Liberalisation Reforms and Manufacturing Productivity in a Transition Economy: The Vietnamese Experience

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Declaration

I declare that this thesis, submitted for the degree of Doctor of Philosophy of the Australian National University, is wholly my own work, except where acknowledgement of other sources has been made to the best of my knowledge. This thesis has not been submitted for qualifications at any other academic institution.

Hai Thanh Nguyen

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Abstract

This thesis examines the impacts of economic liberalisation reforms on manufacturing productivity in a transitional setting, using the unpublished returns to the Vietnamese Enterprise Surveys (VES) from 2006 to 2017. The liberalisation reforms under consideration encompass trade liberalisation, foreign direct investment (FDI) policies, and ownership policy reforms, which have the potential to enhance productivity at the establishment level.

Following the introductory chapter that spells out the purpose and scope of the study, Chapter 2 provides an overview of liberalisation reforms and the manufacturing sector's performance in the reform era. The chapter shows that reforms have brought about significant structural changes in the manufacturing industry: export-oriented industries have emerged as the primary source of manufacturing dynamism, with the private sector, particularly, the foreign-invested sector playing an increasingly important role.

Chapter 3 analyses the trends and patterns of total factor productivity (TFP), with emphasis on the role of changes in the ownership structure. The generalised method of moments proposed by Ackerberg, Caves, and Frazer (2015) is used to estimate firm-level TFP. The results of the comparative analysis show a significant increase in TFP, with fully owned foreign firms (FOFs) exhibiting the highest productivity growth and the state-owned enterprises (SOEs) and their joint ventures with foreign firms (JV-SOEs) recording the lowest productivity growth. Private domestic enterprises (PDEs) closely followed the productivity patterns of FOFs and their joint ventures with foreign firms (JV-PDEs).

Motivated by the results of Chapter 3, Chapter 4 examines whether ownership reforms have contributed to improving manufacturing productivity. The analysis yields three key findings. First, the productivity of FOFs is higher than that of JV-PDEs, supporting the hypothesis that

relaxing ownership restrictions on FDI has helped improve manufacturing productivity. Second, both SOEs and JV-SOEs are at the bottom of the productivity ranking by ownership structures, implying that partial divestiture of SOEs through forming joint ventures is not immune to various productivity-retarding factors affecting SOEs. Finally, JV-PDEs perform better than JV-SOEs, suggesting that the choice between the state and private entrepreneurs as joint-venture partners is important in determining the productivity of joint venture firms.

Chapter 5 examines the spillover effects of the presence of foreign-invested enterprises (FIEs) on the productivity of domestic firms. The analysis sheds light on three different channels of productivity spillover by constructing horizontal, backward, and forward productivity spillover variables. A non-competitive input-output (IO) table is used along with the VES to construct the productivity spillover variables. The results indicate that backward and forward linkages with FIEs increase productivity for local firms, with FIEs belonging to different ownership structures having different productivity spillover effects. There is also evidence that local firms operating within global production networks benefit more from the presence of FIEs than those involved in the horizontal specialisation.

In constructing the variables of interest in the previous chapter – the productivity spillover variables – we need to compute the intersectoral linkages using the non-competitive IO table. However, for most countries, including Vietnam, only competitive type IO tables, which lump together domestically produced and imported inputs in a single interindustry IO matrix, are available. As a supplement chapter, Chapter 6 discusses the procedure to transform the competitive into the non-competitive type and finds considerable divergences in intersectoral linkages using two types of IO tables. Chapter 6 suggests the need to use the non-competitive IO tables in measuring intersectoral linkages in countries highly dependent on imports, like Vietnam.

The final chapter summarises the key findings of the thesis and provides the policy implications for Vietnam for achieving long-term productivity growth. The chapter ends with suggestions for several important areas for future research.

Notes on Publications

Several conference papers and publications have been produced from the content of this thesis.

Chapter 5 has been published as:

Nguyen, H. T. (2021). How does the productivity of foreign-invested enterprises spill over to domestic firms in Vietnamese manufacturing?. *Journal of the Asia Pacific Economy*, 1-36.

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List of Abbreviations

ACF	Ackerberg, Caves, and Frazer
AFTA	ASEAN Free Trade Area
AIC	Akaike Information Criterion
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
BCC	Business Cooperation Contract
BIC	Bayesian Information Criterion
BOT	Build-Operate-Transfer
BTA	Bilateral Trade Agreement
CEPT	Common Effective Preference Tariff
CIEM	Central Institute for Economic Management
CPI	Consumer Price Index
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
CRE	Correlated Random Effects
EPZ	Export Processing Zone
FDI	Foreign Direct Investment
FE	Fixed Effects
FIE	Foreign-Invested Enterprise
FOF	Fully Owned Foreign Firm
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
GO	Gross Output
GPN	Global Production Network
GSO	General Statistics Office
HHI	Herfindahl-Hirschman Index
HS	Harmonised System
HT	Hausman-Taylor
IO	Input-Output
ISIC	International Standard Industrial Classification
IV	Instrumental Variable
JV	Joint Venture
JV-PDE	Joint Venture with Private Domestic Enterprise
JV-SOE	Joint Venture with State-Owned Enterprise

LCD	Less Developed Country
LP	Levinsohn and Petrin
MNE	Multinational Enterprise
MPI	Ministry of Planning and Investment
MVA	Manufacturing Value-Added
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
OP	Olley and Pakes
PDE	Private Domestic Enterprise
R&D	Research and Development
RE	Random Effects
SITC	Standard International Trade Classification
SME	Small and Medium-sized Enterprise
SOE	State-Owned Enterprise
TCS	Technology and Competitiveness Survey
TFP	Total Factor Productivity
TNC	Transnational Corporation
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organisation
US	United States
USD	United States Dollar
VA	Value-Added
VCCI	Vietnam Chamber of Commerce and Industry
VES	Vietnamese Enterprise Survey
VND	Vietnamese Dong
VSIC	Vietnamese Standard Industrial Classification
WTO	World Trade Organisation

Chapter 1 Introduction

1.1 Purpose and scope

Liberalisation reforms are mainly sought to "reduce or remove impediments to the efficient allocation of resources" (Ostry, Prati, & Spilimbergo, 2009, p.4). Many aspects of the economy are affected during the liberalisation process, such as fiscal reforms, financial sector reforms, trade reforms, or foreign direct investment reforms. There is a consensus that the reforms have positive effects on firm productivity and thus become an essential source to boost and sustain long-term growth.

