has significant impacts on export behaviour of domestic firms that vary depending on local firm's heterogeneity in China. In another study, Sun (2012) investigates the positive effects of foreign direct investment on domestic exports in China by making use of a rich firm-level balanced panel dataset of 3,260 domestic firms during the period 2000-07. By making use of GMM estimation applied to panel data over the 2005-07 period for six manufacturing industries in China, Sun and Anwar (2016) find that foreign investment promotes domestic firms' involvement in exports through raising competition in the textile industry. Anwar and Sun (2018) estimate a Melitz-type model using

panel data for the Chinese manufacturing sector and show that an increase in the presence of foreign direct investment leads to a significant increase in the export quality of China's manufacturing sector, especially in Hong Kong, Macao and Taiwan.

Among the studies that examine the linkages in general, some of them find no or negative export spillovers from foreign investment to domestic firms exporting activities. Barrios et al. (2003) conduct a study using firm-level data for Spanish manufacturing firms over 1990-1997 and find no significant evidence to support the hypothesis that local firms will export as a result of the export activity of foreign firms in the same sector. Using data on Ukrainian manufacturing firms for 1996-2000, Lutz et al. (2008) find no evidence of foreign investment-linked export spillover effects on local firms. By applying Heckman's two-step selection model, based on data collected from 494 firms in 2001-2002, they show that the quality of the host country's institutional environment does not affect the decision by foreign-owned firms to export. However, they conclude that the level of exports by foreign firms was lower in host countries where the institutional environment had a higher level of economic freedom. Using time-series data for 1990-1991 and 2014-2015, Chakraborty et al. (2017) conclude that the presence of foreign investment did not encourage the export activity of domestic firms in India, as these firms believe that foreign investment inflows to their country primarily target the domestic market.

Some studies examine the linkages through horizontal and vertical channels where they find evidence of positive or negative spillovers through either horizontal, backward or forward linkages. Using panel data from 1988 to 1996, Blalock and Gertler (2008) note that Indonesian manufacturing firms with greater absorptive capacity gain more from downstream foreign investment. In the case of United Kingdom (UK) industries during 1992-1999, Greenaway and Kneller (2004) examine the effect of foreign investment and conclude that the decision of a domestic firm to export is positively associated with the presence of foreign firms

in the same industry. Kneller and Pisu (2007) by applying the Heckman selection model to a firm-level dataset of 1992-99, find positive horizontal linkages for the export decision and positive backward linkages for export performance in UK manufacturing firms. Alvarez and López (2008) find evidence that significant horizontal productivity spillovers contribute both to the presence of foreign export-oriented firms and to the export activity by domestic firms in case of Chile during the period 1990-99. Girma, Görg, and Pisu (2008) employ a dataset to examine both horizontal and vertical export spillovers effects for export-oriented and domestic market-oriented firms separately and find that spillover benefits vary for domestic exporters and non-exporters. By using the Heckman selection model on firm-level census data in China, C. Chen, Sheng, and Findlay (2013) find evidence of positive horizontal and backward spillovers from foreign direct investment in Chinese manufacturing firms over the 2000-03 period. In a study by Long and Hale (2014), negative backward and forward spillovers from foreign investment are also found in a full sample of Chinese manufacturing firms during the 2000-06 period.

In the case of Vietnam, there are few studies in the literature dealing with export spillovers. D. T. H. Nguyen and Sun (2012) investigate the positive effect of foreign investment on domestic firms' decision to export. They apply a Heckman selection model on a pooled dataset for the year 2003 and 2004 and find that foreign investment has significant positive spillovers for exports by domestic firms. They also highlight the role of firm-specific characteristics, such as firm age, average wage, import intensity and types of ownership, in the decision by domestic firms in Vietnam to export. Using firm-level cross-sectional data from Vietnam's manufacturing sector in 2000, Anwar and Nguyen (2011) conclude that foreign investment has a positive and significant spillover effect on the exporting activities of Vietnamese firms. Based on Heckman's two-step selection model, they find that foreign investment promoted the decision by domestic firms to export and boosted their export share

during this period. They indicate that the presence of foreign investment in Vietnam significantly affects the decision to export and increases the export share of Vietnamese firms through both horizontal and vertical linkages. They also highlight the difference in domestic firms' exports in terms of the level of technology of domestic firms, their ownership structure, and their geographical proximity to foreign firms.

The literature demonstrates that foreign firms have an influence on the export behaviour of domestic firms. That influence can be positive or negative, depending on the characteristics and absorptive capacity of local firms. Foreign firm export spillovers can be derived from both horizontal and vertical linkages and can be positive or negative, large or small, depending on many factors, such as the strength of linkages between domestic and foreign firms, firms' characteristics, host countries' policies and context and so on.

4.3. Methodology and data

4.3.1. Model

The exporting behaviour of firms may be driven by many factors, both internal and external. For example, a firm's level of sales, labour cost, capital per worker, location, share of sales in the domestic market and so on, can influence export behaviour. External factors, such as the presence of foreign firms, the industry and region specifics can also have an influence on the export activity of domestic firms (B. J. Aitken & Harrison, 1999a; Karpaty & Kneller, 2011; Sun, 2009b). Clearly, not every firm engages in export activity, because firms differ from one another in their characteristics that lead them to their own production decisions. Consequently, firms can choose whether to serve the international market, the domestic market, or both. In our dataset covering 2010-15, less than 10% of Vietnamese firms were involved in exporting. Therefore, we address this issue through modelling and estimating truncated dependent variables.

Another consideration is the annual entry and exit of domestic firms to and from the export market. If we use a balanced panel comprising continuing domestic firms only, the estimated coefficients of foreign firms would only explain the effect of foreign presence on the export behaviour of surviving domestic firms. Since there are many firms without exports that could be removed from the data to yield balanced panel data over the years, we choose instead to use an unbalanced panel dataset, which allows for firms exiting and entering thereby yielding richer information about domestic firms' export activities. Recognizing that a firm's exit or entry is influenced by changes in policies or macroeconomic changes occurring over the years, we use dummies for years to control for such effects. We also employ four-digit level sector dummies to control for sectoral characteristics. We incorporate variables at firm and industry level to capture both internal and external factors that affect domestic firms' exporting activities.

Unlike the numerous existing studies (B. Aitken et al., 1997; Anwar & Nguyen, 2011; Greenaway et al., 2004; Karpaty & Kneller, 2011; Kneller & Pisu, 2007; Sun, 2009b), where Heckman's approach is applied to a cross-sectional or pooled dataset, the study proceeds with a panel data set and apply the Heckman selection approach on panel data. In order to analyse the impacts on both the decision to export and export performance of local firms using a panel dataset, I follow Jeffrey M. Wooldridge (1995) and Haussen and Uebelmesser (2018)- henceforth the Wooldridge approach- and apply two steps. The first step is estimation of the selection regression based on a probit model to estimate the probability of firm participation in exporting and control for factors that influence firm's decision to export. This is estimated as a cross section for each year. The second step is then to test if the presence of foreign firms affects domestic firms' export performance (export share and absolute export volume) conditional on the export participation decision of domestic firms conducted from the first step.

Following Jeffrey M. Wooldridge (1995), standard errors are bootstrapped based on 2000 replications.

Export participation in the first step is measured as a binary variable, which takes the value of one for those firms that have export activity. Export share in the second step is measured as the proportion of exports out of the firm's total sales during the year and can take any positive value from zero to one. The following equations illustrate our empirical model, where the first equation (4.1) is the selection equation and the second equation (4.2) is the outcome equation.

$$exp_{ijt} = \alpha_0 + \alpha_1 explagged_{ijt-1} + \alpha_2 scale_{ijt} + \alpha_3 wage_{ijt} + \alpha_4 capint_{ijt} + \alpha_5\, location_{ijt} + \alpha_6\, tfp_{ijt} + \alpha_7 ownership_{ijt} + \alpha_8 Horizontal_{jt} + \alpha_9 Backward_{jt} + \alpha_{10} Forward_{jt} + \alpha_{11} HHI_{jt} + \alpha_{12} PCI_{pt} + u_{ijt} \quad (4.1)$$

where exp_{ijt} is export decision which equals to one if firm involves in exporting business and zero otherwise. This is to estimate the probability of a domestic firm to engage in exporting activities separately by year and then to compute the inverse Mills ratio (IMR) indicated by $\hat{\lambda}$. This allows for examining the impacts of the independent variables on export decision of local firms. The IMRs then is included into the second equation (4.2) as an additional regressors to control for selection. $explagged_{ijt-1}$ is the first lag of export which is included only in the first step to act as an exclusion restriction. For identification, the Heckman approach requires an exclusion restriction (See: Heckman, 1977b) in terms of a variable that is highly correlated with the decision to export in the first step, but has no (or a very weak) relationship with the export performance in the second step. Finding such an exclusion restriction can be challenging. The literature has previously employed export experience (the number of years that firm has been exporting), sunk costs for to entry global market, or the information (or relations) that firm has with international markets (Alessandria & Choi, 2007; Roberts & Tybout, 1997) as first step exclusion variables. Since the data does not allow us to access such

data consistently over the study period, the paper proceed with lagged exports (*explagged*). It can be argued that firms with export activity in year *(t-1)* will have already information and established relations in the international market, which then can lower their sunk costs and encourage firm to continue exporting in year *t*, but this may not necessarily really impact on how much firm export in year *t*.

Thus, the outcome equation is as follows:

$$expshare_{ijt} = \beta_0 + \beta_1\hat{\lambda}_1 + \beta_2\hat{\lambda}_2 + \beta_3\hat{\lambda}_3 + \beta_4\hat{\lambda}_4 + \beta_5\hat{\lambda}_5 + \beta_6 scale_{ijt} + \beta_7 wage_{ijt} + \beta_8 capint_{ijt} + \beta_9 location_{ijt} + \beta_{10} tfp_{ijt} + \beta_{11} ownership_{ijt} + \beta_{12} Horizontal_{jt} + \beta_{13} Backward_{jt} + \beta_{14} Forward_{jt} + \beta_{15} HHI_{jt} + \beta_{16} PCI_{pt} + v_{ijt} \quad (4.2)$$

where export share of firm *i* out of total sales of firm *i* at time *t*, or export share ($expshare_{ijt}$) is zero then the firm does not export. This otherwise assumes a positive value when the firm undertakes to enter the foreign market. Following Anwar and Nguyen (2011) and Sun (2009b), we use export share as indicative of a firm's export performance, expecting to capture not only export volume but also the export proportion of a firm's total sales. Export share can yield more information about the firm since it can show the importance of exports among a firm's other activities. We also employ export volume (measured in million Vietnamese dong) as the dependent variable to capture the impacts on the absolute value of export for a robustness check.

The variable $wage_{ijt}$ is the firm's labour wage, obtained by dividing the total cost of labour by total labour at the end of the year, $capint_{ijt}$ is capital intensity, calculated by dividing capital at the end of the year by total labour at firm level, $scale_{ijt}$, measures the scale of the firm in the same industry, and is calculated by dividing firm sales by the total sales in the same industry. I take into account the role of local firms' productivity as it is widely recognised as an important factor that affects to exporting activities of firms (Arnold & Hussinger, 2005; Love & Mansury, 2009; H. V. Vu, Holmes, Tran, & Lim, 2016). Total factor productivity

(tfp_{ijt}) is therefore included in the model to represent firm productivity. Based on a Cobb-Douglass production function, I estimate the *tfp* of domestic firms by sectors following the Wooldridge approach (Jeffrey M Wooldridge, 2009).

The variable $ownership_{ijt}$ indicates the type of firm, equal to one if firms are state-owned and zero if firms are private. Since there are differences between these two types in terms of ownership, resources, incentives, etc. which may affect to exporting activities of local firms, we take firm ownership into account. The variable $location_{ijt}$ is the location of the firm, indicating whether it is located in an industrial zone, and is given a value of one if yes and zero otherwise. These variables are at firm level, and are used to capture the effect of firm characteristics on their export behaviour.

PCI_{pt} is the provincial competitiveness index of province *p* at time *t*. I take into account the PCI index, which is conducted annually in Vietnam by USAID and Vietnam Chamber of Commerce and Industry (VCCI) to evaluate the business environment at the provincial level. The PCI is designed to access the way of doing business, economic governance and administrative reforms efforts by city and provincial governments in order to encourage private investment (both domestic and foreign). The PCI included in the model is the overall PCI, which is computed from ten sub-indices reflecting the economic governance and policies that impacts on private sector development. The provinces with a higher PCI perform better in terms of promoting private investment. Therefore, PCI is included to capture the difference between provincial business environments that may affect firm exporting activities.

For the presence of foreign investment in spillovers, the variables of interest are denoted as $Horizontal_{jt}$, $Backward_{jt}$, $Forward_{jt}$ which respectively indicate horizontal, backward, and forward spillovers in industry *j* at time *t*, calculated at industry level by linking the Vietnamese enterprise survey and input-output table. I employ a measure based on the proportion of total

sales within the four-digit sector accounted for by foreign firms to calculate the horizontal linkage.[12]

Following the studies by Smarzynska Javorcik (2004), Anwar and Nguyen (2011), Newman, Rand, Talbot, et al. (2015) Fujimori and Sato (2015), spillovers are calculated as follows.

$$Horizontal(jt) = \sum_{j=1}^{n} FIsales(jt) / \sum_{j=1}^{N} Sales(jt) \quad (4.3)$$

where *Horizontal(jt)* represents the ratio of total sales of foreign firms in industry *j* in time *t* and the total sales of firms in industry *j* in time *t*. *FIsales(jt)* is the total sales of foreign firms in industry *j* in time *t*, and *Sales(jt)* is the total sales of industry *j* at time *t*. These values are obtained from the Vietnamese Enterprise Survey dataset.

Vertical backward spillover is based on the proportion of total output accounted for by foreign-owned firms in upstream sectors. This is calculated as follows:

$$Backward_{jt} = \sum_{j\#k} \delta_{kt} * Horizontal_{kt} \quad (4.4)$$

$$\delta_{kt} = \frac{Y_{j\to k}}{Y_k} \quad (4.5)$$

where $Backward_{jt}$ donates the linkage between the presence of foreign investors in downstream sector *k* and the domestic suppliers in upstream sector *j*. Parameter $\delta(kt)$ is the output of upstream sector *j* supplied to downstream sector *k* divided by the total output of upstream sector *j*. Y_{jk} is the output upstream sector *j* sold to downstream sector *k* and Y_j is the total output of upstream sector *j*.

The vertical forward spillover is the linkage between the presence of foreign suppliers in upstream sector *h* and domestic customers in downstream sector *j*. It is computed as follows:

$$Forward_{jt} = \sum_{j\#h} \sigma_{ht} * Horizontal_{ht} \quad (4.6)$$

[12] We treat foreign investment in this paper as an exogenous variable. However, some studies recently provide different viewpoints on this where they treat foreign investment as an endogenous variable and use policy changes as an instrumental variable ((Barrios, Görg, & Strobl, 2011; Lu, Tao, & Zhu, 2017)), or propensity score matching ((Girma, Gong, Görg, & Lancheros, 2015)), which opens a more interesting approach to investigate the issue for further research.

$$\sigma_{ht} = \frac{Y_{h \to j}}{Y_h} \quad (4.7)$$

The parameter $\sigma(ht)$ is the proportion of upstream sector h's output supplied to downstream sector j, Y_{hj} is the output of upstream sector h sold to downstream sector j and Y_h is the total output of upstream sector h. The parameters δ and σ are obtained from the Vietnamese input – output table IO2012. The IO table provides the information of the inputs and outputs flow among the sectors in the economy. Based on IO2012 Leontief square matrix of 164 sectors (Genreal Statistic Office, 2015), backward linkage can be obtained from the information in the columns and forward linkage can be computed from the rows of the matrix following equations (4.5) and (4.7) above.

Although this approach to measure backward and forward linkages is widely used in the literature, concerns are raised by Salvador Barios et al (2011). In terms of using IO tables to calculate vertical linkages, one might argue that certain conditions need to hold. This is in terms of imported inputs and domestically produced inputs being used in the same proportion, and foreign firms having the same input sourcing behaviour as domestic firms, multinationals from different countries having the same input sourcing behaviour, and multinationals demand for locally produced inputs being reflected by their share of total output. While these are caveats that should be acknowledged and there could be implications for our results, the lack of available data greatly restricts our ability to further refine the measure of Vietnamese linkages.

Following previous studies (Le & Pomfret, 2011; Newman, Rand, Talbot, et al., 2015; Ni et al., 2015), I take into account the Hirschman-Herfindahl (HHI) index of industry j refers to concentration in the market, which can be calculated as

$$\text{HHI}_{\text{jt}} = \sum\left(\frac{xijt}{Xjt}\right)^2 \quad (4.8)$$

where x_{ijt} is the output of firm i in industry j at time t; X_{jt} is the total output of industry j. The inputs to calculate this indicator are available in our dataset.

There are different expectations for the given variables. The variables we are primarily interested in are the foreign investment horizontal linkages, backward linkages and forward linkages. Empirical evidence shows that these can have positive or negative effects on a domestic firm's export behaviour, depending on the firm's characteristics and other external factors. The following are the expectations on the independent variables sketched above[13].

Table 4.1. The expected relationship between dependent and independent variable

Independent variables	Dependent variables	
	Export decision	Export share
scale	+	+
wage	+	+
capint	+	+
location	+	+
ownership	+/-	+/-
tfp	+	+/-
Horizontal	+/-	+/-
Backward	+/-	+/-
Forward	+/-	+/-
HHI	+	+
PCI	+	+
explagged	+	NA

Source: Author

4.3.2. Data

This study uses data obtained from the Vietnam Enterprise Survey (VES) at firm and industry level. Conducted by Vietnam's General Statistics Office for all industries every year since

[13] A description of the variables is provided in the Appendix Table A4.8

2001, this survey gathers balance sheets and other information about firms' activities. All firms are legally required to comply under Vietnam's statistics law. All the collected data are checked by the General Statistics Office for internal consistency and are cross-checked with administrative provincial data before being made available for publication.

Over the period of the survey's implementation, Vietnam has experienced two major economic changes - accession to the World Trade Organization (WTO) and the global economic crisis. We are interested in examining the issues over a longer period to see if there is significant difference between before and after WTO since it marked a milestone in the Vietnam's development. However, this is impossible on account of data limitations since information on exporting activities has only been collected since 2010. This nationwide survey includes every known active enterprise with more than 50 employees each year; firms with less than 50 employees are randomly selected depending on provinces. The majority of sectors in the dataset can be found in the list of Vietnam Standard Industrial Classification (VSIC) codes which includes 88 sectors at the two-digit level. The raw data contains the sector codes for each firm in the dataset. By linking that code to the VSIC codes, we can see which sector each firm belongs to. The ownership of firms is also reported in this dataset. The firms included in the survey may be domestic (private or state-owned) or foreign firms (100% foreign capital firms or joint venture firms – which we define as foreign investment). Each firm is given a unique enterprise code which can be used together with the provincial code to identify an unique firm and link it with other datasets at industry level to construct a panel dataset. We treat all the local firms (both private and state-owned firms), which have firm type code from 1 to 10 as domestic firms. All firms with foreign investment (either 100% foreign direct investment or joint venture), which are coded from 11 to 13, is treated as foreign investment in calculating the linkages. Only domestic firms are included in the final clean dataset in obtaining the results.

The main measures of annual activities of firms reported in the survey include gross output, value added per unit of labour, total revenue, total employees, total assets and so on. Because of the high contribution of the manufacturing sector to GDP of the country (around 30% annually, see (Statista, 2017)), the high proportion of foreign investment (around 50%), manufacturing sector is the base line of this study. However, in order to broaden the view of the spillovers, we also make an effort to look at some selected service sectors, which experience the higher proportion of foreign investment.

The total number of firms in the manufacturing sector increased from 46,042 in 2010 to 68,588 in 2015, while the number of foreign firms rose from 5,141 to 6,608, accounting for 57.5% and 55.4%, respectively, of total foreign firms in Vietnam. A summary of the data from the VES is presented in Appendix Table A4.1

Following Greenaway and Kneller (2004), Karpaty and Kneller (2011), we obtain an unbalanced panel data of domestic manufacturing firms from 2010 to 2015, constructed from the raw data. The total number of firms covered each year varies from 36,995 in 2010 to 51,610 in 2015. The change in the number of domestic firms is due to firms' exit or entry. All missing, negative and zero values in sales, labour, or total labour costs, have been removed from the dataset (less than 1%). In each year, approximately 0.01% observations, which have unreliable export volumes larger than total sales, have also been dropped from the dataset, leaving unbalanced panel data of 266,348 observations for 6 years. As has been discussed earlier, though manufacturing remains as the main interest of our research, we also examine the service sector. We are unable to compute vertical linkages for all service sectors at the 4-digit level as some sectors are not available in the IO tables. We therefore focus on a limited number of service sectors that have a higher proportion of foreign investment and allow us to calculate backward and forward linkages. We then end up with Wholesale and Retail (2-digit level code

45, 46, 47), Finance, Banking and Insurance (64, 65, 66, 67) and Real Estate (68) giving a total of 538,219 observations over 6 years.

The variables at firm level for sales, labour costs, and capital are available in the raw dataset and are reported in millions of Vietnamese dong, export volume and import volume are originally reported in USD and are converted into Vietnamese dong using the average exchange rate adopted from the World Bank database. The horizontal linkages and the Hirschman-Herfindahl index are calculated from the VES at 4-digit sector level. The values of δ and σ for equations (4.4) and (4.6) to calculate the backward and forward linkages are obtained from the Input-Output Table, published by the General Statistical Office (GSO, 2012). Since it is in our chosen period of interest, the IO2012 table is used in this paper to calculate the linkages. The IO2012 table comprises a square matrix of 164 sectors at time *t* where most of them can be linked with a 4-digit sector code from the Vietnamese Standard Industrial Classification (VSIC2007), the others that have no clear link with the VSIC2007 are ignored. A hundred and sixty-four sectors that can be linked with the four-digit sectors from the VSIC in the manufacturing and service industries have been used to calculate foreign investment backward and forward linkages. In these selected service sectors, I end up with 45 sectors at four-digit level, which are able to be connected with the IO table. A brief statistical summary of the data used in this paper is presented in Appendix Table A4.2 and A4.3.

We also consider the sub-dataset, derived from the main dataset, based on industry's level of technology. It is possible that low-tech firms have less motivation to export than medium- and high-tech firms. Using the same approach, I then estimate the impact of foreign investment on low and high-tech firms' export behaviour. There are 112,525 observations in the low-tech group and 153,823 observations in the high-tech group. Following Anwar and Nguyen (2011), high-tech and low-tech firms are defined based the list of high-tech sectors, which are prioritized for the development provided by the Vietnamese government office

(Vietnamese Government, 2015). The technology-level classification is detailed in Appendix Table A4.7.

There are some limitations to data availability that can be highlighted. First, the information on export experience of firms (measured in how many years that a firm has been exporting), which serves as a good exclusion restriction, is not available for earlier years prior to 2010. Second, our dataset does not indicate whether domestic firms have direct or indirect connections with foreign firms, which then leads to drawbacks in terms of evaluating an unbiased impact of foreign investment on domestic firm exporting activity. In a subsequent study, this may be worth considering as an alternative control variable for measuring the linkages if the dataset allows. Third, the linkages in this paper are computed at 4-digit sector level, which means firms in the same sector are influenced by the same way from the presence of foreign investment. It is one of the drawbacks of our study, however due to the data limitation, we are unable to access more detailed information about the linkages at firm level.