Firstly, ownership reforms – the transformation of ownership policies and ownership structure of the economy – are essential to enhance firms' productivity through changes in technological capability, management knowledge, incentive schemes, and others. For example, the reforms in the private sector provide managers with better incentives; therefore, reducing their discretionary behaviour that can benefit firm productivity (Morck, Shleifer, & Vishny, 1990). Private ownership also exposes firms to the market for corporate control or the takeover market, in which the managers of corporations act in the best interests of shareholders, enabling privately owned firms to operate more efficiently than their state-owned counterparts (Shleifer & Vishny, 1997). The positive association between ownership changes and firm productivity is also consistent with merger theories. Corporate takeovers promote economic natural selection, in which efficient firms remain autonomous while poorly performing firms are taken over (Meade, 1968). Mergers enhance the efficacy of resource allocation and encourage managers to maximise shareholder wealth (Jensen, 1988).

Secondly, trade liberalisation can increase firms' productivity through several possible mechanisms (see detailed review in Topalova and Khandelwa (2011)). The first mechanism

is related to the pro-competitive effects. Accordingly, the increased competition from opening the economy to trade can force firms to move down their average cost curve (Helpman & Krugman, 1985), to concentrate on producing products from their core competencies (Bernard, Redding, & Schott, 2011), to decrease manager delays and create x-efficiency gains (Hicks, 1935), or to strengthen innovation incentives among local producers to discourage entry of foreign competitors (Aghion, Redding, Burgess, & Zilibotti, 2005). In addition, trade liberalisation can increase firms' productivity by providing them with better access to superior inputs and technologies (Ethier, 1982; Grossman & Helpman, 1991a; Rivera-Batiz & Romer, 1991).

Lastly, the reforms on FDI enhance firms' productivity through productivity spillover effects. Multinational enterprises (MNEs) have more significant advantages than domestic firms (Caves, 1996; Dunning & Lundan, 2008). The advantages of MNEs may include their production methods, marketing strategies, and supply chain management. Once MNEs set up subsidiaries in host countries, they may be unable to prevent their superior technology and management from spilling over to local firms. Such spillovers have the potential to raise local firms' productivity (Görg & Greenaway, 2004).

Focusing on selected liberalisation reforms that have the potential to increase firm productivity, this thesis aims at providing a microeconomic impact assessment of liberalisation reforms on manufacturing productivity in Vietnam. In addition to contributing to the empirical literature on economic growth, FDI, and productivity, this thesis aims to inform policy debate in the context of economic transformation.

1.2 Why Vietnam?

There are at least five reasons why I selected Vietnam for my thesis. Firstly, Vietnam is a transition success where extensive liberalisation reforms have been conducted and transformed the country from an impoverished nation to a lower-middle-income economy (Arkadie & Mallon, 2004; World Bank, 2012). Together with market-oriented institutional reforms, Vietnam has undertaken proactive international economic integration (Vo, 2005). The extensive reforms have brought about notable economic achievements, which are briefly discussed in Appendix 1-1. Vietnam's experience provides a fitting context to explore the effects of liberalisation reforms on firms' productivity.

Secondly, the unique features of Vietnam's manufacturing sector provide an interesting setting to examine the performance of the manufacturing sector and its TFP growth. On the one hand, the manufacturing sector is characterised by solid export performance. Vietnam's manufacturing exports have consistently grown at double digits, much more significant than other economies in the region (UNIDO, 2019b). On the other hand, the manufacturing sector has become the most attractive for foreign investors (Table 1-1). The increasing involvement of Vietnamese manufacturing in global production networks (GPNs) is expected to enhance firms' productivity.

Table 1-1 Sectoral distribution of FDI (%)

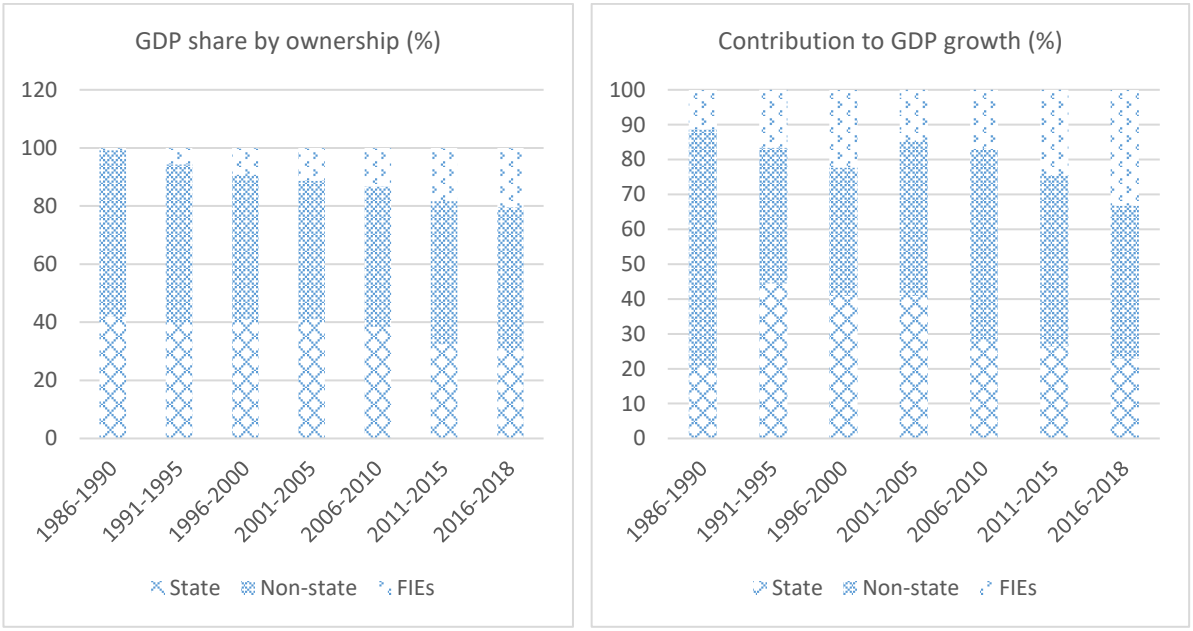
	1988	1998	2008	2018
Primary production	76.5	10.7	9.0	2.5
Industry	7.9	53.3	55.3	67.2
Manufacturing	7.9	45.7	49.7	57.5
Services	15.6	36.0	35.7	30.3
Total	100	100	100	100
USD (million)	342	29,612	163,607	340,850

Note: Figures for a given year show the cumulative approved investment since 1988.

Source: Compiled from data provided by the Ministry of Planning and Investment (MPI), Hanoi.

Thirdly, notable ownership transition makes Vietnam an ideal case for analysing the effects of ownership policy reforms on manufacturing productivity. The recognition and promotion of domestic private and foreign entrepreneurship have taken place side-by-side with state-led development policy aimed at establishing several state-owned enterprises (SOEs) to be "the leading engine of the economy" (Malesky & London, 2014, p.412). As a result, the ownership structure of the Vietnamese economy has been dramatically transformed over the past three decades, with the private sector, particularly, the foreign sector playing an increasing role in this structural change (Figure 1-1).

Figure 1-1 Changes in ownership structure since Doi Moi

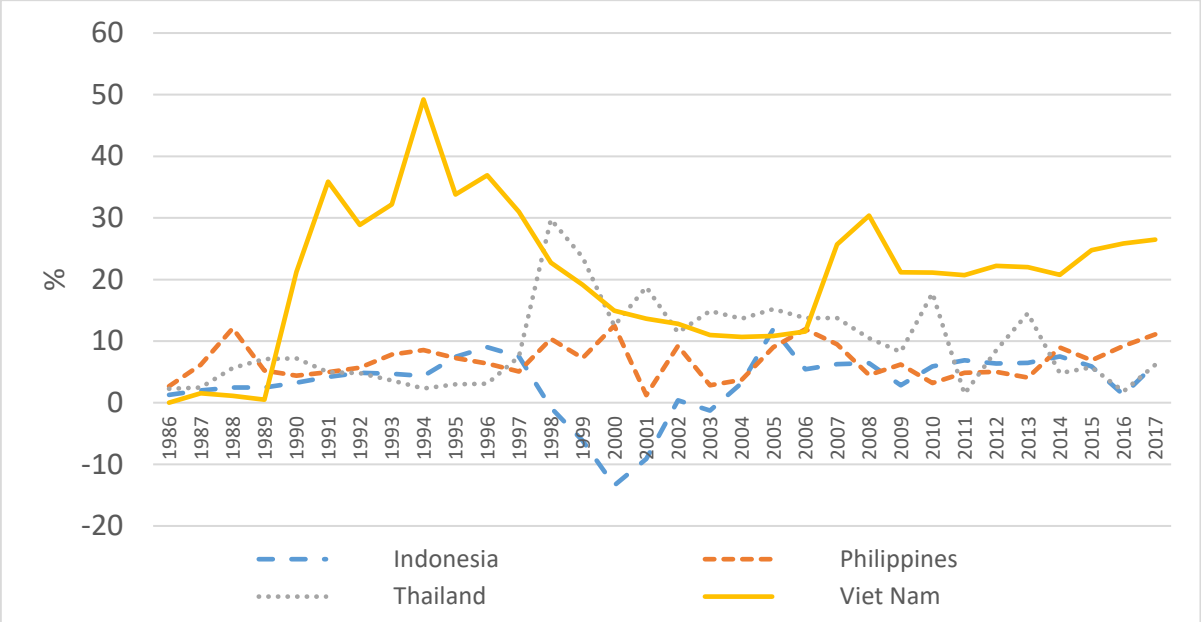


Source: Vu-Thanh (2019)

Fourthly, as an investment hotspot, Vietnam is an interesting case to examine the effects of FDI policy reforms on productivity at the firm level. Vietnam's economic opening has led to an unprecedented expansion of FDI into the economy. As a share of gross fixed capital formation, FDI inflows in Vietnam have surpassed most Southeast Asia countries in the past three decades (Figure 1-2). The expansion of FDI has brought significant benefits to Vietnam's economy in terms of growth, employment, and exports (World Bank, 2017). The essential role

of FDI in Vietnam's economy makes the country an ideal setting for analysing productivity gains from foreign firms' presence.

Figure 1-2 FDI inflows as a share of gross fixed capital formation in ASEAN4, 1986–2017



Source: UNCTAD (2020)

Lastly, Vietnam's high dependence on intermediate imports as a result of integration in global value chains offers an ideal setting for examining the role of imports in intersectoral linkages. In some export-oriented sectors, the dependence on intermediate imports is high (Herr et al., 2016; To & Lee, 2015). For example, the proportion of imported intermediate inputs in total output of: machinery and equipment was 53 percent; electronic equipment was 44 percent; textiles was 41 percent; and apparel and leather was 30 percent. This is in contrast to the low level of some resource-based sectors, such as rice (6.8 percent), crude oil (6.6 percent), and processed food (12.9 percent) (To & Lee, 2015).

1.3 Contributions

The contributions of this thesis are threefold. Firstly, the thesis makes a contribution to the literature on transition economies. Most of the studies on the effects of policy reforms on

productivity have focused on developed countries. These studies document that liberalisation reforms are essential to promote productivity in developed countries. The literature on how liberalisation reforms affect firms' productivity in developing and transition economies is still in its infancy. Most of the studies in this group focused on China and India (for example, Arnold et al., (2016) and Topalova and Khandelwal (2011)). By studying Vietnam, this thesis contributes to illuminating the likely direction of research on the productivity effects of policy reforms in transition economies.

Secondly, the study contributes to the existing literature on the economic effects of liberalisation reforms in Vietnam. The previous studies on Vietnam have mainly focused on structural change and productivity patterns in the initial phase of the liberalisation reforms while using macro- or industry-level data for statistical analysis. By focusing on the second half of the 2000s and using firm-level data, this thesis sheds light on the effects of remarkable policy reforms on manufacturing productivity. On one hand, by taking into account the ownership structure, this thesis contributes to the policy debate on the role of ownership reforms in determining manufacturing productivity. On the other hand, by constructing different channels through which foreign-invested enterprises (FIEs) can affect domestic firms, this thesis contributes to the current debate on the potential effects of policies on attracting FDI on the productivity of the manufacturing sector. The results show that the liberalisation reforms have resulted in an improvement in the manufacturing productivity over the period 2006-2017, justifying the significant efforts of Vietnam in reforming the economy over the past three decades.

Last but not least, the contribution of this thesis lies in the use of the establishment-level datasets over 12 years from 2006 to 2017. The dataset has rarely been used in research before and is not readily available. The next section will discuss in detail these datasets.

1.4 Data

The key dataset used in this thesis is the unpublished returns to the Vietnamese Enterprise Surveys (VES) conducted annually by the General Statistics Office (GSO) of Vietnam. The VES provides the most comprehensive establishment-level surveys in Vietnam. The surveys cover enterprises in all economic sectors formally registered with provincial authorities under the Law on Statistics. In addition, the VES offers rich information on firms' production, such as revenue (sales or gross output), employment, income of the employee, assets, and profits. This information allows for the construction of key variables in the thesis such as value-added and productivity level.

The thesis focuses on the manufacturing sector, covering industries coding at the 2-digit level of the Vietnamese Standard Industrial Classification (VSIC) 2007 from 10 to 31.[1] Petroleum and gas industry (VSIC 19) is excluded for two reasons: most of the production is exported in semi-processed forms, and, unlike other products, petroleum is subject to world market price fluctuations.