4.4. Results and analysis

The Wooldridge approach is used in this paper to test empirically for foreign presence influence on (1) the decision of domestic firms to export and (2) the level of domestic firm exports using a panel dataset. The first step estimates the impact on the decisions of firms to export for each year separately[14]. The data reveals a correlation coefficient between *expvol* and *explagged* of 0.64, and between *expshare* and *explagged* of 0.1 in the manufacturing dataset; 0.49 and 0.005 respectively in the service dataset, which supports *explagged* being used in the first step as an exclusion restriction. As I use the first lag of *export* as an exclusion variable, the first step suffers from a loss of the base year 2010. I also conduct a Tobit regression on panel data and original Heckman sample correction on pooled data as robustness checks, which are presented

[14] The Inverse Mills Ratios in the Heckman estimation on a panel dataset are calculated separately for each year in the first step and then are included in the estimation in the second step.

in Appendix Table A4.4 and A4.5. The results from those estimations are consistent in terms of the signs on the main variables of interest (*Horizontal, Backward and Forward*). However, we focus on the results from Wooldridge approach, given the advantages of this approach over Tobit and Heckman estimation on pooled data estimations which are reported below.

4.4.1. Export decision

Table 4.2 reports the results based on marginal effects obtained from the probit regressions for the manufacturing and service sectors, reflecting the change in the probability of firms' export decision given one unit change in the independent variables

Table 4.2. The impact of foreign investment on export decision of domestic firm

VARIABLES	Manufacturing	Services
Explagged	0.25***	0.20***
	(0.003)	(0.02)
Scale	0.93***	0.81***
	(0.069)	(0.07)
Wage	7.49e-06*	0.000024***
	(3.18e-06)	(0.000006)
Capint	7.88e-07*	0.00000005
	(3.3e-07)	(0.00000006)
Location	0.06***	0.03**
	(0.0028)	(0.005)
Ownership	0.02***	-0.015*
	(0.004)	(0.0048)
Horizontal	0.09***	0.097***
	(0.0044)	(0.021)
Backward	-0.0046	0.19***
	(0.005)	(0.023)
Forward	-0.02***	-0.002
	(0.0024)	(0.0071)
TFP	0.26***	0.02***
	(0.0007)	(0.0004)
HHI	-0.02*	-0.899***
	(0.13)	(0.039)
PCI	0.00008***	0.00002
	(0.00001)	(0.00001)
Observations	266,348	538,219

*Notes: Marginal effect at mean based on Probit estimations. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The dependent variable is export (yes/no), explagged is lag 1 of export, showing whether or not firm has export the previous year, acting as an exclusion restriction.*

In the initial selection regression, domestic firms' export experience in the previous year (*explagged*) has a significant influence on their decision to continue exporting, in both manufacturing and service sectors, which suggests that firms engaged in export activity in the previous year are more motivated to continue exporting the following year. This is consistent with the literature (B. Aitken et al., 1997; Alessandria & Choi, 2007) reflecting that export sunk costs have a significant influence on the decision to export. If domestic firms already have an international market, the export experience they have acquired reduces their costs for information searching and building a customer base abroad, and this experience encourages them to continue exporting. This shows that the lag of export plays an important role in the local firm decision to export and should be included into the first stage of Heckman procedure. In comparing these results with the results obtained where we exclude the lag 1 of export from the first step (see Appendix Table A4.6), I find differences between the two regressions. According to Heckman (1977b), the model with at least one exclusion restriction in the first step provides a better outcome for sectional corrections.

The results indicate a positive horizontal linkage between the presence of foreign investment on domestic firm decision to export in both manufacturing and service sectors. This suggests that when foreign firms invest in a specific sector, it raises the motivation for domestic firms in that sector to start exporting. Normally, multinational companies bring along access to the export markets (B. Aitken et al., 1997), which may lead to informational spillover effects that encourage domestic firms to engage in exporting. I also find significant positive spillovers through backward linkages for the service sector, indicating that foreign firms in downstream sectors are likely to encourage domestic service firms in upstream sectors to engage in exporting. This is in line with a number of existing studies (B. Aitken et al., 1997; Alvarez & López, 2008; Anwar & Nguyen, 2011; Blomström & Kokko, 1998; Greenaway & Kneller, 2004). The study finds, however, evidence of negative forward impacts from foreign

investment on local manufacturing firm decisions to export. This suggests that foreign firms in upstream sectors discourage local firms in the downstream sectors to engage in exporting activities, which is consistent with the findings from Anwar and Nguyen (2011). A number of control variables significantly influence the export decision of local firms. For instance, firms with higher productivity, lager scale or location in an industrial zone or in a province with higher PCI tend to be more encouraged to engage in exporting activities.

4.4.2. Export performance

The second step of the procedure is to estimate the impacts of foreign investment on export performance of domestic firms, given the estimated probability (IMRs-λ) of being an exporter in the first step. The results, obtained from the Wooldridge ordinary least squares (OLS) and Wooldridge fixed effect (FE) model, are presented in Table 4.3. The results based on the regressions for both the proportion of exports out of total sales (*expshare*) and the absolute export volume (*expvol*) are included. Models (1) and (2) are Wooldridge OLS regressions on export share and export volume respectively, model (3) is for Wooldridge FE on *expshare*. Following Jeffrey M. Wooldridge (1995), the study chooses the OLS regression on *expshare* as the baseline for our discussion.

Table 4.3. Export spillovers from foreign investment to domestic manufacturing firm

VARIABLES	(1) OLS-expshare	(2) OLS_expvol	(3) FE_expshare
λ̂-2011	-3.308*	-23,825***	0.0116
	(1.723)	(5,031)	(1.558)
λ̂-2012	-2.238	-24,722***	-0.471
	(1.772)	(6,215)	(1.980)
λ̂-2013	-0.990	-36,221***	0.680
	(1.802)	(5,510)	(1.474)
λ̂-2014	-1.802	-27,997***	0.900
	(1.517)	(8,559)	(1.919)
λ̂-2015	-1.810***	18,127***	-1.879
	(0.494)	(2,142)	(1.678)
Scale	-36.57***	810,485***	-2.015
	(13.03)	(246,381)	(23.57)
Wage	-0.00193	-4.705	-0.00179
	(0.00814)	(40.92)	(0.00410)
Capint	5.87e-05	0.660	0.000195
	(0.000163)	(1.034)	(0.000260)
Location	-1.394	9,429**	-1.764
	(0.914)	(4,249)	(1.530)
Ownership	-1.534	15,417**	1.654
	(1.162)	(6,940)	(3.882)
Horizontal	-0.427	-12,466	3.741
	(8.095)	(37,531)	(5.131)
Backward	28.33*	49,893	10.68*
	(16.11)	(76,034)	(6.112)
Forward	-3.073***	-12,319**	-1.247
	(1.135)	(5,617)	(1.337)
TFP	-1.818***	14,937***	-2.119***
	(0.403)	(2,282)	(0.814)
HHI	17.90	6,020	18.66
	(15.39)	(82,419)	(14.06)
PCI	0.00439	-24.93	-0.0149**
	(0.00510)	(29.60)	(0.00700)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	-
Constant	17.88***	-40,818***	86.15**
	(5.725)	(10,468)	(38.21)
Observations	9,756	9,756	9,756
R-squared	0.362	0.194	0.379
Number of id	4,206	4,206	4,206

*Notes: Robust standard errors based on 2000 replications in parentheses for the OLS estimation (*** p<0.01, ** p<0.05, * p<0.1). 137 dummies for sectors at 4-digit level. The linkages, HHI are at 4-digit industry level. PCI is at provincial level. Other variables are at firm –level.*

There is no evidence to support the presence of negative horizontal export spillovers on domestic firms from foreign presence. This finding differs from Anwar and Nguyen (2011) in their study of Vietnamese data from 2002 which finds positive horizontal spillovers and a range of other case studies which also find positive spillovers (B. Aitken et al., 1997; Alvarez & López, 2008; Blomström & Kokko, 1998; Greenaway & Kneller, 2004). The result is consistent with previous studies which also find no significant impacts from foreign investment on domestic firm exports in the same industry (Lutz et al., 2008), and those studies that report significant negative horizontal spillovers (Kneller & Pisu, 2007). The finding here suggests that multinationals do not have significance influence on local firms' export performance in the same sector. It reflects the fact that the positive horizontal spillovers may not occur, while multinationals perhaps remain unconnected with their local competitors. However, the findings also suggest that the presence of foreign firms does not drive away the benefits of competing in the international market from the point of view of local firms- which may due to the limited connection between them.

The study finds evidence of a positive effect from firms with foreign investment on local firms' export share through backward linkages, which is confirmed in both the Heckman OLS and FE regressions. This suggests that foreign firms in downstream sectors promote domestic firms in upstream sectors, which are already exporting to increase their export share, but do not encourage local firms to move into exporting given the negative coefficient on the backward linkage in stage 1. In Vietnam, domestic firms in upstream industries mainly supply inputs to foreign firms, but these inputs comprise intermediate supporting products in small numbers (World Bank, 2016). It is arguable that Vietnam's entry to global value-added chains comes through foreign investment and that then leads to significant export-led growth. The facts show that many of Vietnam's exports in the manufacturing sector have a high level of imported content and low domestic value added. To this extent, the situation indicates that

domestic firms have become suppliers for export-oriented foreign firms but with low value-added tasks, such as packing and supplying basic materials (World Bank, 2017d). When supplying to foreign firms, local suppliers must follow the foreign firms' requirements, and the latter transfers both technology and labour to domestic firms to help local suppliers meet their requirements. Local suppliers can learn from multinationals and improve their own productivity, which may lead to an increase in the export share of local firms.

With regard to forward linkages, as in earlier studies (Kneller & Pisu, 2007), the paper finds a strongly significant negative relationship between the presence of foreign firms and the export behaviour of domestic firms in the downstream sector through both export share and absolute value. This indicates that an increase in foreign suppliers results in less probability of export participation, and also in a smaller export share for local buyers. There is a possibility that local firms in downstream sectors usually buy intermediate goods from domestic suppliers while remaining unconnected with foreign suppliers in upstream sectors. Meanwhile, foreign firms in upstream sectors appear to supply inputs mostly to foreign firms rather than domestic customers in downstream sectors, which is recognized in the case of Vietnam (World Bank, 2017c, 2017e). Foreign firms in the downstream sectors now may gain in terms of productivity spillovers from their foreign suppliers in the upstream sectors. This can result from high quality inputs supplied by the upstream foreign firms not being utilized by their local counterparts. This allows foreign firms to gain advantages over their local counterparts in downstream sectors in terms of becoming more productive and competitive. Therefore, the small and less competitive local exporters not only have less chance to engage in exporting activity, but there is also a reduction in their export share.

Furthermore, positive forward linkages occur when foreign firms in upstream sectors supply updated and high-quality inputs to local firms in downstream sectors, which then promote local firm productivity thereby encouraging them to serve the international market.

However, such spillovers can only be generated when local firms have adequate resources (technology, human capital, etc.) to absorb the advantage effectively and vice versa. Indeed, domestic firms in the downstream sectors may have a reliance on low-skilled labour along with low levels of technology that prevents them from taking advantage of the advanced inputs from the upstream foreign suppliers. In the cases where employees of local firms are unable to operate technology effectively, there may be negative backward spillovers. Unfortunately, the dataset does not allow us to confirm these possibilities as it does not include the information about the linkages between domestic and foreign firms at firm level.

A number of firm characteristic variables are found to have impacted on the export performance of domestic firms. In particular, together with scale of firms (*scales*), the study finda strong evidence to support the impact of *tfp* on the export performance of domestic firms. This indicates that the more productive firms are likely to export more in terms of absolute volume compared with lower-productivity firms. However, the export share of the more productive firms is found to be lower, suggesting that the role of *tfp* is more likely to improve total sales as a whole, where it may favour domestic sales rather than exports[15]. Other factors such as scale and capital intensity also have impacts on domestic firm export share and absolute export volume in some cases, confirming the role of those variables in the export performance of firms. However, the results show that the other internal factors do not have much effect on the level of export performance implying that those factors exert influence on total firm production but not much on their export performance. Interestingly, state-owned firms tend to be more motivated to export and are more productive in term of export performance. As reported in Table 2 in the previous section, *ownership* has a significant positive influence on

[15] We use the level of TFP to include in the regressions. TFP is estimated at firm level. The Wooldridge approach is used to estimate the Vietnamese firm's production function based on the Cobb – Douglas formulation at 2-digit- sector-level. There are 23 2-digit-level sectors (code 10 - 33) for manufacturing and 8 for service sector (code 45 - 47, 64 - 67 and 68). The contribution of labour is greater than that of capital in most of the cases.

the decision to export and significant effect is found on the export volume of domestic firms, which means that state-owned firms tend to be more involved in export activity than private firms. In reflecting on this, Vietnamese state-owned firms receive more support from the government than private firms in terms of land use and information, giving them a chance to take advantage over private firms. As a result, they may have more information available to them and greater opportunity to begin serving the international market. Furthermore, state-owned companies in Vietnam work in certain specific areas, such as electricity, telecommunications etc., designed to secure the economy and mainly serve the domestic market. Nevertheless, they are large-scale monopoly companies and may have advantages over domestic private firms for entering the international market (World Bank, 2017d). Industrial factors such as PCI and HHI do not seem to have significant impacts on the export performance of Vietnamese manufacturing firms.

A slightly different story occurs in the case of the service sector where we find weak evidence to support the influence from foreign investment on local service firms export performance. Across the regressions, we find only significant positive impacts of backward linkages based on Wooldridge OLS estimation on export share, indicating that local firms in upstream sectors benefit from multinationals in downstream sectors, which is consistent with previous finding in manufacturing sector. However, no significant impact is found to support the horizontal and forward spillovers from foreign investment on local firms export performance from those selected service sectors. Table 4.4 provides more detail.

Table 4.4. The spillovers on export performance in service sector

	(1)	(2)	(3)
VARIABLES	OLS- Expshare	OLS - Exportvol	FE - Expshare
λ̂-2011	-8.158***	-92,780	-3.755***
	(1.648)	(66,055)	(1.316)
λ̂-2012	0.0445	-3,984	1.420
	(1.056)	(19,218)	(1.057)
λ̂-2013	0.358	2,192	-0.432
	(0.587)	(6,468)	(0.475)
λ̂-2014	-1.249*	-12,504	-0.911
	(0.661)	(7,898)	(0.892)
λ̂-2015	0.412***	9,316***	0.968*
	(0.153)	(3,264)	(0.514)
Scale	-4.745	1.425e+07**	-95.36**
	(16.88)	(6.254e+06)	(44.00)
Wage	-9.13e-05	-0.800	0.0106***
	(0.00246)	(140.6)	(0.00288)
Capint	-1.76e-06	-0.0984	-1.67e-05
	(2.55e-05)	(2.291)	(5.02e-05)
Location	3.124***	-15,315	-1.797
	(1.055)	(13,667)	(1.635)
Ownership	1.137	47,183	-3.754
	(0.825)	(31,302)	(3.071)
Horizontal	-8.560	27,984	-0.566
	(5.918)	(133,770)	(7.802)
Backward	11.84*	-163,447	-5.687
	(6.704)	(129,282)	(7.375)
Forward	0.0801	37,387	-0.312
	(1.718)	(29,492)	(1.782)
TFP	0.767***	2,157	0.302
	(0.134)	(4,855)	(0.271)
HHI	-15.58	255,533	17.81
	(14.19)	(396,086)	(12.79)
PCI	0.0219***	89.29**	-0.0257***
	(0.00399)	(35.96)	(0.00604)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	
Constant	-12.35***	-146,759***	-15.53***
	(1.379)	(36,288)	(3.646)
Observations	17,526	17,526	17,526
R-squared	0.112	0.200	0.127
Number of id			9,311

*Notes: Robust standard errors based on 2000 replications in parentheses for the OLS estimations (*** p<0.01, ** p<0.05, * p<0.1). 45 industry dummies at 4-digit level are included.*

As has been discussed earlier, not many firms from the Vietnamese service sectors are engaged in exporting as they have not been productive enough to attract foreign customers to come and use Vietnamese services such as banking or insurance or housing. In fact, events occur the other way around as foreign firms enter and invest in those sectors to serve not only domestic but also foreign customers and drive the demand for the domestic firms away. This could be the case where we find the negative horizontal linkage but not significant enough to confirm. Moreover, given the fact that domestic and foreign firms have their own customers and stay disconnected from each other, there are not much in the way of linkages.

4.4.3. Export spillovers on low-tech and high-tech domestic manufacturing firms

Since it can be argued that export behaviour differs among manufacturing firms, due to their varying characteristics and the differing effects of external factors, we consider results on two sub samples: high-tech and low-tech groups of domestic firms. Firms in high-tech sectors might be expected to have greater advantages in production and competition than firms in low-tech sectors (Anwar & Nguyen, 2011). In the Vietnamese manufacturing sector, high-tech firms seem to have developed closer relations with foreign firms that are mostly high-tech themselves, which results in a demand and supply of local inputs to meet high-tech production requirements.

From the results reported in Table 4.5, it is clear that low-tech firms are affected by foreign presence in exports more than high-tech firms in terms of export performance through all the linkages. In particular, the low-tech firms seem to be more strongly negative influenced by the presence of foreign investment than high-tech firms in the same and downstream sectors.

Table 4.5. Export spillovers in high-tech and low- tech manufacturing firms

VARIABLES	(1) OLS-High-tech	(2) FE-High-tech	(3) OLS-Low-tech	(4) FE-Low-tech
$\hat{\lambda}$-2011	-6.241***	-2.022*	-10.86***	-3.060**
	(1.598)	(1.187)	(1.577)	(1.499)
$\hat{\lambda}$-2012	1.350	1.203	-5.478***	-2.679
	(1.297)	(1.322)	(1.646)	(1.642)
$\hat{\lambda}$-2013	-2.627***	-1.089	-5.547***	-0.988
	(0.781)	(0.788)	(1.166)	(1.340)
$\hat{\lambda}$-2014	-0.761	-1.439	-5.356***	-0.256
	(1.178)	(1.263)	(1.459)	(1.880)
$\hat{\lambda}$-2015	-0.283	-0.744	-1.510***	1.438
	(0.346)	(1.310)	(0.567)	(1.677)
Scale	1.550	7.583	-2.677	-3.764
	(6.498)	(19.99)	(8.925)	(29.57)
Wage	-0.00248	-0.000992	0.00179	0.00150
	(0.00180)	(0.00150)	(0.0118)	(0.0108)
Capint	4.04e-05	2.43e-05	-0.000384**	0.000232
	(0.000142)	(0.000238)	(0.000178)	(0.000236)
Location	0.804	-0.127	1.302	0.118
	(0.578)	(0.968)	(0.892)	(1.717)
Ownership	-0.678	-9.263**	0.617	3.321
	(0.795)	(3.785)	(1.286)	(3.627)
Horizontal	-1.427	3.126	-30.87***	-10.81
	(5.989)	(2.684)	(11.44)	(7.515)
Backward	7.418	4.130	89.89***	30.54**
	(8.184)	(3.204)	(29.56)	(15.27)
Forward	-1.460**	-0.962	-3.865*	-0.835
	(0.669)	(0.821)	(2.281)	(2.205)
TFP	-1.558***	-0.436	-2.672***	-1.980**
	(0.364)	(0.683)	(0.432)	(0.828)
HHI	-9.638*	-0.154	0.786	17.63
	(5.626)	(5.912)	(14.18)	(17.37)
PCI	0.00155	-0.0129**	0.0147***	-0.0142*
	(0.00398)	(0.00529)	(0.00527)	(0.00722)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Constant	19.05***	-9.668**	16.45**	-0.553
	(6.058)	(4.037)	(6.548)	(4.266)
Observations	4,035	4,035	5,629	5,629
R-squared	0.213	0.187	0.392	0.472
Number of id		1,763		2,430

*Notes: Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). 74 industry dummies at 4-digit level for high-tech, 38 for the low-tech group are included in the OLS regressions*

Based on the Wooldridge OLS estimation, the presence of foreign firms has a strongly negative effect on the export performance of local firms in the low-tech group through horizontal linkages while there is no significant effect found in the high-tech cluster. In addition, high-tech firms are less negatively affected by foreign firms in downstream sectors than that are low-tech firms. However, while we find positive impacts through backward linkages in low-tech group, local high-tech manufacturing firms seem to have no influence from the presence of foreign firms in upstream sectors, which may due to the limited connection with the foreign firms. These results hence indicate that low-tech firms are more influenced than high-tech counterparts through the linkages. It may be due to local firms in the high-tech group are more competitive and productive than those in low-tech cluster where they are not negatively affected by the presence of foreign competitors. This finding might be seen in the context of a lack of existing evidence that export spillovers can be larger for the high than low-tech Vietnamese firms.

4.5. Conclusion and policy implications

The recent studies on the linkages between foreign investment and domestic firm exporting activity has seen a number of cases provide evidence of the significant effects, where it could be positive or negative depends on the channel and also the countries and sectors under examination. In case of the Vietnamese manufacturing industry, the paper finds significant positive spillovers through backward linkages and a strongly negative linkage through forward linkages while no significant effect is found through the horizontal channel. Low-tech manufacturing firms are found to be more influenced from the presence of foreign investment than their counterparts in the high-tech group. Total factor productivity, scale, location and ownership of local firms have strong impacts on both decision to export and export

performance of local firms. The study finds, however, little evidence to support these impacts on some selected service sectors.

This research contributes to the limited existing literature on the export spillovers and provides an empirical evidence to confirm the effects through the linkages in case of Vietnam. Unlike Anwar and Nguyen (2011), who confirmed the positive horizontal linkage based on Heckman model on a cross sectional data of 2002, our results suggest the negative impacts through both horizontal and forward linkages found from a more updated comprehensive data, while also find the significant positive spillovers through backward linkages. The results in this study are consistent with previous studies (C. Chen et al., 2013; Kneller & Pisu, 2007), suggesting that foreign investment does have a significant positive influence on the export activities of domestic firms in upstream sectors. It is argued that domestic firms benefit from foreign firms in vertical linkages by the supply of labour or technology infusion (B. J. Aitken & Harrison, 1999a; Anwar & Nguyen, 2011), which may be the case in Vietnam. Domestic firms in upstream sectors may achieve better productivity with higher quality by following foreign firms' techniques and requirements, but may also lag behind in developing their own exports if they focus solely on supplying foreign firms in the domestic market.

Although the relationship between Vietnamese firms and foreign firms is weak, as mentioned above, the former is gradually taking advantage of the relationship with foreign firms by supplying inputs to them. This result gives support to the idea that strengthening the linkage with foreign firms is a good way to improve the productivity of domestic firms by adopting foreign firm techniques and requirements thereby supporting domestic firms seeking to climb to a higher position in the global supply chain. This finding lends support to the Vietnamese government policy of paying much more attention to supporting domestic firms (World Bank, 2017d). The presence of positive backward linkages is confirmed in our study, suggesting that increasing the capabilities and technology of domestic firms to upgrade their

supplier linkages with foreign firms would enable them to explore international markets. Our evidence suggests that the exporting behaviour of domestic Vietnamese manufacturing firms is negatively influenced by the presence of foreign firms through forward linkages. The government should design more appropriate policies and strategies that enable foreign investment to generate positive spillovers and also to strengthen the domestic sectors, thereby limiting the negative effects of foreign firms.

The study leads towards potential avenues for the future research. If better data are available in terms of more detailed information on local firm relationships with foreign investment, then a closer look can be taken of linkages at the firm level. Moreover, one possibility would be to give consideration of the source of foreign investment, where the behaviour of foreign firms may differ depending on their country of origin, business culture, and macroeconomic factors. A further direction for future research may be to consider the characteristics of foreign firms, which may act differently towards local firms in host country, and determine whether foreign direct investment or joint ventures are proposed.

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Chapter Appendix

Table A4.1. Summary of manufacturing Data

Year	Total firms	FDI	Domestic	Manufacturing	FDI	Domestic firms	Domestic firms' clean data
2010	280,541	8,939	271,602	46,042	5,141	40,901	36,840
2011	330,541	11,940	318,601	53,965	5,787	48,178	37,841
2012	359,287	8,610	350,677	56,389	4,965	51,424	41,607
2013	381,599	10,004	371,595	59,362	5,594	53,768	44,494
2014	415,656	11,179	404,477	65,496	6,273	59,223	47,525
2015	455,300	11,925	443,375	68,588	6,608	61,980	48,469

Source: Author's calculation from the VES 2010 – 2015.