The VES allows for grouping ownership into five categories of interest. Firstly, SOEs encompass central state-owned enterprises, provincial state-owned enterprises, central state-owned limited liability companies, provincial state-owned limited liability companies, and shareholding companies with the state capital of more than 50 percent charter capital. Secondly, private domestic enterprises (PDEs) consist of private enterprises, partnerships, private limited liability companies, shareholding companies without state capital, and shareholding companies with the state capital of less than 50 percent charter capital. Foreign-invested enterprises (FIEs) are separated into fully owned foreign firms (FOFs), joint ventures of SOEs and FIEs (JV-SOEs), and joint ventures of PDEs and FIEs (JV-PDEs). This separation allows for better

[1] VSIC 1993, based on International Standard Industrial Classification (ISIC) revision 3, was applied until 2006 before being replaced by VSIC 2007, which is based on ISIC revision 4.

capturing the hybrid nature of different ownership structures.

The Vietnamese Enterprise Surveys (VES) have been conducted yearly since 2000. However, data from 2006 to 2017 is selected because of two main reasons. Firstly, this period corresponds to remarkable policy reforms undertaken since 2006. Notably, the enactment of the unified Law on Investment and Law on Enterprises in 2006, in compliance with World Trade Organisation (WTO) commitments, resulted in a significant structural break in ownership patterns in manufacturing sectors. These policy reforms also brought about an unprecedented expansion of foreign direct investment (FDI) into the country. Therefore, the period 2006 to 2017 is an ideal setting for analysing productivity gains from the ownership reforms and FDI attraction policies. Secondly, from 2006 onwards, the VES underwent changes in the industry code from Vietnamese Standard Industrial Classification (VSIC) 1993 – based on International Standard Industrial Classification (ISIC) revision 3 – to VSIC 2007, based on ISIC revision 4. The changes in the industry code resulted in the unavailability of consistent deflators at the 2-digit level of VSIC 2007 used for transforming variables into real terms (at 2010 prices). For example, deflating the output price of food products (VSIC 10) into real terms requires the output price indices at the 2-digit level of the VSIC 2007 for sector VSIC 10, which is only available since 2006.

The data compilation for constructing the firm-level panel dataset involves the following steps: (i) Deleted all erroneous observations such as firms' code un-identification or wrong location identification; (ii) Generated unique identification for each firm by merging location and tax code or firm code. Although the firm codes between yearly surveys are sometimes inconsistent, these oversights can be rectified by appending their tax code; the reason is that the tax code of a firm is unique every year; (iii) Deleted duplicates – some firms appear several times in one year; (iv) Deleted all observations with missing or negative values on output,

wages, and capital and all observations with missing or 0 values on employment; (v) Deleted all observations with negative or missing nominal value-added (the sum of profit and income tax) and nominal intermediate inputs (the difference between nominal output and nominal value-added); (vi) Deleted all observations with negative real value-added, which is calculated by subtraction of real output from real intermediate input; (vii) Excluded firms that 're-enter' the data; for example, the firm that existed in 2006 and 2007, disappeared in 2008–2009 but re-entered in 2010–2012 with different characteristics from the initial period. This allows overcoming the analytical concerns related to attrition, which refers to "firms closing operations, refusing to participate in the survey, changing their location or not found by the enumerator" (Rand and Tarp, 2020, p.19-20).

In addition to the VES, the thesis also employs a number of useful online and unpublished databases: the General Statistics Office of Vietnam (GSO); the Ministry of Planning and Investment of Vietnam (MPI); the World Bank database; and the UN COMTRADE database. Each chapter will discuss in detail the relevant data.

1.5 Structure and preview of the research

This thesis is organised and presented in seven chapters. Following the introductory chapter, Chapter 2 discusses Vietnam's liberalisation reforms and their impacts on the manufacturing sector's performance and structural changes. The chapter begins with reviewing the improvement and liberalisation of trade, investment, and enterprise legislation. It then examines the performance and structural changes of Vietnam's manufacturing sector. Selected performance indicators, including output, export, and employment, are used to assess the impacts of the reforms on manufacturing performance and structural changes. The main findings are as follows: during the liberalisation reforms, the manufacturing industry

experienced significant structural changes, where the private sector, particularly, the foreign-invested sectors has played an increasingly important role in the ownership structure.

Chapter 3 measures manufacturing's TFP over the period 2006 to 2017 and compares the productivity growth between major ownership structures. Firstly, the chapter discusses different methods available for measuring TFP. Secondly, the chapter employs the generalised method of moments proposed by Ackerberg, Caves, and Frazer (ACF) (2015) to derive the 2-digit sector's production function, based on which the consistent production function coefficients are estimated. After obtaining the time-varying TFP measures for each firm, the chapter examines variation of aggregate and sectoral TFP by different ownership structures. The results indicate a slightly upward trend in TFP growth across all ownership types, with SOEs and their JVs with foreign firms recording slowest TFP growth and FOFs experiencing the highest TFP growth.

Chapter 4 examines the association between the transformation of the ownership structure and firm productivity in Vietnam. The chapter begins with reviewing the literature on productivity differential by ownership. It then constructs an empirical model of ownership–productivity nexus. In the empirical model, both firm- and sector-specific characteristics are taken into account. The model is estimated using the correlated random effects (CRE) estimator. Lastly, robustness checks are implemented using alternative control variables, different subsamples, and alternative estimators. The main findings are as follows: The transformation of the ownership structure has significantly contributed to improvement of the manufacturing sector productivity: relaxing ownership restrictions on FDI has been instrumental in improving manufacturing productivity; partial divestiture of SOEs through forming joint ventures is not immune to various productivity-retarding factors affecting SOEs; and, the choice between the state and private entrepreneurs as joint-venture partners is essential in determining the productivity of joint venture operation of foreign-invested enterprises in Vietnam.

Chapter 5 examines whether FIEs generates productivity spillovers to domestic firms. Firstly, the chapter overviews the literature on productivity spillover. Then, the chapter constructs an empirical model of the relationship between productivity spillover variables and TFP of domestic firms. The productivity spillover variables are constructed based on the input-output (IO) approach using the non-competitive IO table. The chapter further examines the role of foreign ownership structures and the involvement of domestic firms in GPN on the productivity of domestic firms. Lastly, different robustness checks are conducted to test the persistency of the results. The key findings are as follows: productivity from FIEs spills over to local firms along the supply chains; ownership structures of FIEs serve as an important determinant of productivity spillover; and, local firms operating within GPNs benefit more from the presence of FIEs compared to those involved in horizontal specialisation.

Chapter 6 provides a procedure to construct the non-competitive IO tables to support the variable construction of Chapter 5. The chapter begins with the conceptual issues surrounding the analysis of intersectoral linkages in an open developing country. Then, the chapter reviews related literature employing non-competitive IO tables to analyse the intersectoral linkages. The procedure of constructing the non-competitive IO tables is then developed and applied to the IO tables of 2000, 2007, and 2012. Finally, the chapter presents and interprets the extent of intersectoral linkages. The key findings show that there are considerable divergences between total and domestic linkages, suggesting the need to take into account import in constructing intersectoral linkages in the countries highly dependent on imports like Vietnam.

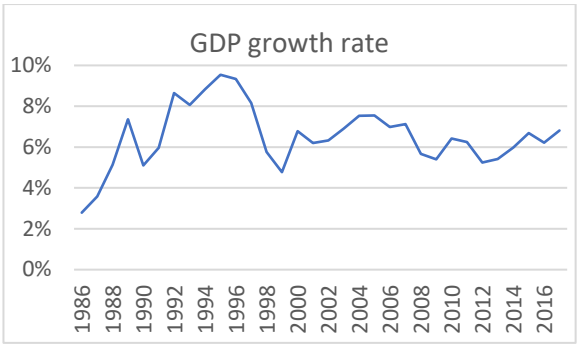
The final chapter summarises the main content of the thesis. Following the objectives and key findings, the chapter discusses the policy implications for Vietnam for achieving long-term productivity growth. The chapter ends with suggestions of several important areas for further research on manufacturing productivity that emerges from this study.

Appendix 1-1 Economic achievements of Vietnam since Doi Moi

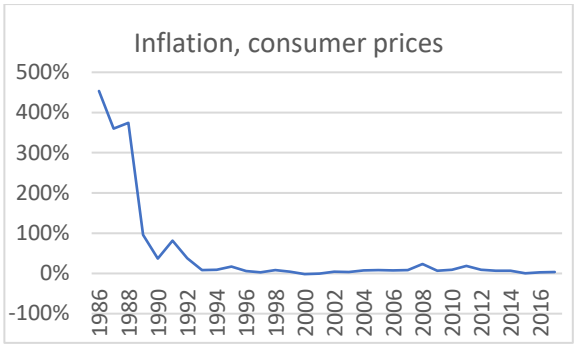
GDP growth: GDP grew continuously from 2.8 percent to 7.4 percent during 1985–1989. However, the disintegration of the most crucial trading partner – the Soviet Union Bloc – led to a decline in GDP growth rate to 5.1 percent in 1990 and 6.0 percent in 1991. Since 1991, the government has given private enterprises permission to directly export and import, contributing to increases in GDP growth rate of 8.6 percent in 1992 and 8.1 percent in 1993. The gradual integration into the world economy resulted in the GDP growth rate of over 9.0 percent in 1995 and 1996. However, the Asian financial crisis brought about a decrease in GDP growth rate to 4.8 percent in 1999. After stable economic growth rates at around 7.0 percent, the world financial crisis in 2008 led to a fall in GDP growth rate to below 6.0 percent. An economic stimulus package in early 2013 restored the GDP growth rate.

Inflation: The State Bank of Vietnam maintained a loose monetary policy and an expansive fiscal policy, leading to mild inflation during 1996–2007. The high inflation rate in 2007 was eased by reducing the required reserved ratio successively throughout mid-2006 – mid-2007. After the global financial crisis in 2008, the State Bank of Vietnam continued relieving the pressure of high inflation by loosening monetary policy.

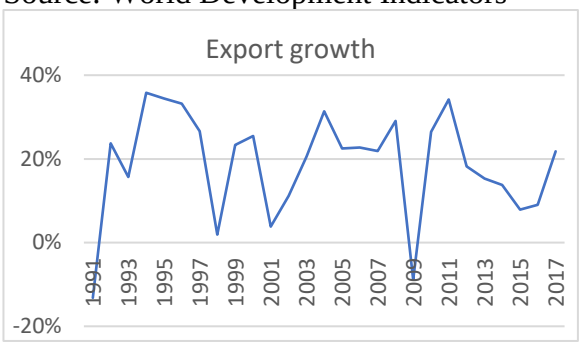
Export growth: Export grew significantly thanks to the export-led policies: the private enterprises' permission to directly export and import; the Law on Enterprises of 1999 and Decree 57, which gives more rights for export companies; and the permission for enterprises, individuals, cooperatives, and foreign investors to export and import all permissible commodities by Decree 44/2001/ND-CP in 2001.



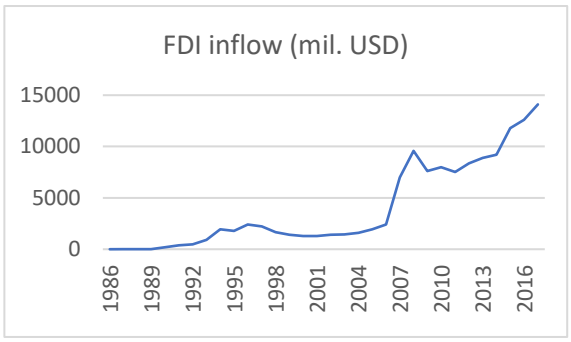
Source: World Development Indicators



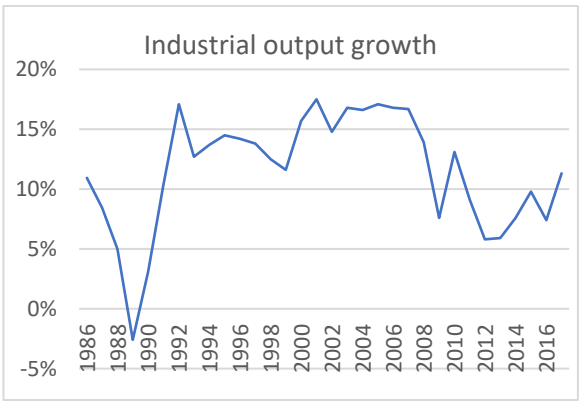
Source: World Economic Outlook Database



Source: GSO



Source: UNCTAD FDI statistics



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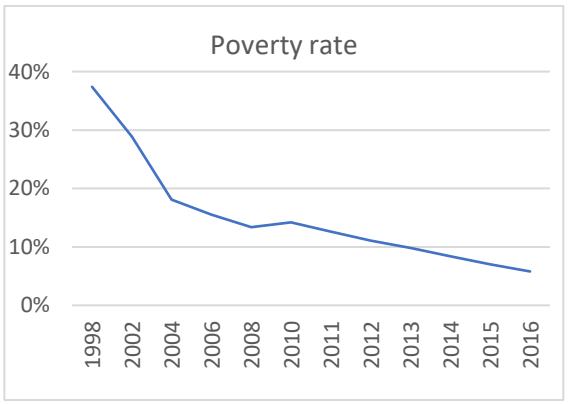


Source: GSO

Investment stock: Since the Foreign Investment Law approval in 1987, FDI inflows surged, reaching 2.6 billion USD in 1997. Following the Asian financial crisis, FDI inflows experienced a significant decline. FDI inflows regained momentum from about 2003, with a notable acceleration following the WTO accession in 2006. FDI inflow reached its peak in 2008, thanks to the significant reform of FDI-related policy in late 2005. The FDI inflow resumed the upward trend since 2012, following those tight policies to control inflation and stabilise the macroeconomy. In 2017, total FDI inflows were 14.1 billion USD, a 2-fold increase compared to a decade ago.