Table A4.2. Statistical Summary of the manufacturing Data

Independent variables	Mean	Median	Std. dev
Expshare	18.8	0.088	31.86
Expvol	34,887	37.86	1,8944
Scale	0.0003	0.00007	0.015
Wage	47.14	40.57	161.34
Capint	731.7	389.2	3033.1
TFP	0.372	0.374	0.23
Horizontal	0.39	0.37	0.22
Backward	0.26	0.12	0.33
Forward	0.48	0.22	0.72
HHI	0.05	0.02	0.07
PCI	59.52	59.67	3.17

Source: Author's calculation from VES 2010-15

Table A4.3. Statistical Summary of the service Data

Independent variables	Mean	Median	Std. dev
Expshare	5.75	0.00	3.72
Expvol	13,692	0.00	229,414
Scale	0.0004	0.00002	0.008
Wage	56.13	52.35	325.98
Capint	2,673	1,142.8	641.7
TFP	5.35	5.43	1.85
Horizontal	0.08	0.05	0.07
Backward	0.09	0.07	0.08
Forward	0.19	0.14	0.18
HHI	0.02	0.005	0.04
PCI	58.12	59.06	4.02

Source: Author's calculation from VES 2010-15

Table A 4.4. Export spillovers on manufacturing sector: Tobit regression

VARIABLES	(1) Tobit-expshare	(4) Tobit-exportvol
λ̂-2011	-9.077***	-36,916***
	(1.208)	(5,151)
λ̂-2012	-2.424*	-20,844***
	(1.336)	(5,717)
λ̂-2013	-6.914***	-42,900***
	(0.956)	(4,097)
λ̂-2014	-4.243***	-32,296***
	(1.167)	(5,035)
λ̂-2015	-1.718	11,412***
	(1.079)	(4,299)
Scale	55.43***	949,400***
	(15.57)	(64,402)
Wage	0.00171	3.897
	(0.00485)	(20.35)
Capint	-0.000222	0.547
	(0.000207)	(0.831)
Location	-0.251	7,695*
	(0.994)	(4,076)
Ownership	4.153**	23,568***
	(1.837)	(7,336)
Horizontal	-6.987	-16,312
	(8.461)	(35,946)
Backward	36.43**	106,013*
	(14.29)	(60,353)
Forward	-3.812***	-16,926***
	(1.196)	(5,069)
TFP	-3.919***	540.8
	(0.467)	(1,924)
HHI	7.115	49,079
	(15.37)	(65,450)
PCI	0.00552	4.823
	(0.00528)	(22.10)
Constant	12.88	-61,487*
	(8.371)	(34,443)
Observations	9,756	9,756
Number of id	4,206	4,206

*Notes: Robust Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Tobit regression on panel data, year dummies and industry dummies (4 digit level) are included.*

Table A4.5. Export spillover on manufacturing sector: Heckman two-step regression on pooled data

VARIABLES	(1) Export share	(2) Decision to export	(4) Export share- no lag	(5) Decision to export - no lag
explagged		1.967***		
		(0.0184)		
wage	0.00265	6.52e-05**	-0.00367	6.69e-05***
	(0.00397)	(2.61e-05)	(0.00288)	(2.31e-05)
scale	-6.863	12.56***	-6.416	12.48***
	(15.21)	(12.51)	(16.23)	(9.24)
Horizontal	2.552	-0.318	-0.782	-0.0454
	(7.260)	(0.214)	(5.846)	(0.149)
Backward	-13.40	0.454	5.195	-0.561**
	(10.82)	(0.301)	(9.366)	(0.229)
Forward	1.472	-0.0422*	-0.788	0.0808***
	(0.942)	(0.0242)	(0.796)	(0.0188)
PCI	0.00886**	0.000215*	0.00809**	0.000111
	(0.00385)	(0.000112)	(0.00341)	(8.43e-05)
location	-0.537	0.484***	-0.396	0.744***
	(0.627)	(0.0223)	(1.362)	(0.0168)
ownership	-0.331	0.168***	1.223	0.283***
	(1.018)	(0.0344)	(1.076)	(0.0254)
capint	-4.72e-05	3.2e-4**	9.86e-06	2.57e-5
	(0.000125)	(1.23e-4)	(4.22e-05)	(1.16e-4)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Constant	59.93***	-2.714***	22.29***	-2.793***
	(5.092)	(0.150)	(7.705)	(0.108)
Observations	79,336	79,336	106,276	106,276

*Notes: Robust Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1), industry dummies are at 4-digit level*

Table A4.6. Heckman on panel without lag export is used at the first step

VARIABLES	(1) OLS-no lag	(2) FE-no lag
$\hat{\lambda}$-2011	-10.44***	-3.469***
	(1.159)	(1.031)
$\hat{\lambda}$-2012	-2.613**	-1.237
	(1.059)	(1.083)
$\hat{\lambda}$-2013	-4.391***	-0.581
	(0.728)	(0.828)
$\hat{\lambda}$-2014	-3.471***	-0.551
	(0.953)	(1.284)
$\hat{\lambda}$-2015	-1.115***	-0.127
	(0.418)	(1.166)
scale	-1.642	-13.48
	(5.215)	(16.60)
wage	-0.00206	-0.000497
	(0.00406)	(0.00352)
capint	-0.000177	0.000389**
	(0.000110)	(0.000182)
location	0.901	-0.389
	(0.560)	(1.052)
ownership	-0.00787	0.381
	(0.832)	(3.154)
Horizontal	-4.185	-1.940
	(5.439)	(5.798)
Backward	15.88*	16.22*
	(8.169)	(8.884)
Forward	-2.351***	-1.447*
	(0.704)	(0.808)
tfp	-2.228***	-0.979
	(0.296)	(0.607)
HHI	-6.986	-8.093
	(7.117)	(9.290)
PCI	0.00776**	-0.0187***
	(0.00364)	(0.00526)
Constant	17.68***	86.62**
	(6.260)	(38.25)
Observations	9,756	9,756
R-squared	0.363	0.380
Number of id		4,206

*Notes: Robust Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Export share is the dependent variable, year and industry dummies (4-digit level) are use*

Table A4.7. Technological level classification

Low technology level group

VSIC2012	
10	Manufacturing of food
11	Manufacture of beverages
12	Manufacture of tobacco products
13	Manufacture of textiles
14	Manufacture of wearing apparel
15	Manufacture of leather and related products
16	Manufacture of wood and of products of wood and cork
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke and refined petroleum products
31	Manufacture of furniture
32	Other manufacturing
33	Repair and installation of machinery and equipment

High technology level group

VSIC2012	
20	Manufacture of chemicals and chemical products
21	Manufacture of pharmaceuticals, medical chemical and botanical products
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of computer, electronics and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment

Table A4.8. Variable description

VARIABLES	DESCRIPTION
Horizontal	The presence of FDI in the same industry – horizontal linkages
Backward	The presence of FDI in downstream sector – backward linkages
Forward	The presence of FDI in upstream sector – forward linkages
HHI	Hirschman-Herfindahl index
Scale	Scale of firm
Wage	Labour's wage
capint	Capital intensity
location	Location of firm (= 1 if a firm is located in an industrial zone)
Ownership	Ownership of firm (=1 if a firm is state-owned and 0 if firm is private owned firm)
TFP	Total factor productivity of firm
PCI	Provincial Competitiveness Index

CHAPTER 5. DOES FOREIGN DIRECT INVESTMENT INFLUENCE R&D AND INNOVATION ACTIVITY IN THE HOST COUNTRY? EVIDENCE FROM AN EMERGING ECONOMY.

5.1. Introduction

Research and development (R&D) are largely recognized as a crucial source that contributes to productivity and economic growth by fostering innovation and technological advance (Khachoo & Sharma, 2017). Endogneous growth theory argues that technological change leads to long-term economic growth (Romer, 1986), where enhancing the stock of knowledge plays an important role for a country to have sustainable economic growth. While firms' investment in R&D aims to develop knowledge and ideas that firms seek for development, innovation is the result where new and superior products, services, technologies or production processes are introduced (Trajtenberg, 1990). Firms are interested in undertaking R&D, then innovation activity, when they have incentives and resources to do so, and when they have better managerial control, are able to take advantage of economies of scale (Schneider & Veugelers, 2010), or are close to a technological frontier (Audretsch, Segarra, & Teruel, 2014). However, not every firm want to spend on R&D, especially young, small firms, not only because it is costly and uncertain but also because they can still be innovative by adopting the latest technologies from the international market, which may be less risky than spending on primary research (Audretsch et al., 2014).

In emerging economies, due to the large technological gap, it is challenging for domestic enterprises to reach to the level of technology available to multinationals in developed countries, even when they have plenty of natural resources (Khachoo & Sharma, 2017).

Therefore, one of the most effective ways for local enterprises in developing countries to close the technological gap with their international counterparts is to take knowledge spillovers from foreign direct investment (FDI). According to De Mello (1999), Görg and Greenaway (2004), FDI might transfer production technology and business innovation to the host country, investing directly and benefiting the host by productivity improvement, technology and the transfer of know-how, enhancement of labour skills, and access to new processes or products, for example. Consequently, FDI's presence may force local enterprises to invest in R&D and innovation in order to strengthen their technological capacity to be able to compete with FDI or to absorb technology transfer from it (Vinish Kathuria, 2000; Khachoo & Sharma, 2017).

In Vietnam, the need to rely more on innovation for future growth has been highlighted in the Vietnamese innovation system (World Bank, 2017e). It is evident that Vietnam is below average for R&D spending as a share of GDP worldwide and far below that in Korea, China and Japan (World Bank, 2017e)[16]. Furthermore, there is a small proportion of enterprises in Vietnam that invest in R&D, which is far lower than in most other Southeast Asian countries and relatively few enterprises acquire licensed or patented knowledge to support their innovation efforts[17]. More often than in other countries, however, product innovation in Vietnam appears to aim at reducing costs and, less frequently, at introducing completely new functions.

The existing literature finds that there is an association between the presence of FDI and improvement in domestic firms' capacity to undertake R&D (Erdal & Göçer, 2015; Sasidharan & Kathuria, 2011). The spillovers may occur through horizontal linkages, when the presence of FDI increases competition among firms, forcing local plants to innovate to survive;

[16] The report suggests that the average R&D expenditure of Vietnamese firms (1.6% of annual sales) is lower than that in some neighboring countries such as Lao (14.5%), the Philippines (3.6%), Malaysia (2.6%) and Cambodia (1.9%).

[17] According to the World Bank report (2017), around 23% of Vietnamese firms declare they have introduced a new or significantly improved product or service over the three previous years. This number is lower than that in other countries, such as Cambodia and the Philippines, where this proportion is above 30%.

or vertical linkages where FDI firms can support their local suppliers or customers as they participate in innovative activity to make productivity gains. Although FDI has been found to significantly affect Vietnamese enterprises' technology and productivity (Feola et al., 2016; Van Ha, Mark Holmes, Tinh Doan, & Gazi Hassan, 2019; Newman, Rand, Talbot, et al., 2015; Ni et al., 2015), the potential influence of foreign investment on Vietnamese firms' R&D and innovation activity has not been investigated. Since FDI is expected to be important for domestic firms' innovation as part of Vietnamese government policy for attracting foreign investment, there is a need to examine whether FDI indeed plays a role in this process. This research aims to fill the gap in the Vietnamese literature in the field by addressing three research questions: (i) What factors drive firms' decision to invest in R&D and determine the intensity with which they pursue R&D? (ii) Does FDI influence domestic firms' R&D activity in Vietnam and if so, in what ways? (iii) Is there any FDI spillover on firms' innovation activity in Vietnam?

The chapter contributes several significant insights to the literature on the links between FDI and local plants' behaviour in innovative activity. First of all, the paper is among the first studies on Vietnam that examine how important FDI is in promoting R&D and innovation in domestic firms. One Vietnamese government target in attracting FDI is to help the domestic sector become more innovative and productive and FDI companies are regarded as one of the crucial elements of R&D and know-how transfer (World Bank, 2016). With the increasing presence of FDI in Vietnam's economy over the decades, it is worth investigating whether domestic plants enjoy R&D spillovers from FDI, as expected. Using a panel dataset drawn from a unique survey on technology, I find that such internal factors as labour, capital, and export and import status influence enterprises' decision to invest in R&D and innovation, while FDI appears to have little effect.

Secondly, unlike existing literature in the field, this paper focuses on the impact of foreign investment on local firms' R&D and innovation activity through both horizontal and vertical channels. Examining the linkages in an intensive way, this chapter investigates various aspects of the situation through the experience of FDI local competitors, suppliers and customers. Finally, in contrast to many existing studies in the area, this study employs the Jeffrey M. Wooldridge (1995) technique to construct a Heckman selection model on a panel dataset. Our estimation not only helps to deal with the potential econometric issue of selection bias but also allows us to investigate the effect of FDI on a plant's decision to spend on R&D and also on the R&D intensity.

The reminder of the study is structured as follows. Section 2 summarises the literature review. Section 3 highlights the econometric strategy and Section 4 presents a description of the data. Section 5 discusses the empirical results and analysis. Section 6 concludes.

5.2. Literature review

It has been well documented that there is a linkage between the presence of FDI and improvement in domestic firms' capacity to undertake R&D (Erdal & Göçer, 2015; Sasidharan & Kathuria, 2011). Potential spillovers may occur through horizontal linkages, when the presence of FDI increases competition among firms in the same industry. The competition effect appears to be the most significant element promoting R&D in local firms in host countries (Anwar & Sun, 2015; Ben Hassine et al., 2017; Castellani et al., 2017; Hu & Jefferson, 2002; Hu et al., 2005; Li & Hu, 2013; Qu et al., 2013; Sasidharan & Kathuria, 2011). Enhanced competition due to FDI inflow may force local companies to undertake their own R&D and invest in innovation to maintain market share or exit the market (Caves, 1974). FDI firms have superior technology to that of local enterprises, and those advantages come with higher productivity and greater market strength (Veugelers & Houte, 1990). Levin and Reiss

(1984) and Anwar and Sun (2015) argue that a decrease in market strength due to an increase in foreign investment inflows can affect the profit level of existing domestic enterprises, reducing their internal financial capacity and forcing them to invest in R&D either to retain market share at home or expand their business to international markets. Veugelers and Houte (1990), however, argue that competition from FDI firms may limit the scale of production of host country firms and thereby reduce local R&D activity.

Furthermore, the presence of FDI may also influence local companies' R&D behavior through vertical linkages, specifically backward and forward linkages, where local enterprises have the opportunity to benefit from advanced technology from FDI firms (Havranek & Irsova, 2011; V Kathuria & Das, 2005). Backward spillovers may occur when domestic firms in upstream sectors buy inputs or machinery from multinationals in downstream sectors, where technology and know-how can be transferred from foreign firms to their domestic counterparts in the implementation process. It is less likely but still possible for forward spillovers to occur when multinationals in upstream sectors buy inputs from local suppliers. That may encourage domestic suppliers to be innovative and productive in supplying good inputs.

The existing literature includes a number of studies examining the influence of FDI on local firms' general R&D behavior in developed country samples, such as OECD countries (Hejazi & Safarian, 1999; M. Wang & Wong, 2012), the Czech Republic (Kinoshita, 2001), the US (AlAzzawi, 2012), and European countries (Coe, Helpman, & Hoffmaister, 2009; Telatar, Genc, Keser, Ay, & Deger, 2014). Foreign presence in the host country may positively influence local firms' R&D and innovation activity and then enhance the productivity of the domestic sector, as in China (Anwar & Sun, 2015; Y. Chen, Hua, & Boateng, 2017; Hu & Jefferson, 2002; Sun & Anwar, 2019; Wei & Liu, 2006), Taiwan (Chuang & Lin, 1999; Lin & Yeh, 2005), and in other Asian countries (Erdal & Göçer, 2015; Lee & Tan, 2006). While these papers focus chiefly on the way R&D and FDI affect the productivity of local firms, our interest

is in the ways that FDI can influence the R&D behavior of domestic enterprises. A key study dealing with Indian manufacturing firms during the 1994-2005 period (Sasidharan & Kathuria, 2011) found that foreign investment has a significant influence on R&D behavior, including the decision to invest in R&D and the intensity of R&D activity. However, this study analyzes foreign presence only in terms of the proportion of foreign equity in an industry, and thus mainly concerns horizontal linkages, while spillovers through vertical linkages are not investigated.

Some studies find no evidence of negative R&D spillover from FDI on local plants, as in the United States (Wellhausen (2013), Sweden (Braconier, Ekholm, & Knarvik, 2001), Germany (Bode, 2004), and the EU (Damijan et al., 2003). In some emerging economies, however, such as those of Indonesia (Todo & Miyamoto, 2006), South Africa (Ewert & Sibulele, 2010) and Taiwan (Chuang & Lin, 1999), it has been found that FDI reduces incentives for domestic enterprises to improve their own R&D.

In the existing literature on Vietnam, few studies have touched upon the issue. Doan (2018) briefly summarizes the experience of some European countries that have welcomed foreign firms in order to boost domestic R&D activity. Khoi, Dung, and Nga (2016) point out that in the specific case of the Japanese company Ajinomoto, investing in R&D activity in Vietnam has led to the company's advance in the green value supply chain, while Kim, Tran, La, and Nguyen (2019) find that R&D plays a crucial role in innovation in Vietnam. Ngo, Nguyen, Doan, and Nguyen (2020) demonstrate the role of R&D collaboration and technology transfer on the likelihood of a firm choosing to engage in R&D. However, this study does not pay particular attention to the impact of FDI on the decision by local firms to engage in R&D, R&D intensity, or the channels through which the effects may occur.

Another significant contribution in this area is Bach (2018) sectoral-level study on the relationship between trade, FDI, R&D and productivity resulting from OECD foreign investment in Vietnamese local industries. This study finds that R&D have boosted sectoral productivity, but most of this activity is carried on by foreign investors. However, Bach's investigation focuses on the impact of R&D on total factor productivity rather than on the R&D behavior of local firms. Although few studies on Vietnam examine the influence of R&D on innovation and productivity, the way in which FDI influences local Vietnamese firms' R&D activity has not been explored so far. This study aims to fill the gap by investigating whether FDI encourages local firms in R&D and innovation activities through horizontal, backward and forward linkages at firm level.

5.3. Methodology

It is clear that not every enterprise engages in R&D activity and firms are self-selected to carry out R&D activity due to their own characteristics and strategies. Because of the uncertainty involved in the results of R&D and the factor of sunk costs in the establishment of R&D labs and equipment, only a few plants decide to invest in this area. This implies that dealing only with R&D firms would lead to a biased estimation result (V Kathuria & Das, 2005; Nagesh & Aggarwal, 2000).

The Heckman selection correction approach (Heckman, 1977a) is widely applied in dealing with problems of selection bias (Anwar & Nguyen, 2011; Dolton & Makepeace, 1986; Heckman, 1977a, 2013; Newman et al., 2016) and with the self-selection that occurs when a plant chooses to spend on R&D (Iwasaki & Tokunaga, 2016; Khachoo & Sharma, 2017; Sasidharan & Kathuria, 2011). Applying the Heckman selection model, the whole process can be visualized in two stages: the decision to carry ou R&D, which is seen as the selection stage, and determining what resources need to be spent on undertaking R&D, as the outcome stage.

The procedure described below involves the estimation of a selection equation and an outcome equation following Heckman (1977a), Heckman (2013), and Sasidharan and Kathuria (2011):

$$DRD_i^{S*} = \beta^{S\prime} X_i^S + \varepsilon_i^S \quad (5.1)$$

$$RD_i^{O*} = \beta^{O\prime} X_i^O + \varepsilon_i^O \quad (5.2)$$

Where DRD_i^S refers to the dependent variable – the decision to spend on R&D of the individual *i* in the selection equation at step one, and RD_i^O is the intensity of R&D outcome at step two. X_i^S and X_i^O are vectors for the control variables in both the selection and outcome equations, respectively. X_i^S and X_i^O may or may not be equal. $\beta^{S\prime}$ and $\beta^{O\prime}$ are parameters; ε_i^S and ε_i^O are the error terms. For the dependent variables, we observe:

$$DRD_i^S = \begin{cases} 0 & if\ DRD_i^S = 0 \\ 1 & otherwise \end{cases} \quad (5.3)$$

$$RD_i^O = \begin{cases} 0 & if\ DRD_i^S = 0 \\ RD_i^O & otherwise \end{cases} \quad (5.4)$$

We assume that the random error terms in equations (5.1) and (5.2) follow a bivariate normal distribution.

$$\begin{bmatrix} \varepsilon^S \\ \varepsilon^O \end{bmatrix} \approx N\left[\binom{0}{0}, \begin{pmatrix} 1 & \rho \\ \rho & \sigma^2 \end{pmatrix}\right] \quad (5.5)$$

Equation 5.4 is the R&D intensity equation. If a firm decides not to undertake any R&D activity, then the R&D intensity is zero. If a firm decides to carry out R&D, then R&D intensity is assumed to be a positive value. The problem of selection bias appears when a model is estimated for only those firms which have a positive value for y_i^O, that is when y_i^S = 1 and if $\rho \neq 0$ and applying OLS will result in an estimation bias (Heckman, 1977a). In such cases, Heckman suggests a two-step estimation to obtain an unbiased estimation. The first step uses a probit model to estimate parameter β^S by the maximum likelihood method. This selection estimation gives an inverse Mill's ratio (λ), which is then added to the outcome equation to obtain consistent estimates using the OLS technique. Following Jeffrey M. Wooldridge (1995)

approach with panel data, the inverse Mills ratio is computed in the first step separately and is then included in the second step to estimate the effect on R&D intensity.

In our case, following Sasidharan and Kathuria (2011), Greene (2003), Khachoo and Sharma (2017), the selection and outcome equation is detailed in Equations (5.6) and (5.7), respectively.

$$DRD_{ijt} = \alpha_0 + \alpha_1 labour_{ijt} + \alpha_2 scale_{ijt} + \alpha_3 capint_{ijt} + \alpha_4 export_{ijt} + \alpha_5 import_{ijt} + \alpha_6 lbpr_{ijt} + \alpha_7 loc_{ijt} + \alpha_8 jointventure_{ijt} + \alpha_9 fdi_{jt} + \alpha_{10} Hfdi_{jt} + \alpha_{11} Bfdi_{jt} + \alpha_{12} Ffdi_{jt} + \alpha_{13} HHI_{jt} + \alpha_{14} rdcol_{ijt} + u_{ijt} \quad (5.6)$$

The outcome is the R&D intensity equation, which takes the number of R&D projects that firms undertake as the dependent variable. The number of R&D projects is zero when a firm decides not to undertake R&D and assumes a positive value when the firm decides to spend on R&D. Thus, the outcome model is as written in Equation (5.7).

$$RD_{ijt} = \beta_0 + \beta_1 labour_{ijt} + \beta_2 scale_{ijt} + \beta_3 capint_{ijt} + \beta_4 export_{ijt} + \beta_5 import_{ijt} + \beta_6 lbpr_{ijt} + \beta_7 loc_{ijt} + \beta_8 jointventure_{ijt} + \beta_9 fdi_{jt} + \beta_{10} Hfdi_{jt} + \beta_{11} Bfdi_{jt} + \beta_{12} Ffdi_{jt} + \beta_{13} HHI_{jt} + u_{ijt} \quad (5.7)$$

where DRD_{ijt} is the R&D dummy of firm *i* in industry *j* at time *t*, = 1 for R&D if a firm is involved in R&D and = 0 otherwise. RD_{ijt} is the number of R&D projects that the firm has invested in.