Industrial output growth: A sharp decline in industrial growth in 1989 was due to the collapse of the Soviet Union Bloc and the open-door economic policy, which subjected the domestic industry to new global competition. Vietnam enjoyed a stable and higher rate of industrial output during the period 1994–2007. The global financial crisis of 2008 led to a decline in industrial output growth to 9 percent in 2009.

Poverty rate: Poverty reduction is one of the most remarkable achievements of Doi Moi. During 1998–2016, the poverty rate decreased from 37.4 percent to 6.0 percent.

Chapter 2 Liberalisation reforms and manufacturing performance

Abstract

This chapter provides an overview of liberalisation reforms in Vietnam and the performance of the manufacturing sector in the reform context. The chapter shows that there has been a significant improvement and liberalisation of Vietnam's policies on trade, foreign direct investment, and ownership over the last 30 years. Data compiled from the Vietnamese Enterprise Surveys and data from the other secondary sources indicate that the manufacturing sector has obtained important achievements in terms of output, export, and employment. The data also suggests that, during the liberalisation reforms, the manufacturing industry experienced significant structural changes, where the private sector, particularly, the foreign-invested sector has played an increasingly important role in the ownership structure.

2.1 Introduction

Vietnam is one of the transitional economies where extensive liberalisation reforms have been conducted since the mid-1980s. After the North–South reunification in 1975, Vietnam continued its historical policy of a centrally planned economy. However, during that time, Vietnam faced a severe social and economic crisis because of the war destruction and termination of Soviet aid. The situation forced the Communist Party of Vietnam to embark on a reform process, introduced under the slogan Doi Moi (Renovation) in 1986 (Arkadie & Mallon, 2004). The main objective of this socio-economic reform was to transform its centrally planned economy into a market-based system. Unlike the transition economies in Central and Eastern Europe, and somewhat similar to the Chinese reforms, Vietnam adopted a gradual approach to unshackle the economy (Riedel & Comer, 1997; Vu-Thanh, 2019; World Bank, 2012). A wide range of policy reforms has been implemented, both domestic market-oriented reforms and international economic integration. The core elements include trade liberalisation, promotion of foreign direct investment (FDI), and ownership policy reforms.

Following the announcement of Doi Moi, the trade policy regime in Vietnam underwent significant changes toward more liberalisation and transparency. The entry for trading activities has been gradually relaxed, allowing private enterprises and foreign-invested enterprises (FIEs) to trade. The tariff systems were created and amended, while the quantitative restrictions were phased out. In addition, a wide range of incentives for trade has been introduced. These changes, along with active integration into the global and regional economy, have helped redress the anti-export bias embodied in the protectionist regime.

Another radical change introduced by Doi Moi was the opening of the economy to FDI. The reforms on FDI policies mainly sought to simplify administrative procedures for FIEs, remove restrictions, narrow the policy gap between foreign and domestic investors, and provide a more favourable investment environment through a wide range of government incentives to foreign investors. The liberalisation and development of Vietnam's FDI policies since Doi Moi has turned the foreign sector into an important sector in the development of the economy.

Furthermore, the ownership policies of Vietnam have experienced dramatic changes. On the one hand, the recognition of a multi-sector economy has led to profound changes in policies regulating the non-state sector with simplified registration procedures, the removal of investment restrictions, and uniform investment incentives. On the other hand, the state sector has been restructured through various SOE reform programs, such as commercialisation, re-registration, liquidation, and equitisation. The changes in ownership policies have brought about significant structural changes in Vietnam in recent decades. Instead of the dominance of SOEs, Vietnam's economy has been featured a tripartite structure in which the domestic private sector and the foreign investment sector operate alongside the state sector (Vu-Thanh, 2019).

The policy changes since the start of Doi Moi have contributed to the performance and structural changes of the manufacturing sector. The sector has grown at an impressive rate and

become the primary driver of Vietnam's economic growth. The liberalisation reforms, especially the government's proactive FDI and trade policies, have led to the continuous expansion of manufacturing export. The sector has also shown its great potential to generate employment. Due to recognition of the non-state sector and promotion of the FDI sector, the manufacturing industry has experienced major structural changes, where the private sector, particularly, the foreign-invested sector has played an increasingly important role in the ownership structure.

This chapter examines the liberalisation reforms in Vietnam with a focus in particular on the trade policy reforms, the policies of FDI promotion, and the ownership reforms. The chapter also examines how these key elements of the liberalisation reforms influence manufacturing performance. Data compiled from the Vietnamese Enterprise Surveys and data from the other secondary sources indicate that the manufacturing sector has obtained important achievements in terms of output, export, and employment. The data also suggests that, during the liberalisation reforms, the manufacturing industry experienced significant structural changes with foreign-invested sector playing an increasingly important role in the ownership structure. This chapter not only provides the context for the whole thesis but also sets the stage for empirical analysis on the possible relationship between the reforms and manufacturing performance in the ensuing chapters.

This chapter is structured in five sections. Following the introduction, section 2.2 reviews three main aspects of liberalisation reforms: trade policy reforms; FDI promotion policies; and ownership policy reforms. Section 2.3 discusses the data sources. Section 2.4 investigates trends and patterns of some selected performance indicators under the reform context, emphasising the differences among ownership groups at industrial aggregate and disaggregate

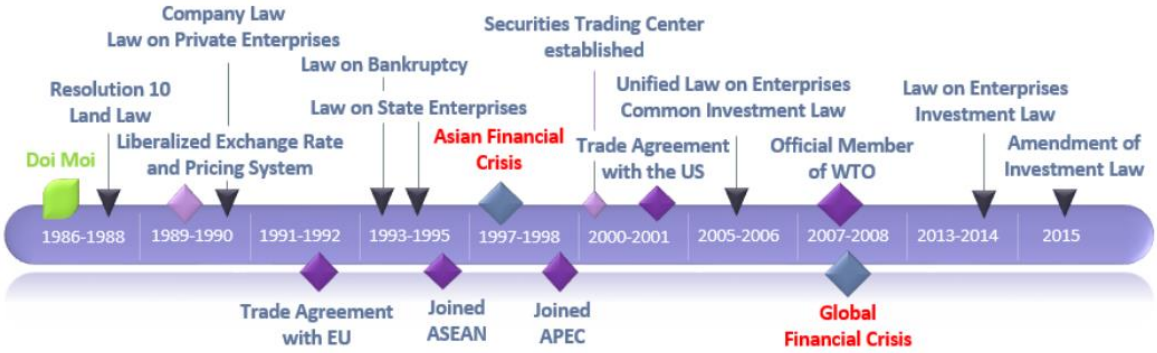
levels. The last section summarises key features of the reforms and their effects on the performance and structural changes of the manufacturing sector.

2.2 Overview of liberalisation reforms

Given a severe social and economic crisis because of the war destruction and termination of Soviet aid, in 1986, Vietnam initiated the Doi Moi policy to transform from a centrally planned to a market economy. The Doi Moi policy is a package of comprehensive economic reforms of both internal and external reforms to revitalise the economy under government control (Figure 2-1). On one hand, the Doi Moi policy focuses on: reforms in agriculture – the abandonment of state-led land collectivisation and encouragement of privatisation to give more rights to farmers (e.g., Land Law in 1987 and Resolution 10); reforms to strengthen the financial markets – the elimination of subsidies and liberalisation of the exchange rate and pricing system (e.g., the introduction of new currency in 1988, establishment of the central treasury in 1987, and New Banking Law in 1989 to separate commercial and central banking functions); reforms to recognise the multi-sectoral economy – policies to allow private enterprises and private property rights (e.g., the Company Law and the Law on Private Enterprises in 1990); policies to privatise SOEs (e.g., Law on Bankruptcy, Law on State Enterprises), and policies to attract FDI (e.g., Investment Law). On the other hand, the Doi Moi policy also focuses on economic integration and diplomatic relations within the region and with the rest of the world: the lifting of the US trade embargo, the normalisation of diplomatic relations with the US in 1995, and entering into various free trade agreements with numerous nations (e.g., joining ASEAN, signing a trade agreement with the US, and joining the World Trade Organisation). As a result, the closed and centrally planned economy has gradually been replaced by a kind of market-oriented system, which can be described as a multi-sectoral economy with the increasingly important role of the private sector and open-door policies

towards international trade and investment. See Athukorala (2006), Auffret (2003), Le (2019), Le and Harvie (2016), Perkins & Vu-Thanh (2010), Riedel and Comer (1997), Tran (2003), Vo (2005), and Vu-Thanh (2019) for detailed discussion on particular reforms.

Figure 2-1 Key milestones in liberalisation reforms since Doi Moi



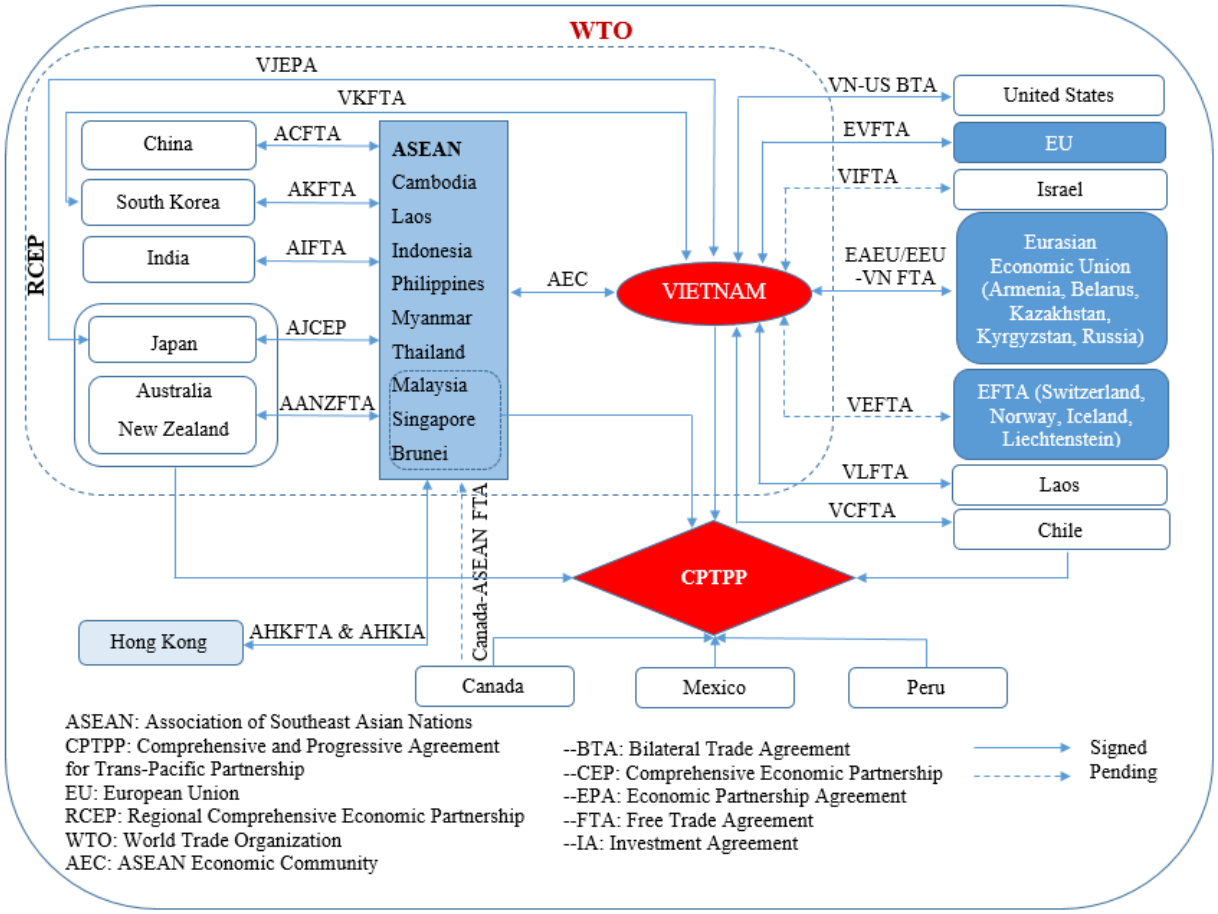
2.2.1 Trade policy reforms

Starting from a long-standing protectionist, state-led trade regime with a deep-rooted import-substitution bias, Vietnam embarked on trade policy reforms with certain counterbalancing measures supporting export-oriented activities (Athukorala, 2006). Firstly, Vietnam has gradually relaxed the entry for trading activities. The trading right has been extended for private enterprises according to the Law on Private Enterprises and the Company Law of 1990 and all FIEs according to Decision 46/2001/QD-TTG. The conditions for engaging in import and export activities were gradually relaxed: import-export licenses were abolished in 1998 and commodities were allowed to trade freely in 2001 (Vo, 2005). Secondly, the tariff systems were created and amended, quantitative restrictions were phased out (import and export quotas), and foreign exchange controls were relaxed (Vo & Nguyen, 2012). Lastly, the government has introduced a wide range of incentives regarding concessions, such as a concessionary profit tax rate and value-added tax exemption, setting up export processing zones, and direct export

support. These measures and instruments have helped to redress the anti-export bias embodied in the protectionist regime (Athukorala, 2006; Auffret, 2003).