Our main variables of interest are horizontal, backward and forward linkages. $Hfdi_{jt}$ – horizontal linkages, refers to foreign investment in sector *j* at time *t.* We calculate $Hfdi_{jt}$ as detailed in Equation 5.8 below, based on the studies by Jude (2012a), Fujimori and Sato (2015), and Smarzynska Javorcik (2004).

$$Hfdi(jt) = \sum_{j=1}^{n} FDIsales(jt) / \sum_{j=1}^{N} Sales(jt) \quad (5.8)$$

where *Hfdi(jt)* is the total sales of FDI firms in industry *j* in time *t (FDIsales(jt))* divided by total sales of all firms in industry *j* in time *t (Sales(jt)).*

$Bfdi_{jt}$ represents backward linkages, which is the ratio of total output accounted for by FDI firms in downstream sectors, computed as in Equations (5.9) and (5.10) below.

$$Bfdi_{jt} = \sum_{j \neq k} \delta_{kt} * Hfdi_{kt} \quad (5.9)$$

$$\delta_{kt} = \frac{Y_{k \to j}}{Y_k} \quad (5.10)$$

where $Hfdi_{jt}$ shows the presence of FDI investors in downstream sector *k.* Parameter $\delta(kt)$ is the output of downstream sector *k* supplied to upstream sector *j* divided by the total output of sector *k*, and Y_{kj} is the total output in downstream sector *k* sold to upstream sector *j* while Y_k is the total output of downstream sector *k*.

$Ffdi_{jt}$ refers to vertical forward linkages, which is the ratio of output from upstream sector *h* sold to downstream sector *j* out of the total output of sector *j*, and is measured as detailed in Equations (5.11) and (5.12).

$$Ffdi_{jt} = \sum_{j \neq h} \sigma_{ht} * Hfdi_{ht} \quad (5.11)$$

$$\sigma_{ht} = \frac{Y_{j \to h}}{Y_j} \quad (5.12)$$

where Y_{jh} is the output of sector *h* sold to sector *j*, and Y_j is the total output of sector *j*. Parameters δ and σ are computed from the Input-Output table (IO) in 2012.

The variable *rdcol* (whether a firm collaborates in research with any other firm in carrying out R&D), which is included in the selection (Equation 5.6) but not in the outcome equation (Equation 5.7), acts as an exclusion restriction as a requirement of Heckman selection model. Any collaboration of a firm in undertaking R&D projects can be related to the capacity for learning and networking, which motivates that plant to take part in R&D. Consequently, enterprises that collaborate in doing R&D are more likely to get involved in carrying out R&D activities for themselves. Having a connection with other firms in doing R&D may encourage a firm to get involved into doing so, though it may not affect how intensely a firm may undertake R&D activity. While the expenditure of firm on R&D mainly driven by the internal

resources of firm such as labour capacity or investment for R&D, the collaboration is more about the R&D experience and networking that a firm has in the past. The data also support this assumption when it shows a very weak correlation between R&D collaboration and R&D intensity, which is only about 0.08 while the correlation between R&D collaboration and the decision to invest in R&D is much higher at 0.45.

The remaining variables in Equations (5.6) and (5.7) are control variables, including representation of the firm's specifics and the sector's characteristics. *Labour* is a firm's total number of workers. Large firms with more labour seem to be more interested in R&D and innovative activity because of economies of scale. *Lbpr* represents labour productivity, which is expected to be positively linked with the R&D activity of a firm. The average wage is used as a proxy for labour productivity. *Scale* is the scale of firm, which is the proportion of a firm's gross output out of the sample's average gross output. Sasidharan and Kathuria (2011) suggest that a firm with large-scale activity will have a greater opportunity to benefit from innovation. *Capint* is the capital intensity, which is calculated by the total capital of a firm at the end of the financial year divided by total number of the firm's workers. Firms with more capital are expected to be more likely involved in R&D activity. *Export* is a binary variable that equals 1 if the firm is exporting and 0 otherwise. In general, export-oriented enterprises face competition in international markets, and hence need to produce quality products that are technologically superior, which is possible if they engage in intensive R&D (Braga & Willmore, 1991; Kumar & Saqib, 1996). *Import* is a binary variable that equals 1 if a firm imports materials or machinery from abroad and 0 otherwise. It is argued that many enterprises operate under severe budget constraints (V Kathuria & Das, 2005) and any rise in raw material import costs or quantities may result in a limited budget to invest in R&D, but it can encourage R&D activity if firms import materials and machinery that support R&D activity at the same time. *Loc* refers to a firm's location and equals 1 if a firm is located in an industrial zone and 0 otherwise. Being

in an industrial zone forces enterprises to invest in R&D activity through collaboration and knowledge spillovers (Nagesh & Aggarwal, 2000; Siddharthan, 1992). Variables and *fdi* and *jointventure* are dummy variables, which equal 1 if a firm is a FDI or a joint-venture firm and 0 otherwise. The existing literature has showed that firms with large market shares tend to spend more on R&D activity, so we use the Hirschman-Herfindahl Index (*HHI*) shows market concentration, making it possible to evaluate the effect of competition. Following Newman, Rand, Talbot, et al. (2015) and Le and Pomfret (2011), *HHI* is calculated as

$$HHIjt = \sum(\frac{xijt}{Xjt})^2 \quad (5.13)$$

where $xijt$ is the output of firm i in industry j at time t; Xjt is the total output of industry j.

We pursue our investigation by looking also at the linkages between FDI and the innovation activity of local enterprises. We assume that those variables that affect firm R&D performance also influence firm innovation activity. Furthermore, R&D activity is also associated with an enterprise's innovation, so we take it into account *(RD)* in this model as a binary variable, which equals 1 if a firm is involved in any R&D activity, and 0 otherwise. The model we use in this step includes the dependent variable ($inov_{ijt}$) as a binary variable, where probit estimation is applied to investigate the impact of the regressors on the probability of a firm undertaking any innovation activity.[18]

$$inov_{ijt} = \gamma_0 + \gamma_1 rd_{ijt} + \gamma_2 labour_{ijt} + \gamma_3 lbpr_{ijt} + \gamma_4 scale_{ijt} + \gamma_5 capint_{ijt} + \gamma_6 export_{ijt} + \gamma_7 import_{ijt} + \gamma_8 loc_{ijt} + \gamma_9 Hfdi_{jt} + \gamma_{10} Bfdi_{jt} + \gamma_{11} Ffdi_{jt} + \gamma_{12} HHI_{jt} + u_{ijt} \quad (5.14)$$

5.4. Data description

This study uses a dataset obtained from the Vietnam Enterprise Survey (VES) and the Vietnam Technology and Competitiveness survey (TCS). While the VES has been conducted annually

[18] A description of the variables is provided in the Appendix, Table A5.1

by the General Statistical Office (GSO) since 2001, the TCS is the part of the VES that focuses on technology and innovation, and has been conducted since 2010. The TCS is a collaboration of the Central Institute for Economic Management (CIEM), the GSO and the Development Economics Research Group (DERG) of the Department of Economics (DoE), University of Copenhagen. The VES is an annual nationwide survey that includes every registered firm with more than 50 workers. Enterprises with less than 50 labours are randomly selected, depending on province. In the 2010-2015 period, around 300,000 firms were included, on average, but only about 7,500 enterprises in the manufacturing sector are surveyed in the TCS (~ 3% of the total sample). General information about firms, such as characteristics, production, output, and financial status, are covered in the VES. Meanwhile, the TCS focuses on firm technology development and adoption.

All firms included in the TCS are in the VES dataset, enabling the researcher to examine not only firm performance but also the level of firm technology and innovation. Each firm has its unique identifying tax code, the same in both VES and TCS, allowing us to link these two datasets. A unique ID for each firm is created by combining province code and firm code and then cross-check by tax code. Table 5.1 provides the numbers of firms in these two surveys.

Table 5.1. Number of enterprises over the 2011-15 period

Year	VES			TCS		
	Total	FDI	All other	Total	FDI	All other
2011	330,541	11,940	318,601	8,185	1,483	6,702
2012	359,287	8,610	350,677	8,692	1,493	7,199
2013	381,599	10,004	371,595	8,010	1,439	6,571
2014	415,656	11,179	404,477	8,023	1,469	6,554
2015	455,300	11,925	443,375	5,102	1,387	3,751

Notes: Author's calculation from raw datasets. The FDI firm in this table is a 100% foreign-invested firm (firm code 12 in 2011 and code 11 in 2012-2015). The rest including state-owned, private and joint-venture firms.

The number of domestic firms has increased rapidly over the study period while the number of FDI firms has been much more stable. Whereas firm-level variables for general

information about a firm, such as sales, labour, capital and so on are obtained from VES, TCS provides information on technology and innovation. As been reported by Central Institute for Economic Management of Vietnam (CIEM) (2015), firms in the TCS survey mostly purchase off-the-shelf technology rather than investing in developing new technology by themselves. However, the main suppliers of currently available technology differ among firm types, which we categorize into three groups: domestic firms (state-owned and private firms), FDI firms (100% foreign-invested firms), and joint venture firms (joint venture between state or private with foreign investment). Table 5.2 provides more details.

Table 5.2. Firms' most important technology supplier

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
2011	Domestic firms	15.35	60.98	3.02	3.87	5.84	9.31	1.62
	FDI	13.33	43.81	3.33	3.81	14.29	20.48	0.95
	Joint-venture	2.20	13.09	3.18	5.64	35.32	39.21	1.36
2012	Domestic firms	14.44	62.49	2.75	4.10	6.03	8.86	1.34
	FDI	1.68	13.36	4.70	7.52	37.58	34.77	0.40
	Joint-venture	1.84	22.70	2.45	7.98	27.61	35.58	1.84
2013	Domestic firms	12.87	64.83	3.68	4.07	5.87	8.12	0.56
	FDI	2.30	14.59	3.49	4.05	39.11	35.61	0.84
	Joint-venture	5.70	18.99	3.80	5.06	27.85	36.71	1.90
2014	Domestic firms	11.30	67.65	3.54	4.73	4.94	7.57	0.28
	FDI	2.39	15.29	3.55	4.37	37.06	36.93	0.41
	Joint-venture	3.27	26.14	4.58	4.58	24.18	37.25	0.00
2015	Domestic firms	12.39	63.06	5.32	4.23	5.95	8.71	0.34
	FDI	1.09	14.25	3.98	4.99	34.30	40.59	0.80
	Joint-venture	3.42	28.77	5.48	5.48	17.81	37.67	1.37

Notes: Author's calculation. The percentage of firms reporting their most important technology supplier (firms less than 50% self-developed). There are seven categories: (1). Vietnamese firms – located in Vietnam – in the same industry; (2). Vietnamese firms – located in Vietnam – in a different industry; (3). Foreign firms - located in Vietnam (FDI) - in the same industry; (4). Foreign firms - located in Vietnam (FDI) - in a different industry; (5). Foreign firms located outside Vietnam in the same industry; (6). Foreign firms located outside Vietnam in a different industry and (7). Others.

It is clear that for domestic firms, the most important suppliers of technology are Vietnamese firms from a different industry (the response of ~ 65% of firms on average). The second main technology provider is Vietnamese enterprises in the same industry (~13%).

Meanwhile, local plants are the main technology supplier for only about 3.5% of multinationals in the same industry (horizontal linkages), and about 4% of FDI firms in a different industry (vertical linkages). The opposite is the case for FDI and joint venture firms, which mostly purchase their main technology from foreign firms located outside Vietnam. More than 33% of FDI firms and 25% of joint venture firms report their most important technology supplier is foreign firms in the same industry located outside Vietnam. Approximately 34% of FDI firms and 37% of joint venture firms confirm that their main technology suppliers are foreign firms in a different industry and located outside Vietnam.

The figures indicate that while the technology for domestic enterprises comes from local suppliers, foreign-invested firms source their technology mainly from outside the country. This not only shows a loose connection between local and FDI firms but also reveals that multinationals much prefer their own channels to supply technology, either from their home country or a third country. Unsurprisingly, 98.5% of local enterprises, on average, confirm that the employees responsible for operating the technology the firm uses are nationals, while less than 1%, approximately, of local firms have foreigners operating their technology. Table 5.3 gives firm reports concerning the main technology operators in the company.

Table 5.3. Workers responsible for operating technology

		Foreigners	Nationals	Repatriates
2011	Domestic firms	0.85	98.98	0.17
	FDI	28.52	71.48	0.00
	Joint-venture	34.00	65.94	0.06
2012	Domestic firms	0.80	98.85	0.35
	FDI	35.50	64.30	0.20
	Joint-venture	16.56	83.44	0.00
2013	Domestic firms	0.68	99.01	0.30
	FDI	30.94	68.71	0.35
	Joint-venture	13.21	86.79	0.00
2014	Domestic firms	0.61	99.22	0.17
	FDI	29.95	69.91	0.14
	Joint-venture	10.90	87.18	1.92
2015	Domestic firms	1.19	98.41	0.40
	FDI	28.26	70.94	0.79
	Joint-venture	10.88	88.44	0.68

Notes: Author's calculation. Percentage of firms reporting that foreigners, nationals or repatriates are the main employees responsible for operating and maintaining technology.

The figures show that foreigners are the main technology operators in FDI and joint venture firms. About 69% of FDI firms and 87% of joint venture firms report that the employees mainly responsible for operating the technology are foreigners. A moderate percentage of FDI (~29%) and joint venture firms (~10%) confirm that nationals are their main technology operators. This fact shows that while domestic firms hardly benefit from technology spillovers through labour linkages with multinationals, the possibility remains for labour mobility from foreign to domestic firms at certain points. Since around 30% of FDI firms have Vietnamese employees as their main technology workers, this fact allows for the spillover of technological knowhow.

A glance at how technology is supplied and operated in the domestic and foreign firms mentioned above has so far indicated that there is a loose link between these two with regard to technology. I then dig deeper into the link between local and foreign enterprises in R&D and innovation activity. The variables on innovation and R&D expenditure are selected from TCS. Although the R&D decision (yes or no to undertake R&D activity) is a binary variable that is

available in the TCS, R&D expenditure (how much a firm spends on R&D) is not surveyed in the survey[19]. To act as the dependent variable, therefore, for the second step I use the number of R&D projects (how many R&D projects a firm has) as the proxy for R&D expenditure. I take the number of ongoing and finished projects as indicators of R&D intensity.

Since the dataset contains information concerning a firm's decision to spend on R&D activity and the number of R&D projects the firm is undertaking, this allows for the use of the Heckman selection model, in two steps – investigating the decision to engage in R&D activity and secondly, the intensity of that activity. Since the dataset enables me to use a number of binary variables as a proxy for innovation, I also examine how foreign investment influences a firm's innovation activity. I consider such activity as promoting improvement in the production process, in product quality and variety, and investing in new sectors. As the dataset offers a binary variable as the independent variable, I process it with a probit model on unbalanced panel data. Table 5.4 provides an overview of R&D and innovation activity across firm types during the period.

Table 5.4. R&D and innovation activity in TCS

Year	Total firms	R&D				Innovation			
		Total	Domestic	FDI	Join-venture	Total	Domestic	FDI	Joint-venture
2011	7,746	648	516	110	22	3,520	2,741	698	81
2012	8,038	694	532	139	23	4,138	3,200	846	92
2013	6,860	399	314	72	13	3,785	2,810	891	84
2014	7,416	379	298	68	13	3,931	2,947	903	81
2015	5,064	235	175	52	8	2,739	1,805	853	81
Total	35,124	2,355	1,895	441	19	18,113	13,503	4,191	419

Notes: Author's calculation from the clean dataset. The number of firms reporting undertaking R&D and innovation activity. "R&D" refers to a firm that has invested in an R&D project. "Innovation" refers to a firm that has made improvements in process organization.

[19] The Vietnam Enterprise Survey (VES) includes information on the level of a firm's R&D expenditure, but only a few firms chose to answer the R&D questions and those questions were asked only in three years (2010, 2011 and 2015). The VES does not survey technology and innovation throughout the period.

It is not surprising that relatively few firms invest in R&D, with an average of about 450 firms (~5% of the TCS, ~0.1% of the VES) reporting doing so during the period. Not only Vietnamese but also FDI firms show little interest in undertaking R&D activity. Each year, an average of 88 FDI firms (~6% of FDI firms in TCS dataset, ~0.7% of FDI firms in VES dataset) invest in R&D in Vietnam. While it may be the case that investing in existing technology brings greater benefit to firms than doing primary R&D projects (Basant & Fikkert, 1996), it is also very likely that FDI firms have better resources in their home country for carrying out R&D projects. The TCS dataset (not reported in these tables) indicates that in domestic firms, nationals are the main employees in charge of R&D (98.64%), while foreigners play an insignificant role. Only 1.22% of domestic firms report that foreigners are the main source of expertise for undertaking R&D, and half of them (142 firms) are large firms (>100 employees). Meanwhile, foreigners are chiefly responsible for carrying out R&D (~61%) in FDI and joint venture firms.

Of firms that report participating in innovation activity (~51% of the TCS), about 74.5% are domestic enterprises and 25.5% are FDI and joint venture firms. Innovation activity in TCS includes five categories: (1) Improvement in process organization (e.g., time-saving procedures); (2) improvement in product quality (e.g., better quality of existing products); (3) expansion of product variety (e.g., new products); (4) expanding enterprise activity into a new sector; (5) and switching to a different sector. We take into account all these activities in the regressions. Category 1 (see Table 5.5) is considered to be the main innovation activity a firm undertakes, with 18,113 observations over the period reporting themselves so engaged. Category 2 has 17,356 observations reporting yes over the period, followed by Category 3 with 12,373 observations. Few firms are engaged in either Category 4 (3,756 observations) or Category 5 (989 observations) during the period. Tables 5.5 provides the details.

To calculate the linkages with FDI, I first obtain horizontal linkages from VES that allow me then to obtain backward and forward linkages from the IO2012 table following Equations 8-12. Since information for firm characteristics is available, production and the linkages, we merge that dataset with TCS to gather information on R&D and innovation. Only firms that appear in both datasets with the same ID are eligible to be included, so all firms that exist in VES but not in TCS or vice versa have been removed from the final dataset. The chapter ends up with a panel dataset of 34,364 observations over the period. Table 5.5 reports the data description.

Table 5.5. Data description

Variables	Min	Mean	Max	SD	Yes
Rdproject	1	2.86	125	10.26	
Labour	1	52	8,320	175.04	
Lbprd	0.32	49.18	421.60	163.14	
Scale	0	0.999	181.68	4.358	
Capint	0.5	729.9	153,408	446,756	
Hfdi	0	0.3186	0.9984	0.2504	
Bfdi	0	0.2229	2.0004	0.2967	
Ffdi	0	0.8374	5.4913	0.9829	
Rdcol	0	0.011	1	0.1009	
Loc					8,087
Export					13,032
Import					10,617
Rd					2,355
Inov1					18,113
Inov2					17,356
Inov3					12,373
Inov4					3,756
Inov5					989
Sample size					34,364

Notes: Authors' calculation from the clean dataset. The last seven variables are binary. The number of observations responding "Yes" are reported in the last column.

5.5. Results and analysis

5.5.1. R&D spillover

The paper first examines the linkages between foreign investment and a local enterprise's R&D activity. In this section, the study provides insights based on Heckman selection estimation on an unbalanced panel dataset covering every firm that appears in both VES and TCS datasets. Following the Wooldridge approach, the first step is to estimate the selection equation based on probit estimation and to calculate the inverse Mill's ratio for each year separately. The second step uses the OLS and FE estimation technique to estimate the effect on R&D intensity by including all the inverse Mill's ratios from the first step[20]. The model is estimated on the full sample (Full sample), sub-sample for domestic firms (DF) and sub-sample for FDI firms (FDI). Year dummies to control for country context and sector dummies (at the 2-digit level) to account for industry specifics are included in all models except for the FE estimation.

[20] The Inverse Mills Ratio in the Heckman selection estimation on panel data are estimated separately for each of the years in the first step.

Table 5.6. FDI and a firm's decision on R&D activity – Selection equation

VARIABLES	(1) Full	(2) DF	(3) FDI
Labour	8.76e-05***	0.000141***	2.64e-05
	(1.30e-05)	(1.79e-05)	(2.17e-05)
Lbpr	0.000729***	0.000809***	0.000743
	(0.000175)	(0.000187)	(0.000505)
Scale	0.00334	0.00496**	-0.000522
	(0.00217)	(0.00197)	(0.00931)
Capint	7.05e-07*	6.73e-07*	5.75e-06
	(5.76e-06)	(6.19e-06)	(2.40e-05)
Export	0.209***	0.210***	0.205
	(0.0379)	(0.0402)	(0.144)
Import	0.140***	0.126***	0.200*
	(0.0392)	(0.0427)	(0.106)
Loc	0.114***	0.149***	0.177***
	(0.0262)	(0.0290)	(0.0661)
Hfdi	-0.0301	0.0407	-0.397*
	(0.0719)	(0.0804)	(0.214)
Bfdi	0.0242	0.0379	0.317
	(0.0873)	(0.0939)	(0.364)
Ffdi	0.0347	0.0297	0.0530
	(0.0280)	(0.0291)	(0.119)
HHI	0.355**	0.430**	-0.322
	(0.173)	(0.192)	(0.457)
Jointventure	-0.275***	-0.286***	-
	(0.0454)	(0.0463)	
FDI	-0.341***	-	-
	(0.0357)		
Rdcol	2.048***	2.090***	1.807***
	(0.0763)	(0.0849)	(0.187)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Constant	-1.168***	-1.425***	-0.265
	(0.303)	(0.345)	(0.496)
Observations	34,364	28,562	5,768

*Notes: Marginal effect at mean based on probit estimations. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). The dependent variable rd (yes/no) indicates whether a firm undertakes any R&D activity. Sectors are at the 2-digit level. Model 1 for the full sample, (2) for domestic enterprises and (3) only for FDI firms.*

Table 5.6 reports the selection equation results and Table 5.7 indicates the outcome equation, which gives an overview of the findings. In Table 5.6, column (1) reports the selection equation estimation using the full panel data set. Column (2) is for the sample of domestic firms, and column (3) is for the FDI sample. Table 5.7 reports the effect on R&D intensity obtained from the OLS and FE estimation for the full sample (columns (1) and (2)),

domestic sample (columns (3) and (4)) and FDI sample (columns (5) and (6)) respectively. In the selection equation estimation, firms that have a connection with others in R&D (*rdcol*) are found to be more likely to engage in R&D activity themselves, which secures for the use of this variable as an exclusion restriction.

The results show that *labour* has a significant, positive effect on the decision by local plants to invest in R&D but there is no such evidence for FDI firms (Table 5.6). This suggests that local firms with greater human resources are more likely to be motivated to engage in R&D, but this is not the case with FDI firms that rely on the local labour force for low-skilled physical jobs rather than high skilled jobs related to R&D. However, the outcome equation (Table 5.7) shows no significant impact from labour on the number of R&D projects that domestic firms undertake. Interestingly, there is evidence that having a larger labour force discourages multinationals from engaging in R&D activity in the outcome equation (column 6 in Table 5.7). This could be the case where one of the motivations for foreign firms to invest in an emerging economy such as Vietnam is to take advantage of low-labour costs. This is usually associated with a low-skilled labour force compared with their home country, which is not sufficiently productive for effective R&D activity to occur. We find a positive coefficient on *lbpr* in the selection function (Table 5.6), suggesting that firms with a more skilled labour force are more likely to take part in R&D activity[21] but this is not the case in the outcome equation (Table 5.7). In Table 5.6, capital (*capint*) appears to be positively linked with R&D decisions in the selection model but does not have a significant effect on the number of R&D projects that firms undertake in the outcome model (Table 5.7). Meanwhile, firm scale (*scale*) is found to have a significant impact on domestic firms' decision to invest in R&D and, once the decision is made, a larger gross output producer tends to spend more on R&D. This is

[21] Since I do not have detailed information on the skill level of a firm's employees, I take wages for labour as a proxy for labour quality, as it is recognized that firms pay higher wages for more highly skilled labourers.

especially the case with FDI enterprises, as we find a significant positive association between *scale* and R&D intensity in the second step (Table 5.7).

Export orientation (*export*) in the selection equation (Table 5.6) is found to have a positive effect on the decision to spend on R&D, implying that firms involved in exporting are more motivated to engage in R&D than those which are not. This is consistent with export-oriented firms being willing to improve their productivity in order to compete better in the international market. However, there is no significant evidence from the outcome equation to guarantee that those firms will undertake more R&D projects. A similar phenomenon is also found for the importing firms where *import* has a significant positive impact on the decision to invest in R&D, indicating that firms importing larger quantities of intermediate inputs and machinery are more likely to engage in R&D activity. Similarly, plants located in an industrial zone (*loc*) are found to be more likely to be involved in R&D activity than those located elsewhere. Since industrial zones in Vietnam are designed to provide better infrastructure for technology development compared with other locations, companies in the industrial zones tend to be more interested in undertaking R&D. Table 5.7 provides more detail.

Table 5.7. The effect on R&D intensity – Outcome equation

VARIABLES	(1) OLS-Full	(2) FE-Full	(3) OLS-DF	(4) FE-DF	(5) OLS-FDI	(6) FE-FDI
Labour	1.36e-05	9.16e-05	0.000451	0.000184	-0.000584	-0.000376*
	(0.000253)	(0.000207)	(0.000393)	(0.000352)	(0.000511)	(0.000223)
Lbpr	0.000730	0.00397	1.39e-06	0.00310	-0.000891	0.00690
	(0.00432)	(0.00487)	(0.00468)	(0.00582)	(0.0128)	(0.00881)
Scale	0.106*	0.0998*	0.0510	0.0519	0.523*	0.451***
	(0.0550)	(0.0556)	(0.0545)	(0.0457)	(0.267)	(0.164)
Capint	3.12e-06	-2.29e-05	7.74e-05	3.31e-05	-4.60e-05	-0.000324
	(0.000115)	(0.000122)	(0.000137)	(0.000132)	(0.000275)	(0.000223)
Export	0.0417	-0.311	0.213	-0.194	-1.918	-0.605
	(0.546)	(0.585)	(0.582)	(0.618)	(2.015)	(1.616)
Import	0.845	1.016	0.846	1.099	0.626	0.436
	(0.643)	(0.742)	(0.723)	(0.800)	(0.746)	(0.785)
Loc	-0.00383	-0.279	0.0122	-0.227	1.061	1.029
	(0.389)	(0.615)	(0.515)	(0.712)	(0.773)	(0.862)
Hfdi	0.161	0.941	-0.0650	0.947	-1.258	0.0683
	(1.112)	(1.148)	(1.486)	(1.480)	(1.589)	(1.665)
Bfdi	-0.339	-0.686	-0.282	-0.930	-0.685	-0.628
	(0.947)	(1.182)	(1.108)	(1.419)	(2.163)	(1.582)
Ffdi	0.471*	-0.139	0.644*	0.0199	-0.258	-0.350
	(0.298)	(0.254)	(0.357)	(0.260)	(0.691)	(0.415)
HHI	-0.245	-1.298	0.181	-0.635	-1.217	0.902
	(1.637)	(2.225)	(2.047)	(2.351)	(2.746)	(4.020)
Jointventure	-0.815	-0.334	-0.954	-0.430	-	-
	(0.790)	(0.733)	(0.895)	(0.739)		
FDI	-0.279	-0.303	-	-	-	-
	(0.533)	(0.668)				
$\hat{\lambda}$-2011	0.954	-0.270	1.736***	0.635	-1.114	-4.177
	(0.664)	(0.647)	(0.656)	(0.486)	(2.107)	(2.731)
$\hat{\lambda}$-2012	-0.919	-1.728**	-0.962	-1.809**	-0.0911	0.383
	(0.873)	(0.863)	(0.914)	(0.872)	(1.304)	(0.991)
$\hat{\lambda}$-2013	0.587	-0.354	0.786	-0.393	0.976	0.961*
	(0.559)	(0.412)	(0.709)	(0.495)	(0.807)	(0.538)
$\hat{\lambda}$-2014	-0.929	-2.116	-1.415	-2.748	1.118	0.886
	(1.663)	(1.719)	(1.979)	(2.218)	(1.135)	(0.805)
$\hat{\lambda}$-2015	-0.214	-0.892	-0.256	-0.880	5.955	4.137
	(1.388)	(1.524)	(1.527)	(1.528)	(5.403)	(4.474)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.717	2.649**	-2.896	0.800	1.706	6.575*
	(1.526)	(1.168)	(1.804)	(0.736)	(2.071)	(3.647)
Observations	2,716	2,716	2,322	2,322	394	394
R-squared	0.047		0.046		0.170	

*Notes: OLS and FE estimation on full sample (Column 1 & 2), domestic-firm sample (Columns 3 & 4) and foreign-firm sample (Columns 5 & 6), including Mill-ratio from the selection estimation. The fdi (dummy) variable is included in the estimation on full sample, and is excluded in these two other sub-samples. Robust standard errors in parentheses for FE estimation on samples that contain only firms reported to have R&D activity at the first step, based on 2000 replications for OLS estimations. (*** p<0.01, ** p<0.05, * p<0.1). Year dummies are included in all regressions while sector dummies (at 2-digit level) are included only in OLS regression.*

An interesting story emerges when we take a close look at the impact of FDI on firm R&D activity. In no cases do we find any significant effect through horizontal linkages (*Hfdi*) on the outcome equation (Table 5.7). Only marginally significant negative horizontal linkages in the selection equation for the FDI subsample are found (column 3 in Table 5.6), indicating that the presence of FDI at sector discourages foreign enterprises from investing in R&D in that sector in Vietnam.

It is also found that in all cases, backward linkage (*Bfdi*) has no significant influence in either equation, indicating that FDI in different sectors does not affect the decision to invest in R&D of either domestic or FDI firms through forward linkages. Meanwhile, forward linkages (*Ffdi*) are found to have no significant impact in the selection equation estimation, but a positive association with R&D intensity in domestic firms in the outcome estimation (Table 5.7). According to the result, foreign investment in downstream sectors appears to encourage local enterprises in upstream sectors to undertake more R&D projects. Domestic suppliers may be motivated to improve the quality of the products they sell to foreign customers, requiring them to spend more on initial R&D. However, foreign suppliers in downstream sectors seem to have no interest in carrying out R&D projects in Vietnam as we do not find a significant coefficient from the estimations on the FDI sample.

One possible explanation is that FDI firms prefer to undertake R&D projects overseas or in their home country. This may limit the technology and R&D spillovers due to the loose link with local enterprises. In our sample, only 6% of FDI firms engaged in R&D activity over 5 years (390 out of 6,005 observations). FDI firms in Vietnam are mostly large and technologically advanced compared with their local counterparts, which mainly participate in the manufacturing sector where R&D and innovation are important (Carol et al., 2012; World Bank, 2017e).

In the estimation, using the full sample of data, a dummy variable (*FDI*) that refers to

FDI firms is employed, assigning a value of 1 if firms are 100% foreign-invested and 0 otherwise. The results show that foreign enterprises are unlikely to get involved in R&D activity in Vietnam where we find a significantly negative coefficient in the selection equation (Table 5.6). This might suggest that the Vietnamese labour force and infrastructure are insufficiently skilled and developed for foreign firms to undertake R&D projects there when compared to opportunities in their home country or overseas. With their skilled labour force and well-developed infrastructure at their headquarters, FDI firms may find it less costly and more productive to undertake R&D in their home country (Sasidharan & Kathuria, 2011).

There is also the possibility that FDI firms may invest in Vietnam because of the availability of cheap labour, since they only need a manual labour force to do basic, physical jobs. In that case, they would not really be interested in undertaking R&D activity in Vietnam. Similarly, being a joint venture (*jointventure*) makes it less likely for a plant to engage in any R&D activity (Table 5.6). Since joint venture firms in the survey are either state-owned or private firms that cooperate with foreign enterprises, the results again suggest that plants with any connection abroad are less likely to invest in R&D activity in Vietnam.

5.5.2. Are there spillovers in innovation?

So far in this study, we have found few significant effects on Vietnamese firms' R&D behaviour resulting from foreign investment in Vietnam. We now process our estimation on the same full dataset to examine if FDI has an impact on firm innovation activity. We consider a firm's strategy to improve its performance through innovation, including: (1) Improvement of process organization (e.g., time-saving procedures); (2) Improvement in product quality (e.g., better quality of existing products); (3) Expansion of product variety (e.g., new products); (4) Expanding enterprise activity into a new sector, and; (5) Moving into a new sector. We take each of these activities, respectively, as the dependent variable in the five models presented

below in Table 5.8. As our independent variables are binary variables that belong in one of these five categories, probit estimation is applied at this stage.

Table 5.8. FDI and firm innovation

VARIABLES	(1) inov1	(2) inov2	(3) inov3	(4) inov4	(5) inov5
Rd	0.313***	0.213***	0.389***	0.372***	0.0735
	(0.0272)	(0.0297)	(0.0253)	(0.0285)	(0.0478)
Labour	3.94e-05*	-1.88e-05	-1.22e-05	-9.33e-06	-4.04e-05
	(2.10e-05)	(2.05e-05)	(1.96e-05)	(2.70e-05)	(4.77e-05)
Lbpr	1.47e-06***	1.09e-06***	9.17e-07***	1.78e-07	6.09e-07
	(3.79e-07)	(3.67e-07)	(3.34e-07)	(4.34e-07)	(7.17e-07)
Scale	0.00127	0.00222	0.00431**	0.00401*	-0.00480
	(0.00232)	(0.00245)	(0.00207)	(0.00227)	(0.00466)
Capint	-7.32e-07	-4.13e-06	-4.56e-06	1.30e-05***	1.26e-05***
	(3.66e-06)	(3.75e-06)	(3.73e-06)	(3.72e-06)	(4.56e-06)
Export	0.0636**	-0.0366	0.0853***	0.0121	-0.0720
	(0.0254)	(0.0272)	(0.0249)	(0.0314)	(0.0485)
Loc	0.0753***	0.0295	0.0847***	-0.0159	0.00175
	(0.0187)	(0.0201)	(0.0182)	(0.0231)	(0.0360)
Import	0.0504*	0.0641**	0.0295	0.0227	0.0117
	(0.0271)	(0.0289)	(0.0264)	(0.0336)	(0.0527)
Hfdi	-0.0858*	0.0501	0.0919*	-0.0551	-0.0664
	(0.0512)	(0.0555)	(0.0503)	(0.0630)	(0.0961)
Bfdi	-0.0640	0.00501	0.00562	-0.0452	-0.0564
	(0.0631)	(0.0672)	(0.0620)	(0.0765)	(0.123)
Ffdi	0.0643***	0.0124	-0.0131	-0.0252	-0.0229
	(0.0201)	(0.0214)	(0.0198)	(0.0241)	(0.0389)
HHI	-0.217*	0.299**	0.510***	0.144	0.486**
	(0.125)	(0.136)	(0.126)	(0.150)	(0.224)
FDI	-0.149***	-0.148***	-0.168***	-0.235***	-0.280***
	(0.0242)	(0.0257)	(0.0236)	(0.0308)	(0.0497)
Jointventure	-0.122***	-0.0544	-0.0862***	-0.225***	-0.0994
	(0.0333)	(0.0358)	(0.0327)	(0.0425)	(0.0688)
	(0.241)	(0.230)	(0.231)	(0.313)	(0.365)
Year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
Constant	0.475**	0.190	-0.506**	-1.361***	-1.812***
	(0.236)	(0.224)	(0.226)	(0.306)	(0.353)
Observations	34,364	34,364	34,364	34,364	34,364

*Notes: Probit estimation is applied on binary independent variables. Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).*

In the full sample, a similar story is found for the impact of FDI on local enterprises' innovation. We find that the presence of foreign investment in the same sector has a positive influence on the probability of firms expanding their product variety (Model 3) while it has a negative association with the improvement of process organization (Model 1). The finding indicates that the more FDI there is in a given sector, the more existing firms in that sector are likely to invest in the development of new products. This may be due to the competition brought about in the sector by FDI that encourages firms to expand their business to be able to compete with other FDI firms. In all types of innovation, there is no significant effect from backward linkages.

Forward linkages, meanwhile, influence only improvement in process organization (Model 1) and joint venture firms are not interested in engaging in such innovative activity. FDI firms are less likely than other firms to engage in any innovative activity, and we find *fdi* has a negative sign over all regressions, suggesting that FDI firms are not interested in innovation in Vietnam either. It is possible that FDI firms may turn to their home country or a third country to pursue such initiatives. Another possibility is they have already brought with them the latest technology, which is still close to the technological frontier compared with local firms, still far from that point, and these FDI firms are still operating well without the need of a large investment in innovation. The same story is found in the case of joint-venture firms, which again suggests that Vietnam is not a promising place for R&D if the firm has an option to carry out R&D abroad.

For some firms, we find specific factors that may affect their innovation activity. For example, *labour* is found to be responsible for improvement in process organization (Model 1). Labour productivity (*lbpr*) has a positive effect on most innovation activity and capital also is found to have a positive effect on most such activity, except for Model 4 (expanding firm activity into a new sector) and Model 5 (moving into a different sector). Firms located in an

industrial zone are more likely to be involved in innovative activity. Being an exporter encourages a firm to improve its process organization (Model 1) or expand its product variety (Model 3), while being an importer helps a firm to improve its product quality (Model 2) and also process organization (Model 1). Not surprisingly, firms that undertake R&D activity are likely to be more innovative, as *RD* is found to has a significant positive impact in most cases.

5.6. Concluding remarks

Using Vietnam as a case study, this paper has furthered our understanding of what drives the motivation of firms to engage in R&D and innovation. This motivation includes the influence exerted on R&D and domestic firms' innovation by the presence of foreign investment. A notable finding from this study is that applying Heckman selection modelling to account for selection bias, firm employment, labour productivity, firm's scale, export and import status and location all have a significant effect on the decision to participate in R&D, but not all these factors, except perhaps *scale*, and *labour* for the case of FDI firms only, affect R&D intensity. Furthermore, our results reveal that while the presence of FDI at industry level discourages foreign plants from investing in R&D through horizontal channels, domestic firms' R&D intensity appears to be positively linked with foreign investment through forward linkages. An analysis of innovation activity indicates little effect from the presence of foreign investment on firm-level innovation activity, whereas firm specific employment, wages, output, export and import status are found to have greater effect.

However, data limitations do not allow us to use the total amounts that firms spend on R&D. Instead, we consider the number of R&D projects a firm undertakes. Our results are consistent with the view that foreign-invested enterprises may be more motivated to carry out R&D in their home country or a third country, and this, potentially, is the reason why FDI has little significant influence on firms' R&D and innovation in Vietnam. This is not surprising,

since Vietnam is a developing country with limited resources for R&D and innovation activity, a situation that discourages multinationals from engaging in these activities. This scenario reveals that foreign investment creates limited spillovers, and therefore domestic firms' innovative activity should rely more on local resources.

The findings provide a picture of how R&D and innovation activity undertaken by Vietnamese firms is linked with foreign enterprises, and therefore some significant policy recommendations can be drawn. Although FDI is widely considered to be the main source of R&D and innovation for emerging countries, this is not necessarily the case for Vietnam. The loose linkages between FDI and local enterprises may be one of the reasons for the insignificant spillover. While there is some evidence of spillover through forward linkages, government policy might focus on supporting domestic customers who buy inputs from multinationals to tighten the linkages with their foreign suppliers in order to improve their technological capacity. Meanwhile, domestic suppliers in upstream sectors and local competitors in the same sectors may do better to seek domestic resources in order to raise their technology levels, rather than relying on spillovers from FDI. Furthermore, since FDI appears to have little impact on local firms' investment in innovative activity, changes in government policy should focus on providing more support or creating incentives that can help leverage the domestic sector to speed up their research and development activity. Policy aimed at attracting FDI may also need to be redesigned to encourage FDI to operate in high-tech sectors and invest more in innovative activity in Vietnam.

As location in an industrial zone also encourages local firms to invest more in R&D, more attention needs to be paid to launching new high-tech zones or to redesigning existing industrial zones, allowing more local enterprises to join and enhance their technological capacity. Furthermore, poor infrastructure and an unskilled labour force may be factors discouraging foreign firms from undertaking R&D and innovation activity in Vietnam.

Therefore, government policy may need to concentrate more on improving basic infrastructure and the quality of the local labour force in order not only to pave the way for FDI to invest in R&D but also to promote local enterprises' investment in innovative activity.

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Chapter Appendix

Table A5.1. Variable description

VARIABLES	DESCRIPTION
Rd	Decision to invest in R&D (=1 if a firm has R&D acitivity and 0 otherwise)
lbpr	Labour productivity of firm
Scale	Scale of firm
Capint	Capital intensity of firm
Export	Dummy variable (= 1 if a firm engages in exporting activity and 0 otherwise)
Import	Dummy variable (= 1 if a firm has any importing activity and 0 otherwise)
Loc	Location of firm, dummy variable (=1 if a firm is located in an industrial zone and 0 otherwise
Hfdi	Horizontal linkages
Bfdi	Backward linkages
Ffdi	Forward linkages
HHI	Hirschman-Herfindahl Index
fdi	Dummy variable (= 1 if a firm is a FDI firm and 0 otherwise)
jointventure	Dummy variable (- 1 if a firm is a joint venture firm with foreign investment and 0 otherwise)

CHAPTER 6. DOES FOREIGN INVESTMENT CROWD-IN DOMESTIC INVESTMENT? EVIDENCE FROM VIETNAM

6.1. Introduction

According to the exogenous growth theory, Foreign direct investment (FDI) is regarded as an important source of economic growth, especially in developing countries as it contributes to the capital accumulation of the host country (Mahembe & Odhiambo, 2014). Multinational enterprises that invest in host countries bring with them their capital to invest in advanced technology, management skills, well-known brand names and so on, which in turn may affect the investment behaviour of local firms. One of the key questions in evaluating the role of FDI is whether multinationals crowd-in local investment (where the presence of FDI stimulates more investment from the domestic sector) or crowd-out their local counterparts (displacing the domestic producers or taking away their investment opportunities). FDI, on the one hand, might motivate local investment through competition, technology adoption, and human capital channels, or on the other hand, could discourage domestic investment through competition (B. J. Aitken & Harrison, 1999b; Blomstrom et al., 2000; Iwasaki & Suganuma, 2015; Javorcik, 2002; Kheng, Sun, & Anwar, 2017). If FDI fails to encourage the accumulation of capital or stifles local investment in the host country, then governments need to question the benefits from FDI flows into the economy.

After the launch of "Doi moi" in 1986, the Vietnamese government aims to attract FDI in order to enhance economic productivity and to achieve sustainable growth during the transition. By adjusting certain requirements of the Enterprise Law, the government indirectly provides enterprises with greater incentives that are more beneficial to large firms. While multinationals and state-owned enterprises are large, most domestic private firms are small and medium-sized. However, the Enterprise Law in 2000 along with some updates made it simple for private firms to register and enter areas that earlier were reserved for state-owned firms. It

also emboldened more un-registered firms to become formal. In addition to this, the updated version of the Enterprise Law in 2005 marked another stepping-stone insofar as making no distinction between different ownership categories of firms in the regulatory framework. Essentially, the legal treatment discriminating between state-owned firms, FDI and domestic private firms were removed. This is considered as paving the way for Vietnam's accession to the World Trade Organization (WTO) in 2007. Rights protection and business freedom have also been upgraded with the 2005 Enterprise Law, which removed all licenses and business conditions that were not specified in laws, ordinances, or decrees as of September 1st, 2008. The introduction of the 2014 Enterprise Law has removed all the area of overlap between the 2005 Enterprise Law and the 2005 Investment Law, which allows start-ups to enter the market easier with less paper works needed. The new Law further simplified business licenses, introduced online business registration, and moved regulations on corporate governance closer to international practice. This helps to create a fair competitive environment for domestic private firms and support private start-ups.

FDI enterprises with their advantages in terms of high managerial skills, high levels of technology and larger size, find it much easier than domestic private enterprises (less skilled labour, outdated technology, and small-sized) to take advantages of government incentives. This provides FDI sector with a greater probability of success in both domestic and foreign markets. In fact, the FDI sector contributed to around 70% of Vietnam's exports in 2017 according to Vietnam General Statistics Office (Genreal Statistic Office, 2017), and was found to have a negative impact on local plants' exports within the same sector (Ha, Holmes, & Hassan, 2020), especially in manufacturing industry where it takes an average of around 50% of total FDI inflows into the economy (Anwar & Nguyen, 2011). While FDI plays an important role in Vietnam's exports (Anwar & Nguyen, 2011; Ha, Holmes, & Hassan, 2020), those sectors that are export-oriented may attract more FDI and vice-versa: the sector that has a high

proportion of FDI can become bigger exporter, it probably has a stronger impact on local investment in that sector.

The objectives of this study are to investigate how foreign investment at sector level impact domestic aggregated sectoral private investment, to examine the FDI spillover effects through different channels and to discover if export-oriented sectors benefit more from foreign presence. Since the linkages with FDI through different channels can be captured at 4-digit sector level, a sectoral study is conducted to address the following research questions: (i) Does FDI presence encourage domestic private sectoral investment? (ii) Are there FDI spillover effects through the linkages on the domestic private aggregate sectoral investment? (iii) How other types of investment including state-owned and joint-venture investment affect the domestic private investment? (iv) Are sectors that are more engaged in exporting likely to be more influenced by FDI than those that are not?

The study adds new elements to the existing literature. First, unlike previous studies on developing countries that use country-level data or the limited number of studies on Vietnamese firms' survival using firm-level data, the paper examines the crowding effects on local private investment using a sector-level dataset. Since the Vietnam Enterprise Survey (VES) survey of the chosen period allows us to employ a panel dataset at four-digit sector level, it is in a good position to take the advantage of having a strong balanced dynamic panel dataset for our analysis. Moreover, the paper captures a dynamic relationship between investments and their lag values by using two-step system GMM estimation that can account for potential endogeneity and autocorrelations in the model. This is regarded as more efficient than other GMM estimators and is more robust than OLS, as well as fixed effects and random effects estimation of a dynamic relationship and dataset (Arellano and Bond (1991). Second, our study is among the first studies in Vietnam that investigate the crowding effects by taking into account FDI spillovers that may occur through different channels at 4-digit sector level. This

allows the paper to have a considerable picture of the crowding effect from FDI to domestic private investment among sectors in Vietnam. Third, this study contributes to literature by looking more closely into the effects in export-oriented sectors that have not been examined in the existing literature on Vietnam. While the contribution of FDI in the Vietnamese export appears to increase, it is worth to examine if that benefit the Vietnamese private investment in those sectors in any way.

The rest of the paper is structured as follows: Section 6.2 provides theoretical framework and empirical evidence. Section 6.3 outlines methodology and data used in the study. Section 6.4 presents the results and analysis. Conclusions and policy implementation are discussed in Section 6.5.

6.2. Literature review

6.2.1. Theoretical framework

According to the literature, the linkages between foreign presence and local investment can be positive or negative. B. J. Aitken and Harrison (1999b) and De Backer and Sleuwaegen (2003) claim that FDI can improve local investment through the human capital channel. When FDI occurs and new businesses are established in the host country, the new companies need to employ local workers. Employees, after working for a foreign company and experiencing learning-by-doing, are trained and ready to start up their own businesses. In addition, FDI firms with their higher standards and productivity are able to hire the best workers available in the host country. Working for FDI enterprises improves workers' experiences and skill, so they can earn a higher level of income. This may result in a higher investment level in the host country in the future. FDI may promote local investment in the host country if local enterprises adopt new technologies and machineries introduced by FDI firms and domestic enterprises might need to hire workers from foreign firms to run new technology, then their investment increases.

Domestic workers, who are employed by multinationals, may inspire local plants to invest in technology so they can take part in the foreign firms' production processes, by supplying goods or services to foreign companies (Blomstrom et al., 2000).

FDI, through their advanced technology and through providing infrastructure such as transportation, telecommunications, etc., may generate positive externalities that benefit domestic investment. In developing countries, especially in undeveloped sectors, such positive externalities are helpful to boost domestic investment as domestic sectors may not have their own facilities or it is costly to build up all the necessary things (Agosin & Machado, 2005; Apergis, Katrakilidis, & Tabakis, 2006). In addition, raising the level of competition forces local plants to search for and invest in more effective and modern technologies, or to use their capital and other resources more effectively (Blomström et al., 2001). Javorcik (2004) argues that FDI can increase capital inflows such as portfolio investment or foreign loans, which may help to reduce interest rates in the domestic money market and then increase domestic investment.

However, it is also argued that foreign investment might crowd-out local investment. FDI, which often enters the domestic market with advanced technological and managerial experiences or even tax incentives provided by the host government, may raise risks for domestic enterprises (Noorzoy, 1979). FDI firms may displace local producers or force local plants to reduce their product, then reduce their investment in the future (De Mello, 1999). Domestic investment can be also crowded out because of new and superior technologies brought to the domestic market by FDI where the former, with a lower level of technology, cannot compete with the later and lose their profit, which leads to a reduction in their production and investment (Deok-Ki Kim & Seo, 2003).

Crowding-out effects from FDI on local investment are at their worst if the presence of FDI forces local plants to leave the market. Theory shows how FDI affects the survival of local

firms. FDI enters the domestic market and increases competition, thus forcing local firms out of the market, according to B. J. Aitken and Harrison (1999b), Haddad and Harrison (1993), Blomström and Kokko (1998) and Djankov and Hoekman (2000). Competition in the host country's market increases with the presence of foreign direct investment who have advantages in final good markets and result in lower market prices, which may lead to fewer advantages for local enterprises and force them to give up on the market (Jovanovic, 1982; J. Markusen & Stähler, 2011; J. R. Markusen & Venables, 1999; Navaretti, Venables, & Barry, 2004).

Theoretically, there are two types of FDI effects on local investment: horizontal linkages (competition between enterprises within an industry), and vertical linkages (competition between enterprises across industries). It is argued that for horizontal linkages, FDI enterprises mainly take the place of domestic firms through competition and labour mobility (Blomström & Kokko, 1998). Conversely, through vertical linkages, FDI might encourage local firms to expand their business. Vertical linkages can be upstream or downstream, where domestic enterprises are suppliers or customers of FDI enterprises. Under these conditions, domestic firms have more interactions with FDI enterprises by supplying intermediate products or selling products for FDI firms (J. R. Markusen & Venables, 1999). Therefore, when FDI firms are customers of local suppliers, they might support them with technical and human assistance to ensure that input products from local suppliers are of a high enough standard to meet the FDI firms' requirements. These linkages with local suppliers may lead to forward spillovers, which might increase productivity and reduce prices in domestic firms, giving them more chance to succeed (Blalock & Gertler, 2008).

Overall, crowding-in or crowding-out impacts from FDI on local firms are different from country to country, according to Agosin and Machado (2005). This is because of the differences in the host country's policies, the structure of the host country's economy, the type of FDI inflow, and the character and strength of local enterprises.

6.2.2. Empirical evidence

In a range of studies, scholars have examined whether FDI crowds-out or crowds-in local investment in both developing and developed countries. Most of the work done is about the effects at country level. One of the significant studies includes Agosin and Machado (2005) who are among the first researchers to develop the theoretical model for investment that involves FDI variable and its estimations on panel dataset. They apply one-step Generalized Method of Moments (GMM) on a panel dataset over the period 1971-2000 for 12 countries from some developing regions (Asia, Africa, and Latin America). They find that foreign investment either leaves domestic investment unchanged in some cases, or replaces domestic investment in some other cases. In a more recent study, crowding effects are examined on 46 developing countries (Morrissey & Udomkerdmongkol, 2012, 2016) during the period of 1996-2009 using system GMM estimation. They find evidence to support the crowding-out effect, which means foreign investment discourages their domestic counterpart in the host country. Going beyond Morrissey and Udomkerdmongkol (2012), Farla, De Crombrugghe, and Verspagen (2016) review the study of the former researchers by revising the models and estimation technique, and so argue that the results depend on the estimation method and the exact of the dependent variables. They provide an opposite conclusion insofar as suggesting that foreign investment raises the overall level of domestic investment thereby supporting the case for a crowding-in effect.

Other studies find crowding-in effects at firm level. Jansen (1995) indicates a crowding-in effect from export-oriented FDI on local investment in Thai Lan while Wu, Sun, and Li (2012) and G. S. Chen, Yao, and Malizard (2017) confirm that FDI has a crowding-in effect on local firms in China. There is evidence of the crowding-in effect in India (Rath & Bal, 2014) or Uganda (Ahmed, Ghani, Mohamad, & Derus, 2015) Rath and Bal (2014). The crowding-in

effect is also confirmed in some European countries including Hungary and Czech Republics (Jan Mišun, 2002; Kosova, 2010; Mišun & Tomšík, 2002).

In many other cases, there is evidence that FDI presence leads to a decrease in local investment. Jan Mišun (2002) finds strong evidence that FDI crowded out local investment in Poland from 1990 to 2000 while De Backer and Sleuwaegen (2003) indicate that FDI crowded out local investment in Belgium. FDI is also found to displace local investment in some Latin American countries, but not in Asia and Africa countries from1971-2000, according to Agosin and Machado (2005). For the Czech Republic, Kosova (2010) finds evidence of a crowding-out effect from FDI on local investment in the short term between 1994 and 2001. Mullen (2010), in the case of US manufacturing industries, finds evidence that an increase in outward FDI stocks is associated with a decrease in both domestic capital stock and flows in a particular industry. Pilbeam and Oboleviciute (2012) find that FDI had no negative influence on domestic investment in the new EU12 members in long-term, but for the EU14 old states, the crowding-out effect of FDI on domestic investment was significant. Y. Wang (2013) also concludes that because of the competition brought along with multinationals in the same industry, local firms seemed to have shorter lives and more closures in Canada during the period from 1973 to 1997. G. S. Chen et al. (2017) indicates that wholly foreign-owned enterprises crowded out indigenous enterprises in China for the period of 1994-2014.

Some early studies have focused on crowding effects from FDI on Vietnamese firms, mostly at firm-level. Using the Cox hazard model, Kokko and Thang (2014) provide a general picture of how FDI affects local firm survival in Vietnam between 2001 and 2008. The results show a positive effect of downstream FDI on the survival of local enterprises while upstream FDI is found to reduce the lifespan of domestic private enterprises. Pham (2016) uses firm-level data from the Vietnam Enterprise Survey from 2001 to 2010 to investigate the relationship between FDI and local firms' investment. This study finds opposing empirical evidence. On

one hand, the increase of foreign capital in Vietnam leads to a decrease in local plants' investment at the firm level. On the other hand, at the industry level, there is evidence of crowding-in effects with increases in FDI capital. The results also highlight that domestic firms tend to lose market share to FDI firms when they compete directly, but they tend to be benefit from higher levels of FDI in the industry. T. M. Vu, Yamada, and Otsuki (2017) conclude that foreign-invested firms' survival depends on their type of ownership and nationality. Joint ventures with entities rather than with state-owned enterprises (SOEs) are more likely to exit than the joint venture with SOEs and FDI firms.

Unlike other studies in Vietnam, which mostly pay attention to firms' survival at the firm level or existing literature in developing countries explores the linkage between foreign and domestic investment at country-level, this study examines the linkage at sector level. In our study, in order to take advantages of the spillover effects that occur through different channels captured at sector level, I focus on crowding effects at 4-digit sector level. Applying system GMM estimation on a 6-year balanced panel dataset covering a more recent period, the chapter contributes to fill in the gap about the crowding effects from foreign to domestic private investment in the Vietnamese literature.

6.3. Methodology and Data

6.3.1. Model

The paper examines the crowding effects, if it exists, from foreign direct investment to domestic private investment in Vietnam, where it takes into account all sectors at the 4-digit level across the country. The linkages are investigated by estimating equation (6.1) below

$$DP_{j,t} = \beta_1 FDI_{j,t} + \beta_2 X_{j,t} + \alpha_j + u_{j,t} \quad (6.1)$$

where *DP* refers to total domestic private investment, *FDI* is total foreign direct investment – which is the main variable of interest. *X* is a vector of control variables found in the literature to affect domestic private investment in a dynamic relationship. α_j is the fixed sector effect and u_j is the error term. *j* represents the sector at 4-digit level and *t* denotes time.

The modelling about investment follows the approach of Agosin and Machado (2005), Morrissey and Udomkerdmongkol (2012) and Farla et al. (2016) who look at crowding effects from foreign to local investment in developing countries at country level. In the model proposed by Agosin and Machado (2005), the total investment of an industry is the combination of investment from the domestic sector $(I_{d,t})$ and foreign sector $(I_{f,t})$ as follows:

$$I_t = I_{d,t} + I_{f,t} \quad (6.2)$$

where domestic investment comprises domestic private investment, state-owned investment and joint-venture investment. Thus, at sector level, investment in equation (1) becomes:

$$I_{j,t} = DP_{j,t} + DS_{j,t} + JV_{j,t} + FDI_{j,t} \quad (6.3)$$

where *DS* is domestic state-owned investment and *JV* is joint-venture investment where both are related to domestic private investment. All the investment values here are net investment, excluding depreciation. It is assumed that total sales of a sector is related to total investment of that sector this year due to an expectations effect, and so we include total sales to account for some of the sector's characteristics. Therefore, the vector of control variables ($X_{j,t}$) consists of state-owned investment (*DS*), joint venture investment (*JV*), total sales at sector level (*Totsales*). Year dummy is also included to account for macroeconomics factors such as economic growth, interest rate, expectation, policy changes and so on.

The estimation of equation (6.1) faces a potential problem of endogeneity insofar as explanatory variables being correlated with the error term (Ullah, Akhtar, & Zaefarian, 2018). In our model, the effect of foreign investment on domestic private investment depends on factors such as the economic policy, business environment, type of FDI or the strength of

domestic firms or private sectors and so on. (Agosin & Machado, 2005). Since the relevant data are not always sufficiently available, these factors are not captured directly in our model, which means that they are included as unobservables in the error terms. Potential external instrumental variables, for example the government policy for each sector in Vietnam or sectoral FDI data in other neighbouring countries, are out of reach. Since it is unable to find proper external instrument variables, I draw an instrument from the dataset itself. It is assumed that the unobservables are captured by the lagged value of the dependent variable and lags of the endogenous variables. Therefore, a dynamic panel data with a small-time dimension (T) and large number of groups (N) is built, which in our case, is a (6x397) panel dataset. I then treat the investment variables - *FDI, DS,* and *JV* - as endogenous.

To address the potential issue due to the endogeneity and dynamic relationships between investments and their lags, the paper follows Morrissey and Udomkerdmongkol (2012), Farla et al. (2016), to apply system GMM estimation, which was proposed by Arellano and Bover (1995) and then fully developed by Blundell and Bond (1998). The model consists of level equation (6.4) and difference equation (6.5). This advanced estimation constructs a system of two equations, the original and transformed equation and is a System GMM. The paper employs system GMM estimation, which requires additional moment condition compared with the difference GMM (Arellano & Bond, 1991; Blundell & Bond, 1998) especially in case when the number of instruments is larger. Roodman (2009) argues that as a rule of thumb, the number of instruments should remain below the number of groups (in our case, the number of sectors at 4-digit level, which is 397)[22]. The set of equations is as below

The level equation

$$DP_{j,t} = \gamma DP_{j,t-1} + \beta_1 FDI_{j,t} + \beta_2 X_{j,t} + \alpha_j + u_{j,t} \quad (6.4)$$

[22] Some of the previous studies such as Morrissey, O.,& Udomkerdmongkol, M (2012) and Agosin, M. R, & Machado, R. (2005) do not report the number of instrument in their results and analysis.

The difference equation:

$$DP_{j,t} - DP_{j,t-1} = \gamma\left(DP_{j,t-1} - DP_{j,t-2}\right) + \beta_1(FDI_{j,t} - FDI_{j,t-1}) + \beta_2(X_{j,t} - X_{j,t-1}) + (u_{j,t} - u_{j,t-1}) \quad (6.5)$$

There is potential issue in equation (6.4) and (6.5) is that not only the dependent variables (most notably *FDI*) are potentially endogenous but also the error terms in both equations are correlated with the lagged values of the dependent variable, now become regressors. System GMM estimation therefore requires instrument variables to deal with this problem. As suggested by Arellano and Bover (1995), Roodman (2009) Aggarwal, Demirgüç-Kunt, and Pería (2011), lagged values– of the level of the regressors are used as the instrument variables for the dependent variables in equation (6.4). Similarly, lagged values of the difference in the independent variables are used as the instrument variables for the independent variables in equation (6.5). According to Blundell and Bond (1998), Arellano and Bond (1991) and Roodman (2009), GMM estimation is designed for dynamic panel data. There are a number of assumptions that need to be fulfilled when applying GMM estimation. These include (i) some independent variables may be endogenous, (ii) the nature of the relationship is dynamic, (iii) some other regressors may not be strictly exogenous, and (iv) it is a panel dataset with a small T and large N. Applying GMM estimation provides an effective way to handle the problem of endogeneity and serial correlation in the equations with lagged variables from such dynamic panel data.

Ullah et al. (2018) argue that GMM estimation controls for three main major sources of endogeneity: (i) unobserved heterogeneity, (ii) simultaneity and (iii) dynamic endogeneity. As discussed earlier, the nature of panel data and the dynamic nature of the domestic – foreign investment relationship and other characteristics of our model and data suggest that GMM estimator is a proper approach to offer more efficient and consistent estimates for the coefficients compared with other estimation techniques (Roodman, 2009).

To secure the validity and consistency of GMM estimation, I also apply two specification tests as suggested by Arellano and Bond. These include the Sargan/Hansen test for over-identification and Arellano-Bond test for autocorrelation. According to Roodman (2009), a crucial assumption for the validity of GMM estimation is that the instruments are exogenous. The Sargan/Hansen test is for the joint validity of the instruments, which is expected to fail to reject the null hypothesis that the instruments as a group are exogenous. It is also important to mention that the system GMM estimation is consistent if the idiosyncratic errors are not auto-correlated at second-order for equation 6.5. The Arellano-Bond test is applied to the residuals in order to test for autocorrelation aside from the fixed effects, in which they provide the test for first and second-order autocorrelation (AR1 and AR2, respectively). Failure to reject the null hypothesis for the second-order autocorrelation guides us towards employing GMM estimation (Roodman, 2009).

I then extend our model to account for the FDI spillovers that may occur within and between sectors. As the study examines the influence of FDI on local private investment at sectoral level, it is also worth accounting for the sectoral linkages that FDI has with their local counterpart firms. The linkages are recognized as spillover effects that might impact on the behavior of local investment. These linkages are horizontal, backward and forward. While horizontal linkages capture the linkage between foreign and local plants within sectors, backward linkages show the link between foreign customers and their local input suppliers and forward linkages indicate the link between foreign suppliers and their local customers. Following Newman, Rand, Talbot, et al. (2015), Fujimori and Sato (2015), Javorcik (2004) and Jude (2012b), spillovers are calculated as follows.

$$Hfdi_{jt} = \sum_{j=1}^{n} FIsales_{jt} / \sum_{j=1}^{N} sales_{jt} \qquad (6.6)$$

where $Hfdi_{jt}$ represents the ratio of total sales of the foreign enterprises in sector *j* in time *t* to the total sales of enterprises in sector *j* in time *t*. $FIsales_{jt}$ captures the total sales of foreign

enterprises in sector j; $sales_{jt}$ is total sales of sector j. Therefore, *Hfdi* can refer to market-stealing effect (Aiken and Harrison, 1999), that is: if FDI dominates sales of a particular sector, then FDI appears to steal market share away from local plants and that may crowd-out domestic investment.

Backward and forward linkages are obtained as follows

$$Bfdi_{jt} = \sum_{j \neq k} a_{kt} * Hfdi_{kt} \quad (6.7)$$

where $Bfdi_{jt}$ represents the backward linkages between domestic suppliers in upstream sector j and their foreign buyers in downstream sector k. $a(kt), k \neq j$ is the share of sector j output supplied to sector k.

$$Ffdi_{jt} = \sum_{j \neq h} b_{ht} * Hfdi_{ht} \quad (6.8)$$

$Ffdi_{jt}$ captures the forward linkages between foreign suppliers and their domestic buyers. $b(ht)$ is calculated as the total intermediate goods from sector h to sector j divided by the total output of sector h.

To summarise, the baseline model is adopted from Agosin and Machado (2005) as in equation (6.4). However, the paper takes into account the role of the linkages and sector's total sales to capture FDI spillovers effects and sectoral characteristics. This study satisfies the assumption that the number of instruments is less than the number of groups throughout our estimations. Time dummies are included in the regressions to remove time-related shocks from the error terms. Not only is our main variable of interest, *FDI*, treated as endogenous but also so is *DS* and *JV*. Apart from the main model, this study takes the story further by taking a closer look at sectors that are export-oriented and in manufacturing industry[23].

[23] A description of the variables used in the chapter is provided in the Appendix at the end of the chapter, Table A6.1

6.3.2. Data

After the launch of *Doi moi* – the economic reform process – in 1986, the Vietnamese central economy turned toward introducing elements of market economy with private entrepreneurship. This process has resulted in the liberalization and privatization of both the input and output markets, though the public sector retains considerable market power across many sectors of the economy. Foreign investment was first welcomed in the late 1980s at a very low rate and thereafter started to rise from 1990 and then increase remarkably from 2007 following Vietnam's WTO accession from 2.4 billion USD in 2006 to 6.7 billion USD in 2007 and 14.1 billion USD in 2017 (World Bank, 2017a).

Meanwhile, the development of domestic private firms has not been straightforward where it was slow and cautious in the 1990s and early 2000s. By the end of 2000, there were around 40,000 domestic private firms. These firms only contributed about 10% of GDP. After the introduction of the Enterprise Law in 2001 and the change in the direction of the political viewpoints toward suggesting the important role of the private sector, the number of private enterprises started to increase steeply. The number of private firms surpassed 150,000 and accounted for 27.3% of total output in 2008 (Kokko & Thang, 2014) and has continued to increase rapidly after that. Table 6.1 provides more detail.

Table 6.1. Number of enterprises in Vietnam, 2010-2015

Year	Total Firms	FDI	Domestic	Domestic Private
2010	280,541	8,939	271,602	266,461
2011	330,541	11,940	318,601	312,814
2012	359,287	8,610	350,677	345,712
2013	381,599	10,004	371,595	366,001
2014	415,656	11,179	404,477	398,204
2015	455,300	11,925	443,375	436,767

Source: Author's calculation from VES.

The data used in this research are at 4-digit sector-level. The data for the investment of firms located in Vietnam is available from the Vietnam Enterprise Survey (VES) dataset and are collected by the Vietnam General Statistic Office. This data is a firm-level data that covers every active, registered-firm in all sectors throughout the country. Each firm in the dataset is linked to a sector code indicating which sector that firm belongs to. Sector codes are reported at 5-digit level according to the Vietnam Standard Industrial Classification (VSIC). VSIC is designed to show the sector code at 2-digit level as the first two digits of the entire code, 4-digit level as the first 4 digits of the code and 5-digit level as the official code that shown in the dataset. This mechanism remains consistent across all levels and sectors, which is used by the VES to indicate a firm's classified clusters. This allows us to be able to take into account sectoral-data analysis at 4-digit level[24].

The whole dataset contains consistent 397 sectors, making it a strong balanced panel dataset of 2382 observations over a 6-year period. This paper captures the effect of FDI in terms of the amount of new investment at the four-digit sector level. Net investment in a certain year is calculated by subtracting the capital by the end of the year from the capital by the beginning of that year, where the capital is net capital, excluding the depreciation throughout the year. To construct the dataset, we first group the raw data by sector at 4-digit level using sector's code. From there, we sum up the investment of all the firms in the same sector by firm types to obtain *DP*, *FDI*, *DS* and *JV* investment. Domestic investment includes private, state-owned and joint-venture investment[25]. Total sales (*totsales)* is the sum sales from all the firms (both local plants and multinationals) in the same 4-digit sector. We group the data each year

[24] Details about levels of the sectors can be found in the Vietnamese Standard Industrial Classification.

[25] We are interested in looking at how foreign investment effects domestic private investment, so we only use domestic private firms' investment to calculate the domestic private investment, making up by all the firm's code is 6 to 10 for 2010-2015. State-owned investment is computed by summing up all the investment from firms with firm's code lines from 1 to 5. Joint-venture investment is conducted from investment of all firms that have firm's code 12, 13. Foreign direct investment is 100% foreign direct investment, which is conducted from firms with firm's code is 11.

by sector code to compute this series. This is calculated separately for each year before being merged to construct the final panel dataset. All values are deflated using the Producer Price Index (PPI)[26]. Table 6.2 below is the description of the dataset employed in this study.

Table 6.2. Data description

Variables	Observations	Mean	Std. Dev.	Min	Max
DP	2,382	1,744.1	41,733.7	-233,175.1	1,944,226
DS	2,382	649.4	9,731.9	-97,603.04	300,760
FDI	2,382	454.2	15,045.1	-103,500.1	680,499.9
JV	2,382	312.1	4,371.1	-8,733.063	192,561.9
Totsales	2,382	27,122.1	72,335.8	0	1,132,468
Hfdi	2,382	0.241	0.266	0	0.998
Bfdi	2,382	0.262	0.355	0	1.62
Ffdi	2,382	0.415	1.058	0	8.047

Notes: Authors' calculation from VES for the investment variables. Investment values are in billion dongs

Horizontal linkages are obtained from the VES dataset following equation (6.6). To calculate the linkages with the presence of foreign investment at sector level, we link the sector's code in the VES dataset with the Input-Output (IO) table. Since IO2012 was constructed in the same study period as this paper, the paper uses the Leontief matrix from IO2012 table to calculate backward and forward linkages. Backward linkage indicates the links of the downstream customers with their suppliers in the upstream sectors. *a* in equation (6.7) is calculated from the indexes by column in the Leontief matrix that then allows us to obtain backward linkages. Forward linkage represents the links between customers in the upstream sectors who buy products from their downstream sellers. *b* in equation (6.8) is computed from the indexes by rows in the Leontief matrix[27] which then available to proceed that equation to compute forward linkages. More information about correlations between the variables is provided in table 6.3 below.

[26] PPI data can be found online at CEIC's website. Year 2010 is the base year, 2010 = 100.
[27] More information about backward and forward linkages' calculation from the IO table can be found at GSO's website

Table 6.3. Correlation table

	DP	*DS*	*FDI*	*JV*	*Totsales*	*Hlinkages*	*Blinkages*	*Flinkages*
DP	1							
DS	0.156	1						
FDI	0.1222	0.1656	1					
JV	0.1526	0.4712	0.1709	1				
Totsales	0.0556	0.3224	0.3402	0.1631	1			
Hfdi	0.0007	0.0013	0.0006	0.002	0.0076	1		
Bfdi	-0.0125	-0.0083	-0.0038	0.0813	0.0429	0.0158	1	
Ffdi	0.0018	0.0093	-0.0057	0.0676	0.054	0.0061	0.3714	1

Source: Authors' calculation from VES

6.4. Results and analysis

6.4.1. Crowding effects on domestic private aggregate investment

Following Roodman (2009), a basic OLS analysis is conducted to provide an initial glance of the effect of foreign investment on local private investment. The paper also applies fixed-effects (FE), random effect (RE) and instrumental variable (IV) estimations, where there are consistent results across the estimations. The results are reported in columns (1), (2) and (3) respectively in Table 6.4[28]. The study finds positive effects from FDI investment on domestic private investment at sector level across the models. Meanwhile, the linkages appear to have no significant impact on domestic private investment in OLS, FE, RE and IV estimations.

[28] Estimation that includes interest rate as a control variable was conducted initially and the result showed no significant impact of interest rate on investment. The author then decided to exclude the interest rate from the model.

Table 6.4. The impact of FDI on domestic private investment: Initial regressions

Dependent variable: Present domestic private investment (DP) at sector level in billion dongs (VND)

VARIABLES	(1) OLS	(2) FE	(3) RE	(4) IV
$DP_{(t-1)}$	0.000738	-0.00574	0.000738	-1.352***
	(0.00501)	(0.00607)	(0.00501)	(0.210)
DS	0.365***	0.425***	0.365***	0.415***
	(0.0436)	(0.0493)	(0.0436)	(0.0618)
FDI	0.149***	0.167***	0.149***	0.115**
	(0.0214)	(0.0274)	(0.0214)	(0.0579)
JV	2.238***	2.665***	2.238***	5.268***
	(0.119)	(0.155)	(0.119)	(0.416)
Totsales	-0.00451	-0.0285**	-0.00451	0.00394
	(0.00320)	(0.0123)	(0.00320)	(0.00915)
Hfdi	-0.148	-0.182	-0.148	-0.034
	(0.1718)	(0.3784)	(0.1718)	(0.1997)
Bfdi	-0.1704	0.1401	-0.1704	-0.2382
	(0.1436)	(0.6570)	(0.1436)	(0.1869)
Ffdi	0.0128	0.6332	0.0128	-0.0028
	(0.0541)	(0.7076)	(0.0541)	(0.0662)
Year dummies	Yes	Yes	Yes	No
Constant	566.8	-892.4	566.8	643.9
	(551.5)	(1,366)	(551.5)	(411.0)
Observations	2,382	2,382	2,382	1,588
R-squared	0.320	0.294		0.611
Number of groups		397	397	

*Notes: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). In the IV estimation, $DP_{(t-1)}$ is used as the instrumental variable. There are 2,382 observations in the initial sample. There is a loss of observations in the IV estimation due to the use of lag value. Coefficients on Hlikages, Blinkages and Flinkages are rescaled by taking the initial coefficients time the ratio of the means of the linkages (Hlikages, Blinkages and Flinkages) out of the mean of the dependent variable (DP)*

FE estimation can potentially control for unobservable heterogeneity, which is constant over time (Ullah et al., 2018). However, FE estimation is conducted under the assumption of strict exogeneity, which means the independent variables have no correlations with the error terms and are not affected by any changes in the past or present domestic investment (dependent variable) (Ullah et al., 2018). This assumption does not hold in our model where we have the current values of both the dependent and independent variables that are potentially

correlated with their past and future values. Furthermore, FE is more appropriate for a static panel data set, which does not allow for lags of the dependent variable. In our case, we have a dynamic model with lag values of our variables included in it that makes FE, RE estimations inappropriate.

The employment of IV estimation is also considered, where the results are reported in column (4) of Table 6.3. Due to limitations in selecting a potential external instrumental variable, the paper employs the first lag of the dependent variable under 2SLS, following Roodman (2009). However, 2SLS is efficient under homoscedasticity, but after differencing, the different error terms could face serial correlated problems (Roodman, 2009). With a dynamic relationship presents in our model, 2SLS does not seem to be an appropriate approach.

The study then proceeds the model with GMM estimation. Since system GMM can be regarded as more robust and efficient under conditions of heteroscedasticity and autocorrelation (Roodman, 2009) compared with Difference GMM, we choose to apply System GMM estimation using the one- and two-step procedures. Table 6.5 reports the results[29].

[29]To avoid overidentification, estimation of the model proceeds with the inclusion of the instrument lagged two years (Roodman, 2009). The Hansen test for the validity of the instrument in the model is satisfied.

Table 6.5. Baseline - GMM estimations

Dependent variable: Present domestic private investment (DP) at sector level in billion VND

VARIABLES	(1) One-step	(2) Two-step
$DP_{(t-1)}$	0.487***	0.472***
	(0.124)	(0.114)
DS	0.210	0.0440
	(0.140)	(0.160)
$DS_{(t-1)}$	-0.966***	-0.569**
	(0.211)	(0.224)
$DS_{(t-2)}$	-0.200	-0.199*
	(0.189)	(0.111)
FDI	0.360***	0.388***
	(0.0620)	(0.0631)
$FDI_{(t-1)}$	0.346***	0.358***
	(0.102)	(0.0920)
$FDI_{(t-2)}$	-0.0243	-0.0905**
	(0.0828)	(0.0424)
JV	7.565***	1.805
	(2.079)	(2.931)
$JV_{(t-1)}$	-1.888***	-1.658***
	(0.626)	(0.469)
$JV_{(t-2)}$	0.144	0.0452
	(0.262)	(0.117)
Totsales	0.0224***	0.0168***
	(0.00836)	(0.00555)
Year dummy	Yes	Yes
Constant	-16,989***	5,486***
	(2,034)	(1,220)
Observations	1,588	1,588
Number of groups	397	397
Number of instruments	29	29
AR1	0.000	0.009
AR2	0.000	0.650
Sargan	0.000	0.000
Hansen	-	0.111
Difference in Hansen	0.000	0.142

*Notes: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). One-step system GMM estimation is model (1) and two-step is model (2). P-values are reported for the Arellano-Bond test for second-order autocorrelation AR(2) confirms there is no second-order serial correlation in the models in two-step system GMM estimation. The number of instruments (30) is less than number of groups (397) in all regressions. P-values are reported for Sargan and Hansen test confirm the validity of the instruments*

Our estimates meet the requirement for the validity of the GMM approach where the number of instruments remains below the number of groups in all the regressions. The

instrument proliferation does not over fit the endogenous variables. The p-value for the Hansen test indicates no over-identification among the instruments. The results also indicate the absence of first and second order autocorrelation of the residuals. The p-value attached to the Arellano-Bond test for second order autocorrelation (AR2) confirms the null hypothesis no second order serial correlation. Year dummies are included in all the regressions to capture the macroeconomics effects. As the two-step GMM regression approach is regarded as more efficient compared with a one-step approach (Roodman, 2009), the following discussion is mainly focused accordingly. First lag of domestic private investment is significant reinforcing the presence of a dynamic relationship and the appropriate use of GMM estimation.

The overall results indicate a significant crowding-in effect from our main variable of interest, FDI at the sector level. The study finds a significant positive effect on the current FDI and first lag of FDI and light negative impact from third lag of FDI. The results suggest that at the 4-digit sector level, one billion VND invested by foreign firms this year leads to an increase of 0.388 billion VND in domestic private investment in the same sector in the same year and one billion VND FDI increased last year results in 0.358 billion VND increase in the domestic private investment this year. There may also be externality effects as one of the most popular methods used by provincial governments in Vietnam to attract more FDI is to improve infrastructure such as transportation, logistics and telecommunications that creates positive externalities for both foreign and domestic sectors (World Bank, 2017c). While the coefficient on the third lag of foreign investment is negative (-0.095), the net effect is still positive.

This confirms that FDI has had a significant positive impact on local investment in Vietnam at 4-digit sector level during the 2010-2015 period. The Vietnamese economy has experienced a sharp increase in the FDI inflow in the period. It is recognized that while foreign-invested private firms and state-owned firms have preferential access to land and to credit, as well as to government procurement, domestic private firms do not enjoy these benefits (World

Bank, 2017c). This leads to an unbalanced environment for domestic firms to engage in fair competition in both the input and output markets. Thus, the increase in foreign investment in the same sector last year may encourage domestic private firms to invest more this year in order to compete with the multinationals. Surprisingly, it is showing that negative competition effects may outweigh any positive impacts from FDI on local investment in a couple of years, that leads domestic private counterparts to invest less in the present. However, the net effects over the years are still positive, indicating that the presence of FDI encourages local investment.

In general, evidence in support of a complimentary effect from the presence of foreign investment on local investment is found in this study. It is not surprising that foreign-invested firms have more advantages over local enterprises, where the latter are relatively smaller and less competitive. Instead, foreign direct investment flows into an industry with high, advanced technology, better management, and strategies, larger size in terms of capital and labour, etc. This raises competition within that industry and other industries as well that forces domestic sector to invest more to be more competitive.

The Vietnamese Government has made considerable efforts to enhance the business and investment climate in the economy, for example by improving infrastructure and issuing favorable laws and regulations that emphasize the role of private and foreign sector in the economy. Those remarkable changes, on one hand, help to boost investment in the whole economy, but on the other hand, they leave a larger gap for foreign firms to take the advantages. Less productive domestic private sector can take the positive externalities, but also need to invest more to be able to compete with multinationals. As FDI is found to be associated with labour productivity of Vietnamese domestic firms (Van Ha et al., 2019), other possibility to explain for the crowding effect is through the labour channel. The calculation from VES shows that the monthly average wage in foreign firms in Vietnam during the 2010-2015 period was about 4,500,000 VND (~ 205 US dollars) while it was only about 2,980,000 VND (~135 US

dollars) in local private firms, indicating that FDI firms pay higher wage than their domestic counterparts. As discussed in the earlier theoretical section, this may positively affect the average wage of the economy as a whole. Therefore, an increase in FDI inflow may associate with an increase in the labour wage that then requires local firms to spend more on their inputs that result in an increase in their investment.

Other types of investment are also found to have a significant effect on local private investment. The paper finds evidence to support a negative impact from the second lag of joint-venture investment to current domestic private investment. This is explainable since joint venture firms are a mix of domestic and foreign investors where the local ones may have considerable understanding and information about the local market and economy, which make them strong competitors of the local private firms. Meanwhile, state-owned enterprises, which are generally large and secured by the government, seem to have a negative impact on local private investment. State-owned firms are seen as big monopoly or semi-monopoly enterprises, which are financed and secured by government, seem to have more advantages over domestic private firms. As they share the same market, if state-owned firms have the projects to increase their investment, then there would be less investing opportunities left for private investment. Sector's total sales is also found to have significant positive effects on the local private investment indicating that the better a sector perform with its sales, the more motivation it creates for the local investors on increase their investment.

Overall, evidence is found to support that the presence of FDI encourages the domestic sectoral private investment. The finding is in line with existing studies in developing countries where crowding-in effects are found (G. S. Chen et al., 2017; Farla et al., 2016; Rath & Bal, 2014), but in contrast to a range of other studies of developing countries (Agosin & Machado, 2005; Ahmed et al., 2015; G. S. Chen et al., 2017; Morrissey & Udomkerdmongkol, 2012) and developed countries (Kosova, 2010; Mišun & Tomšík, 2002; Pilbeam & Oboleviciute, 2012)

that find strong evidence of a crowding-out effect. Our findings are consistent with Pham (2016), who finds a crowding-in effect at firm level but somewhat opposite to the results from the Vietnamese literature conducted by Kokko and Thang (2014), which reports that foreign firms seem to raise the hazard for domestic private enterprises to have a long lifespan.

6.4.2. FDI spillover effects

The extended estimations of this study provide a closer look at the linkages that local investors have with their foreign peers within and between industries. The paper finds a consistent evidence of FDI crowding-in effect on domestic private investment in all the regressions. Interestingly, horizontal spillover *(Hlinkages)* appears to have significant negative indirect impacts on the domestic private investment. This means that the presence of FDI in the same sector may drive the demand away from their domestic counterparts that force them to invest les. However, if we combine the impacts from the FDI investment and horizontal spillover that occurs in the same sector considering the market-stealing effect, there is an overall a crowding-in effect from FDI on local private investment. While no significant backward spillovers *(Blinkages)* are found, forward channel *(Flinkages)* generates strong positive spillovers on the domestic investment. Since forward spillover occurs when local firms in downstream sectors buy inputs/material from the foreign suppliers in the upstream sectors, this process may lead to an increase in the domestic investment in downstream sectors. Table 6.6 provides more detail.

Table 6.6. FDI spillover effects.

VARIABLES	(1) One-step	(2) Two-step
$DP_{(t-1)}$	0.365***	0.342***
	(0.0949)	(0.0553)
DS	0.518***	0.222*
	(0.0978)	(0.132)
$DS_{(t-1)}$	-0.618***	-0.0650
	(0.161)	(0.159)
$DS_{(t-2)}$	0.0956	-0.0775
	(0.135)	(0.0649)
FDI	0.311***	0.307***
	(0.0448)	(0.0476)
$FDI_{(t-1)}$	0.193**	0.252***
	(0.0776)	(0.0457)
$FDI_{(t-2)}$	-0.165**	-0.192***
	(0.0640)	(0.0317)
JV	9.289***	-0.782
	(1.309)	(2.258)
$JV_{(t-1)}$	-1.539***	-0.976***
	(0.414)	(0.231)
$JV_{(t-2)}$	-0.155	-0.184***
	(0.176)	(0.0677)
Totsales	0.0274**	0.0242**
	(0.00611)	(0.00382)
Hfdi	-0.3006	-0.2841*
	(0.4274)	(0.1455)
Bfdi	0.3134	0.0367
	(0.5469)	(0.1638)
Ffdi	-0.0736	0.2095**
	(0.2146)	(0.0960)
Year dummy	Yes	Yes
Constant	1,121	-831.5
	(1,132)	(534.9)
Observations	1,588	1,588
Number of groups	397	397
Number of instruments	54	54
AR1	0.000	0.045
AR2	0.000	0.682
Sargan	0.000	0.000
Hansen	-	0.330
Difference in Hansen	0.000	0.335

*Notes: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). One-step system GMM estimation is model (1) and two-step is model (2). P-values are reported for the Arellano-Bond test for second-order autocorrelation AR(2) confirms there is no second-order serial correlation in the models. The number of instruments (54) is less than number of groups (397) in all regressions. P-values are reported for Sargan and Hansen test confirm the validity of the instruments.*

As a crowding-in effect has been found from FDI, several extended estimations are conducted to look at the crowding effect in the sectors that are largely linked with the presence of foreign investment through different channels. Dummy variables represent large-FDI-linked sectors and included into our models. *Hlarge* shows the sectors that their total sales through are dominated by FDI, which equals 1 if a sector has more than 50% (*Hfdi* > 0.5) of its sales accounted by foreign firms and 0 otherwise. There are around 12% of the sample are large-horizontal linked with FDI. Similarly, *Blarge* is a dummy variable representing sectors that have large link with FDI through backward channel (*Bfdi* > 0.5) and *Flarge* represents large link through forward linkages (*Ffdi* > 0.5). Approximately 13% of the sectors in the sample that are high-linked with FDI through backward and around 15% are large-FDI-forward-linked sectors[30]. Table 6.7 presents the results.

[30] Sectors that are highest-linked with FDI though different channels are listed in the thesis's appendix on pages 210-212.

Table 6.7. The impacts on the larger FDI-linked sectors

Variables	(1)	(2)	(3)
$DP_{(t-1)}$	0.324***	0.356***	0.290***
	(0.0501)	(0.0552)	(0.0575)
DS	0.228**	0.305***	0.299**
	(0.112)	(0.110)	(0.133)
$DS_{(t-1)}$	-0.104	-0.166	-0.145
	(0.141)	(0.140)	(0.162)
$DS_{(t-2)}$	-0.0652	-0.0537	-0.0209
	(0.0566)	(0.0576)	(0.0775)
FDI	0.309***	0.293***	0.279***
	(0.0394)	(0.0392)	(0.0440)
$FDI_{(t-1)}$	0.264***	0.264***	0.305***
	(0.0381)	(0.0394)	(0.0471)
$FDI_{(t-2)}$	-0.184***	-0.194***	-0.171***
	(0.0302)	(0.0294)	(0.0328)
JV	-0.389	0.0247	-0.684
	(2.085)	(2.158)	(2.477)
$JV_{(t-1)}$	-1.000***	-0.974***	-1.013***
	(0.200)	(0.210)	(0.274)
$JV_{(t-2)}$	-0.182***	-0.228***	-0.209**
	(0.0594)	(0.0581)	(0.0953)
Totsales	0.0247**	0.0246**	0.0276**
	(0.00358)	(0.00363)	(0.00449)
Hfdi	-0.2535*	-0.3324**	-0.4246**
	(0.1477)	(0.1438)	(0.1662)
Bfdi	-0.0763	0.3498	0.1895
	(0.1574)	(0.3252)	(0.2996)
Ffdi	0.2069**	0.2015**	0.9980***
	(0.0915)	(0.0987)	(0.2796)
Hlarge	0.0089	-	-
	(0.0081)		
Blarge	-	-0.2394	-
		(0.2894)	
Flarge	-	-	2.9879***
			(0.9617)
Year dummy	Yes	Yes	Yes
Constant	-867.2*	1,115***	-379.3
	(467.1)	(397.8)	(516.1)
Observations	1,588	1,588	1,588
Number of groups	397	397	397
Number of instruments	54	54	54
AR1	0.042	0.037	0.026
AR2	0.663	0.651	0.696
Sargan	0.000	0.000	0.000
Hansen	0.398	0.329	0.494
Difference in Hansen	0.206	0.275	0.292

*Notes: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Two-step system GMM estimation is applied in all regressions. Model (1) includes a dummy variable representing sectors that have strong links with FDI presence through horizontal linkages (Hlinkage > 0.5). Model (2) includes a dummy variable representing sectors that have strong link with FDI presence through backward linkages (Blinkage > 0.5). Model (3) includes a dummy variable representing sectors that have strong link with FDI presence through forward linkages (Flinkage > 0.5). P-values are reported for the Arellano-Bond test for second-order autocorrelation AR(2) confirms there is no second-order serial correlation across the models. The number of instruments (54) is less than number of groups (397) in all regressions. P-values are reported for Sargan and Hansen test confirm the validity of the instruments. Year dummies are included.*

There is consistent evidence found confirming FDI have crowding-in effects on local private investment in all the estimations in both Table 6.6 and Table 6.7. There are positive significant coefficients on *FDI* and its first lag and, positive coefficients on *Ffdi* and negative on *Hfdi*, which is consistent with other regressions in the study. Sectors that have large links with FDI through horizontal and backward linkages are found to be less influenced by FDI. However, sectors that are heavy-linked with FDI through forward linkage appear to be more likely to invest more than other sectors. Local plants in the downstream sectors need to increase in their investment if they buy inputs, machine or production processes from the FDI providers as the costs for those things are commonly higher than local suppliers. That, in turn, results in a rise of aggregate investment at the sector level for the downstream sectors who have strong link with the FDI suppliers in upstream sectors.

6.4.3. Are export-oriented sectors more influenced from FDI?

FDI may impact on domestic investment differently due to the characteristics, market-orientation and development level of the sector under consideration (Ipek & Kizilgöl, 2015). Ipek and Kizilgöl (2015) argue that FDI may lead to crowding-in effects on domestic export-oriented sectors through advanced technology, managerial skills, marketing techniques and opportunities to expand into international markets while S.-C. Chang (2005) confirms that it is a causal relationship. Vietnam has applied consistent policies towards developing an export-oriented economy. According to World Bank (2017c), Vietnam has become one of the most open economies in the world with nearly 180% of trade-to-GDP ratios. While Vietnam's export performance has demonstrated increased export competitiveness with an annual growth rate of 9.8% during the 2006-14 period, the presence of FDI plays a key role in the process as it contribute roughly 70% of the total exports from Vietnam (World Bank, 2017c). In an earlier study, FDI is found to have significant effects on the exporting behavior of Vietnamese firms (Ha et al. 2020).

In order to test whether or not domestic private investment in export-oriented sectors gain more from the presence of FDI, we take a closer look at this. I create dummy variables capturing exports (*exp*), with a value of 1 if that sector is export-oriented and 0 otherwise and *expH, expB, expF* indicate the interactions between export and horizontal linkages, backward linkages and forward linkages respectively. According to Ministry of Industry and Trade (MOIT), an export-driven sector is a sector that has export volume equals or above USD100 million per year. The information on which sector has potential to be an export-driven sector – which is pointed by the government- is adopted from MOIT (Ministry of Industry and Trade, 2019) . According to the report, there are around 50 sectors at 4-digit level are export-oriented sectors. I apply the same GMM technique where we include the interactions between the dummy variables and FDI as additional explanatory variables. The results are reported in Table 6.8. Based on the type of multiplicative dummy variable that is included, a range of potential benefits from FDI is considered. Column (1) and (2) potentially show what difference being an export-oriented sector can make.

Table 6.8. Impact of FDI on domestic investment in exporting and manufacturing sectors

Variables	(1)	(2)
$DP_{(t-1)}$	0.261***	0.332***
	(0.0534)	(0.0453)
DS	0.183*	0.277***
	(0.111)	(0.0828)
$DS_{(t-1)}$	-0.0773	-0.304**
	(0.137)	(0.118)
$DS_{(t-2)}$	-0.0700	-0.0935**
	(0.0579)	(0.0406)
FDI	0.318***	0.348***
	(0.0439)	(0.0262)
$FDI_{(t-1)}$	0.286***	0.276***
	(0.0477)	(0.0298)
$FDI_{(t-2)}$	-0.157***	-0.132***
	(0.0296)	(0.0262)
JV	-0.643	2.773**
	(2.110)	(1.371)
$JV_{(t-1)}$	-1.046***	-0.998***
	(0.268)	(0.146)
$JV_{(t-2)}$	-0.126*	-0.123***
	(0.0721)	(0.0440)
Totsales	0.0278**	-0.0374***
	(0.00600)	(0.00414)
Hfdi	-0.29449	-0.398**
	(0.17885)	(0.169)
Bfdi	-0.48450	-1.525**
	(0.55425)	(0.371)
Ffdi	0.25249*	0.549***
	(0.14922)	(0.173)
Exportdum	443.7	-
	(5,782)	
ExpH	-	0.907
		(0.569)
ExpB	-	1.205***
		(0.423)
ExpF	-	-0.777***
		(0.269)
Year dummy	Yes	Yes
Constant	-189.9	1,029**
	(646.2)	(508.3)
Observations	1,588	1,588
Number of groups	397	397
Number of instruments	54	66
AR1	0.049	0.020
AR2	0.676	0.397
Sargan	0.000	0.000
Hansen	0.288	0.175
Difference in Hansen	0.278	0.487

*Notes: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Two-step system GMM estimation is applied in all regressions. Model (1) includes a dummy variable representing sectors that are export oriented. Model (2) includes a dummy variable representing the interactions between export and the linkages. P-values are reported for the Arellano-Bond test for second-order autocorrelation AR(2) confirms there is no second-order serial correlation across the models. The number of instruments (54) is less than number of groups (397) in all regressions. P-values are reported for Sargan and Hansen test confirm the validity of the instruments.*

Significant positive coefficients on FDI are found in all the regressions, confirming that FDI has crowding-in effect on local private investment. The results also show the same story on the linkages. While being an export-oriented or manufacturing sector itself does not make any difference in their investment behavior (*exp* in column 1), if that sector also has linkages with FDI through backward linkages, it appears to invest more than other sectors (*expF* in column 2). There is no such effect occur if export-oriented sectors have linkage with FDI through horizontal channel and negative effect occur for export-oriented sectors though forward linkages. This reveals that FDI in downstream sectors generate more investment spillover only on export-oriented sectors who are their suppliers in the upstream sectors. The domestic investment in those sectors may be benefit from the projects/contracts with their FDI customers that encourage them to invest more. Domestic investment in the sectors that are export-oriented and in with the presence of FDI in that sector do not benefit more from FDI because the international market share in that sector is dominated by the foreign firms.

6.5. Conclusions

This paper investigates the crowding effects of FDI on domestic private investment at the sector level in Vietnam. Two-step system GMM estimation is applied on several dynamic balanced panel datasets and all the regressions are valid with the test for no second order autocorrelation (AR2) and the validity of instrument (Sargan/Hansen test). Overall, the study finds that FDI crowds-in domestic private investment, implying investment by the former increases that of the later in the same sector in general. More specifically, an increase of foreign investment in a sector last year and this year leads to more investment made by local private firms in present in that sector. A negative impact from joint-venture investment and state-owned investment on domestic private investment is also confirmed. Moreover, the paper does find evidence of the FDI spillover effects that passes on to local investment through the forward linkages, which means domestic private investment in the downstream sectors appears to be motivated by

having FDI suppliers in upstream sectors. The results from the extended estimations also support the view that domestic investment in export-oriented benefit more from FDI than domestic firms in other sectors. Being in an export-oriented sector does not encourage local private firms to increase their annual investment. However, an export-oriented sector that has strong link with FDI through vertical linkages appears to be more likely to invest more than other sectors.

Bearing in mind the general concerns about the effectiveness of FDI on the host economy, the results suggest that attracting FDI inflow is an effective way to boost investment by domestic firms at the sector level. Future government policy should therefore still focus on the priority of attracting more foreign investment into the economy whether it is direct or joint-venture investment. Strengthening the linkages with FDI through vertical channel also help to boost domestic investment, especially in the export-oriented sectors. However, there is still a need to encourage and support the domestic sector by investing effectively in order to compete better with foreign investment who operates in the same sectors. Moreover, policies toward attracting FDI inflows also need to focus on the area where FDI can not only create a positive influence on domestic investment, but also can enhance the linkages and transfer technology, human capital qualities in order to boost domestic private investment.

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Chapter Appendix

Table A6.1. Variables descript

VARIABLES	DESCRIPTION
DP	Domestic private investment
DS	Domestic state-owned investment
FDI	Foreign direct investment
JV	Joint-venture investment
Totalsales	Total sales of a sector
Hfdi	Horizontal linkages
Bfdi	Backward linkages
Ffdi	Forward linkages

CHAPTER 7: CONCLUSIONS

The purpose of this chapter is to offer a general conclusion, including policy recommendations that follow the key findings, and suggest potential avenues for future research. In summary, this thesis has provided a picture of FDI spillovers on Vietnamese enterprises during the 2010-2015 period. Although there are unsolved problems due to data limitations, the thesis contributes new insights to the field, which have not been discovered before in the existing literature concerning Vietnam. The chapter also discusses avenues for future research on the issue, taking into account major changes in the way the world's economy works.

7.1. Main findings

Foreign investment is regarded as an important source of supplemental capital in the total capital of the economy in a developing country and contributes to the economy as a whole. Meanwhile, the impact of foreign investment on domestic firm performance remains controversial, depending on host country policy and economic environment. This thesis has provided empirical evidence on the linkage between foreign presence and domestic firms in Vietnam. Four main aspects have been taken into account: the effects of FDI on local firm productivity, exports, R&D activity, and investment. This thesis has endeavoured to point out that investigation is needed, as FDI does not always benefit local enterprises, so that policy for attracting and monitoring FDI in Vietnam may need to be adjusted.

It is important to note that host countries expect FDI not only to contribute to economic growth directly, but also to encourage local enterprises to boost their productivity and performance. Therefore, it is important to examine whether local firms gain from the presence of foreign investment. The motivation for this thesis originated from the idea that the Vietnamese economy is becoming more dependent on the FDI sector, while its domestic

counterpart is not growing as fast as it should, compared with FDI. To build a foundation for sustainable economic growth in the long term, domestic enterprises should be the main contributors to GDP and employment. Consequently, having a positive influence from FDI may be considered a fast, effective way to strengthen the domestic sector. However, the influence of the presence of foreign investment on local plants is not always positive. This thesis provides a picture of how FDI affects domestic enterprises in the same sectors (horizontal linkages), in upstream sectors (backward linkages), and in downstream sectors (forward linkages). The thesis has put forward significant evidence of the impact from foreign investment on the domestic sector in Vietnam, and has made a number of contributions to existing literature in the field.

With regard to the key research contribution, the first paper conducts empirical research on the way FDI affects local manufacturing enterprise productivity through horizontal and vertical linkages. Total factor productivity is used as the yardstick for firm productivity, which is estimated from the production function using the Wooldridge GMM approach over the whole manufacturing sector. The results for the linkages between FDI and local firm productivity show a negative impact within the industry through the horizontal channel, while there is a strong backward influence on domestic firms in upstream sectors. Forward linkages from FDI to a local customer in the downstream sector do not appear to promote accompanying increases in productivity. Further examination of local firm ownership shows that private firms receive significant contributions from FDI, while state-owned firms appear to gain little or nothing from FDI. Meanwhile, there are similarities in terms of the impacts from FDI among technology groups, as no significant effects are attested through horizontal linkages, nor are there positive effects through backward linkages. Regional factors make a small difference insofar as firms in the Central Region benefit a little more from spillovers compared with firms in other locations.

The second paper investigates how foreign presence affects domestic firm export activity in the manufacturing and service sectors. The empirical strategy of this study focuses on FDI spillover to the export decisions and intensity of local firms by applying the Heckman selection model on a panel dataset. The estimates reveal that investment by foreign firms has a significant positive effect on domestic firms' decision to export in the same and in upstream sectors. The proportion of exports from domestic firms declines through horizontal and forward linkages, but increases through backward linkages in the manufacturing sector. However, there is only weak evidence in support of export spillovers on domestic firms in the service sector. There is evidence that the presence of foreign firms has differing effects on the export activities of low- versus high-tech firms in the manufacturing sector, since low-tech manufacturing firms appear to be more influenced by the presence of foreign investment than their counterparts in the high-tech group.

The third paper provides an examination of FDI spillovers on local firms' R&D and innovation. An estimation approach that controls for selection bias is applied to a panel dataset in the manufacturing sector to discover how the presence of FDI influences a domestic firm's decisions, including how much to invest in R&D. The presence of foreign direct investment is found to have little significant impact on the decision process. Indeed, this occurs only through the forward channel. Also, there are no significant FDI spillovers confirmed for R&D intensity. Furthermore, foreign or joint venture firms are found to be less inclined to undertake R&D activity in Vietnam. Similarly, foreign investment presence has a loose association with the innovation activity of domestic firms, and foreign-invested enterprises are less likely to invest in any innovative activities. The results suggest that foreign-invested or joint venture firms are less interested in carrying out R&D and innovation activities in Vietnam.

While the previous three papers investigate the linkages between FDI and domestic firm activities at firm level, the final paper deals with the question whether foreign investment

affects local enterprises at industry level. Using System Generalized Method of Moments estimation on a strong balanced dataset over the 2007-2015 period, the results suggest that foreign direct investment positively motivates domestic private investment in the same sector in both the short and long term. This indicates that sectors that see more FDI investment appear to invest more overall. Joint-venture investment involving foreign and domestic firms has a generally positive impact on domestic private investment. In contrast, no significant effect is found from investment in state-owned companies. Domestic private investment in export-oriented manufacturing sectors does appear to respond positively to the presence of foreign investment, which means that sectors that export more are also more influenced by the presence of foreign investment in those sectors.

7.2. Policy recommendations

Over the last 30 years, the Vietnamese government has considered FDI as an important driver for the economic growth as it is a crucial source for the total capital accumulation. Therefore, the policies focus on attracting FDI have been established to attract more FDI into the country. The government promulgates investment policies to encourage domestic investment and also to attract FDI inflows. However, the FDI investment policies in the past period mainly focused on attracting the FDI by giving tax or land use incentives and less requirement on the technology transfer or knowledge infusion from FDI to the domestic sector, which may need to be taken into consideration of the policymakers for the periods ahead.

This thesis has demonstrated the positive effect from backward spillovers dominating the impact of FDI on local enterprises. This result indicates that increased foreign investment leads to opportunities for domestic enterprises to improve their productivity and export behaviour. Additionally, this situation reveals that Vietnamese enterprises provide inputs for

FDI enterprises and so can benefit from this process. However, despite the positive effect of the supply of inputs and goods to FDI enterprises, domestic enterprises are small in scale, lack capital, and are characterised by out-of-date technology. Evidently, these firms have not taken full advantage of their connection with FDI enterprises to boost their performance. To take advantage of the positive results of cooperation with FDI enterprises, Vietnamese enterprises should invest, improve their management skills, technological product lines and their production processes. This in turn will help them meet international standards and participate in the global supply chain.

In contrast, the absence in most cases of any significant positive consequences from downward linkages reflects a loose connection between local and foreign firms, where domestic enterprises may rarely buy the intermediate goods of FDI enterprises. It is important to note that the price of input materials supplied by FDI enterprises is higher than that of domestic providers, since the former are not compatible with the standard used by domestic firms (generally speaking, the domestic standard lags behind what multinationals have to offer). This may be the reason why forward linkages are found to encourage local firms to invest in R&D activity.

Interestingly, FDI appears to have negative horizontal spillovers on productivity, but a positive influence on the export activity of local businesses. This indicates that the competition brought by foreign investment creates more pressure on local firms which can lead to significant effects. FDI enterprises may have created new products of good quality and with trendy designs, which better meet the needs of the domestic market and rapidly increase their share in the international market. This result drives demand away from local firms and forces them to reduce their production. In exports, due to increasing competitive pressure from the products of FDI enterprises, domestic exporters need to adopt new equipment and technology to improve their productivity and, therefore, expand their exports. Foreign-invested firms are

found to be less interested in carrying out R&D and innovation activity in Vietnam, which may be explained by the smaller quantity of resources for such activities that Vietnam has to offer compared with these firms' home countries.

This thesis has shown so far how FDI affects local enterprises and some of the possible reasons for it. There are several significant policy recommendations that can be drawn from these findings that involve supplementing existing policy in Vietnam by attracting selected FDI inflow and so boosting the domestic sector in the long term. First, since one of the expectations of the country in seeking FDI is to support local enterprises indirectly, the thesis has shown that the results do not always meet expectations. In some cases, there is empirical evidence of negative spillovers passed on to local firms from foreign investment. What we can learn from this can be construed as follows: (i) The development of the domestic sector should not depend on the FDI sector too much, and (ii) attracting FDI into the economy may need to be re-oriented in cases where the indirect effect from FDI support of the local sector is the priority. For example, attracting more FDI in the same industry with the expectation of boosting exports by local firms will not work, as we see the presence of FDI in the same sector negatively affects local exporters.

Second, as the forward linkages are confirmed to have positive spillovers, it is important to keep promoting and supporting local suppliers. To strengthen these suppliers, therefore, more attention needs to be paid to supporting industries. Attracting investment in these industries may serve to improve their capacity to supply existing customers and expand their activities to the international market. Once local suppliers can produce inputs that meet international requirements, it is easier to join the global value chain that in turn will help local plants keep up with the latest technology and stay strong in the long term. Furthermore, as we observe that competition may have a positive influence on local firm productivity, it is worth

pointing out that attracting foreign investment in supporting industries may motivate local enterprises to improve their productivity.

Third, since foreign-invested firms are found to have very little influence in encouraging local enterprises to invest in R&D (only on R&D decisions through forward linkages), it appears that attracting FDI to help the domestic sector gain technology improvements through R&D and innovation is not working. Foreign firms appear to have no interest in undertaking R&D or innovation in Vietnam, since they assume that they have better resources in their home countries. Therefore, the policy for attracting FDI to develop R&D in Vietnam's economy may need to be re-designed to encourage high-tech projects from overseas. This may require an adjustment in relevant legal documents (Law on Science and Technology, Law on Technology Transfer) that can pave the way for foreign investors to invest in high-tech projects that are suitable for Vietnamese conditions. The government should consider creating incentives or motivation that favour the introduction of high-tech projects into the economy. In the meantime, domestic sectors may also need to be oriented and supported to invest more in R&D and innovation from other sources (not only from FDI).

Fourth, from this study, we can see that location of firm (being in an industrial zone) does matter to the firm's activities and is one of the attractive factors to both domestic and foreign investment. Vietnamese government has been paying attention on the establishment of industrial zones since the late 1990s and these zones has become a main driver for economic growth of the country. With the aim to become an industrialized economy in the 2030s, more established industrial zones would be a leverage not only to attract more FDI inflow, but also to boost local firms' performance.

Finally, at some points the thesis has shown that the linkages between foreign firms and their local counterparts are loose (mostly seen through vertical linkages), which may result in less significant FDI spillovers. Strengthening the linkages cannot be achieved by the domestic

sector alone. Effort is also needed from the government and the FDI sector. If FDI enterprises remain disconnected from local firms and only take advantage of low labour costs, there will be no connection between the two sectors and no positive spillovers will occur. Meanwhile, domestic firms need to improve their productivity so they can cooperate with FDI firms. The government should not only focus on attracting more FDI projects but also on classifying and prioritizing projects that include local suppliers.

7.3. Avenues for future research

Based on the discussion so far, potential future research could focus on how government policy can promote the domestic sector. Some sectors benefit from foreign investment but others may not. Further research evaluating thoroughly those sectors that could be enhanced by either domestic or foreign investment or both may lead to insights useful to policymakers seeking effective ways to strengthen the domestic sector.

Clearly, the role of FDI in the Vietnamese economy is crucial, so the government continues to focus on attracting more foreign investment into the economy. Since the key relationship between foreign investment and domestic firms may change over time, improved data availability for researchers will provide the opportunity for future research. Moreover, as more data about FDI and links with local enterprises become available in the future, there will be additional avenues for future studies to provide a complete picture of the total contribution of FDI to the economy and the domestic sector. This thesis has endeavoured to make the best use of data available at the time in order to carry out research on links with foreign investment at industry level. If more detailed information becomes available identifying firms that have a connection with FDI through horizontal, backward and forward linkages, then future research may uncover an interesting narrative about a firm's direct linkages with FDI, rather than only through linkages at the 4-digit industry level.

Data concerning firm R&D constitute a specific limitation. The Technology and Competitiveness Survey was the best survey about technology and innovation at firm level available at the time this research was conducted. However, future surveys are expected to provide a section more focused on R&D and covering a larger range of firms. If those surveys had been available, Chapter 5 on spillovers and R&D would have been able to offer a broader overview of the issue.

In the thesis, furthermore, R&D intensity is measured by the number of R&D projects that a firm carries out each year, and this constitutes another limitation. If data become available in the future about how much a firm spends on R&D each year, the estimations could be more accurate. Similarly, in Chapter 3, using the Wooldridge GMM approach, the lag of investment is used as an instrument to estimate the production function of local enterprises. This is not always considered to be the best instrumental variable and there are other potential instruments, such as the volume of material, intermediate inputs and the use of energy. However, it was not possible to take any of these variables into consideration because they were not available through the survey over all the years studied. Future surveys and wider data availability may address this difficulty.

If the data become available, a promising avenue of research could be developed from this thesis that looks more closely at the influence of foreign investment on local enterprise by country of origin. Recently, Vietnam has experienced a large increase in the amount of FDI inflows from Korea, China, Japan, Singapore and other countries with differing business cultures and different ways of operating. An important question to answer will be whether foreign firms from these countries affect local enterprises differently. It will also be important to examine whether these foreign firms can help develop domestic supporting sectors in Vietnam, given that backward linkages appear to be the most effective channel for spillovers.

This undertaking would of course require an intense survey focusing on FDI firms and their link with supporting industry in Vietnam.

Finally, further investigation is greatly needed over the next few years, as changes are expected in the ways foreign direct investment will behave, due to the tremendous effects that Covid-19 has had on the global economy. The world saw a rapid drop in FDI inflow in 2020 when most countries were battling the Covid-19 crisis, and FDI may behave differently when the world goes back to normal (or establishes a new normal) again. Thankfully, Vietnam has done well in coping with the pandemic so far, which has not only helped keep the economy going but also is attractive to multinationals who want to operate in an emerging, populous, politically stable economy and who seek to diversify their investment.

Other events, such as trade and investment agreements between the EU and Vietnam signed in 2020, are also expected to boost FDI from the EU to Vietnam. Furthermore, the trade war between the USA and China has driven investment out of China to South East Asian countries, including Vietnam, and this also has supported FDI inflows into the country. These remarkable changes may have a significant effect on the direction of FDI inflows and the ways multinationals operate overseas, resulting in other ways FDI can influence domestic investment and local enterprises that it will be very important to examine further.

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Thesis Appendix

Table A1. Some large-FDI-linked sectors through horizontal linkages

	4-digit sector code	Sector's name
1	0610	Extraction of crude petroleum
2	1050	Manufacture of dairy products
3	1074	Manufacture of macaroni, noodles, couscous and similar farinaceous products
4	1075	Manufacture of prepared meals and dishes
5	1079	Manufacture of other food products not yet counted
6	1420	Manufacture of articles of fur
7	1511	Tanning and dressing of leather; dressing and dyeing of fur
8	1512	Manufacture of luggage, handbags, saddlery and harness
9	1520	Manufacture of footwear
10	2022	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
11	2023	Manufacture of soap and detergents, cleaning and polishing preparations
12	2029	Manufacture of other chemical products not yet counted
13	2030	Manufacture of man-made fibres
14	2610	Manufacture of electronic components
15	2620	Manufacture of computers and peripheral equipment
16	2630	Manufacture of communication equipment
17	2640	Manufacture of consumer electronics
18	2651	Manufacture of measuring, testing, navigating and control equipment
19	2652	Manufacture of watches and clocks
20	2660	Manufacture of irradiation, electromedical and electrotherapeutic equipment
21	2670	Manufacture of optical instruments and equipment
22	2680	Manufacture of magnetic and optical media
23	2720	Manufacture of batteries and accumulators
24	2740	Manufacture of electric lighting equipment
25	2920	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
26	2930	Manufacture of parts and accessories for motor vehicles
27	3091	Manufacture of motorcycles
28	3211	Manufacture of jewellery and related articles
29	3212	Manufacture of bijouterie and related articles
30	3220	Manufacture of musical instruments
31	3230	Manufacture of sports goods
32	3240	Manufacture of games and toys
33	3250	Manufacture of medical and dental instruments and supplies, shape- adjusted and ability recovery apparatus
34	6511	Life insurance
35	6512	Non-life insurance

Notes: 4-digit-level sectors that are large-linked with the presence of FDI. In those sectors, total sales of FDI firms account for more than 85% total sales of the sector.

Table A2. Some large-FDI-linked sectors through backward linkages

	4-digit sector code	Sector's name
1	0610	Extraction of crude petroleum
2	1010	Processing and preserving of meat
3	1321	Manufacture of knitted and crocheted fabrics
4	1322	Manufacture of made-up textile articles, except apparel
5	1323	Manufacture of carpets and rugs
6	1324	Manufacture of cordage, rope, twine and netting
7	1329	Manufacture of other textiles not yet classified
8	1410	Manufacture of wearing apparel, except fur apparel
9	1430	Manufacture of knitted and crocheted apparel
10	1520	Manufacture of footwear
11	1811	Printing
12	1812	Service activities related to printing
13	1820	Reproduction of recorded media
14	2022	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
15	2023	Manufacture of soap and detergents, cleaning and polishing preparations
16	2029	Manufacture of other chemical products not yet classified
17	2030	Manufacture of man-made fibres
18	2220	Manufacture of plastics products
19	2630	Manufacture of communication equipment
20	2640	Manufacture of consumer electronics
21	2710	Manufacture of electric motor, generators, transformers and electricity distribution and control apparatus
22	2731	Manufacture of fibre optic cables
23	2732	Manufacture of other electronic and electric wires and cables
24	2733	Manufacture of wiring devices
25	2740	Manufacture of electric lighting equipment
26	2750	Manufacture of domestic appliances
27	2790	Manufacture of other electrical equipment
28	2910	Manufacture of motor vehicles
29	2920	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
30	2930	Manufacture of parts and accessories for motor vehicles
31	3211	Manufacture of jewellery and related articles
32	3212	Manufacture of bijouterie and related articles
33	3220	Manufacture of musical instruments
34	3230	Manufacture of sports goods
35	3240	Manufacture of games and toys

Notes: 5% of the sample that are largest-linked with the presence of FDI through backward linkages.

Table A3. Some large-FDI-linked sectors through forward linkages

	4-digit sector code	Sector's name
1	0610	Extraction of crude petroleum
2	1311	Preparation and spinning of textile fibres
3	1312	Weaving of textiles
4	1313	Finishing of textiles
5	1701	Manufacture of pulp, paper and paperboard
6	1702	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
7	1709	Manufacture of other articles of paper and paperboard not yet classified
8	2011	Manufacture of basic chemicals
9	2013	Manufacture of plastics and synthetic rubber in primary forms
10	2022	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
11	2023	Manufacture of soap and detergents, cleaning and polishing preparations
12	2029	Manufacture of other chemical products not yet classified
13	2030	Manufacture of man-made fibres
14	2220	Manufacture of plastics products
15	2410	Manufacture of basic iron and steel
16	2420	Manufacture of basic precious and other non- ferrous metals
17	2431	Casting of iron and steel
18	2432	Casting of non-ferrous metals
19	2511	Manufacture of structural metal products
20	2512	Manufacture of tanks, reservoirs and containers of metal
21	2513	Manufacture of steam generators, except central heating hot water boilers
22	2591	Forging, pressing, stamping and roll-forming of metal; powder metallurgy
23	2592	Machining; treatment and coating of metals
24	2593	Manufacture of cutlery, hand tools and general hardware
25	2599	Manufacture of other fabricated metal product not yet classified
26	2610	Manufacture of electronic components
27	2620	Manufacture of computers and peripheral equipment
28	2821	Manufacture of agricultural and forestry machinery
29	2822	Manufacture of metal-forming machinery and machine tools
30	2824	Manufacture of machinery for mining, quarrying and construction
31	2825	Manufacture of machinery for food, beverage and tobacco processing
32	2826	Manufacture of machinery for textile, apparel and leather production
33	2829	Manufacture of other special-purpose machinery

Notes: 5% of the sample that are largest-linked with the presence of FDI through forward linkages.

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Chapter 3: Ha, Van., Holmes, Mark. J., & Hassan, Gazi. Productivity spillover from foreign investment on domestic firms: Evidence from a developing country. The paper has been submitted to *Journal of the Asian Pacific Economy*

Nature of contribution by PhD candidate	Conceptualizing the study, designing the empirical methodology, collecting, cleaning and analyzing data, writing of the initial draft, finalizing and submitting the paper.
Extent of contribution by PhD candidate (%)	70

CO-AUTHORS

Name	Nature of Contribution
Mark J Holmes	Guidance, critical feedback on the study structure, methodology and result interpretation, edits and corrections on the drafts, advice on targeted journals.
Gazi Hassan	Feedback on the initial results, advice on targeted journals.

Certification by Co-Authors

The undersigned hereby certify that:

- the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and

Name	Signature	Date
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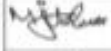
Mark J Holmes		14/08/2020
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Nature of contribution by PhD candidate	Conceptualizing the study, designing the empirical methodology, collecting, cleaning and analyzing data, writing of the initial draft, finalizing the paper.
Extent of contribution by PhD candidate (%)	70

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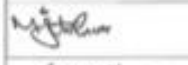
Name	Nature of Contribution
Mark J Holmes	Guidance, critical feedback on the study structure, methodology and result interpretation; edits and corrections on the drafts; advice on targeted journal and paper resubmission.
Gazi Hassan	Feedback on the initial results, advice on targeted journal and paper resubmission.

Certification by Co-Authors

The undersigned hereby certify that:

- the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and

Name	Signature	Date
Van Ha		12/08/2020
Mark J Holmes		14/08/2020
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Nature of contribution by PhD candidate	Conceptualizing the study, designing the empirical methodology, collecting, cleaning and analyzing data, writing of the initial draft, finalizing the paper.
Extent of contribution by PhD candidate (%)	70

CO-AUTHORS

Name	Nature of Contribution
Mark J Holmes	Guidance, critical feedback on the study structure, methodology and result interpretation; edits and corrections on the drafts; advice on targeted journals.
Gazi Hassan	Feedback on the initial results.

Certification by Co-Authors

The undersigned hereby certify that:

- the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and

Name	Signature	Date
Van Ha		12/08/2020
Mark J Holmes		14/08/2020
Gazi Hassan		14/08/2020

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Chapter 6: Ha, Van., Holmes, Mark. J., & Hassan, Gazi. Does foreign presence crowd-in or crowd-out domestic investment? Paper has been submitted to *Economic Change and Restructuring*.

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