Furthermore, Vietnam has actively integrated into the regional and international economy (Figure 2-2). In 1995, Vietnam joined the Association of Southeast Asian Nations (ASEAN) and acceded to the protocol of membership of the ASEAN Free Trade Area (AFTA). Three years later, Vietnam became a member of the Asia-Pacific Economic Cooperation (APEC). The years from 2000 have seen a deeper integration of Vietnam into the world economy. Vietnam signed a bilateral trade agreement (BTA) with the US in 2000, which came into effect in 2001. In 2006, Vietnam finally became the 150th member of World Trade Organisation (WTO) after 11 years of negotiation for accession. Vietnam also became a signatory to various FTAs under the ASEAN umbrella, such as with China (2002), India (2003), South Korea (2005), Japan (2008), and Australia and New Zealand (2009). Vietnam signed the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), which entered into force on 14 January 2019. Vietnam has been in Regional Comprehensive Economic Partnership (RCEP) negotiations. With remarkable effort to integrate into the regional and international economy, Vietnam was among the most open economies with 16 FTAs, 15 strategic partnerships, and 10 comprehensive partnerships as of January 2019 (Nguyen, Dinh, Do, & Vo, 2019). This integration process has helped both domestic and foreign enterprises to access a broader market.

Figure 2-2 Signed and pending Free Trade Agreements of Viet Nam



Source: Vo et al. (2016) and author's compilation from WTO Center (2020)

2.2.2 Policies of FDI promotion

As in the trade area, the trend of policy toward FDI has been toward increasing liberalisation. This trend was inevitable since Vietnam started from a policy of total exclusion of foreign investment (Riedel & Comer, 1997). Vietnam liberalised policies on FDI in the hope that foreign investment would revitalise the ailing economy and improve its economic environment.

The first step of liberalising the policies on FDI was marked by the enactment of the Foreign Investment Law of 1987. The Law offered a number of incentives, such as exemption from corporate tax or repatriation of after-tax earnings, to attract FDI. However, several restrictions

on investment entry limited the FDI attraction.[2] For example, the participation of FIEs in oil and gas exploration and communications was rigidly restricted to business cooperation contracts.[3] In several essential sectors such as transportation, port construction, airport terminal construction, afforestation, tourism, and cultural activities, joint ventures with domestic state-owned enterprises (JV-SOEs) were the sole mode of foreign entry. Fully owned foreign firms (FOFs) in other sectors were allowed under special considerations.

The Foreign Investment Law of 1987 has subsequently undergone amendments or replacements in 1990, 1993, 1996, 2000, 2005, and 2014 to further attract FDI. In general, these changes were mainly sought to simplify administration procedures for FIEs, remove restrictions and narrow the policy gap between foreign and domestic investors, and provide a more favourable investment environment through a wide range of government incentives to foreign investors (Table 2-1). Currently, foreigners are allowed to establish FOFs or to go into joint ventures (JVs) with Vietnamese partners, either in the private or state sectors.

[2] During the first three years after the enactment of the Foreign Investment Law of 1987, there were only 211 projects of 1603.5 million registered capital invested in Vietnam (GSO).
[3] The law regulates three modes of foreign investor participation: (i) business cooperation contract (BCC); (ii) joint venture; and (iii) fully owned foreign firm.

Table 2-1 Key changes in laws on foreign investment

	1990	1993	1996	2000	2005	2014
Administrative reform						
Waiting time for obtaining the license	Around 90 days		60 days	30 days	15 days	
Investment procedures			One-door policy: only one agency responding to all required investment approvals; decentralising the responsibility for monitoring and licensing FDI	Automatic registration of export-oriented FIEs	FDI projects below VND 300 billion (USD 15 million), which are not in the conditional sector list, do not require investment approval	- Certification procedures reduced from 3-stage to a 2-stage process.[4] - Projects with more than 51 percent of foreign capital are subject to investment certificates
Removal of restrictions and discrimination						
Duration of FDI projects	20 years	50 years, 70 years in exceptional cases				
Providing more rights for FIEs		FIEs are allowed to use their profits after paying taxes	FIEs are allowed to create joint ventures with private enterprises	FIEs are allowed to change the mode of investment, split, merge, and consolidate	FIEs are allowed to issue stock to the public; to convert income from foreign currencies to VND	
Reducing discrimination		FOFs and JVs are equal in accessing government incentives			- Abolishing local-content and export-performance requirements, and conditions on technology transfer - FIEs can choose a domestic or international arbitration body in dispute resolution	- Number of prohibited businesses reduced from 51 to 6 - The number of conditional businesses reduced from 386 to 267 (and 243 in the amendment in 2016)

[4] The 3-stage process included: (i) registration of the application; (ii) appraisal of the application; and (iii) grant of the investment certificate. The 2-stage process included only (i) and (iii).

	1990	1993	1996	2000	2005	2014
The scale of government incentives						
Tax exemption on firm's profits or investor's income			- Time of exemption of profit tax increased from 2 years to 4 years - Time for reducing profit tax by 50 percent increased from 2 years to 4 years (even 8 years for priority sectors)			
Other incentives	- Special economic zones were permitted to be set up: the export processing zones, industrial zones, high-tech zones - FIEs operating in special economic zones are offered special incentives: exemption from import-export taxes, tax for the firm's profits and tax for the remittance of earning abroad			- Special incentives for FIEs operating in difficult and remote areas: tax for imported inputs were exempted up to 5 years from the starting business year - Lower tax rates for the remittance of earning abroad: 3 percent compared to 5 percent previously	- The government incentives were expanded to many aspects, such as tax incentives, carrying forward losses, depreciation of fixed assets, and land use incentives - Financial support for technology transfer, human resources training, investment services, investment in infrastructure systems, and entry and exit visas	

Source: Extract from Tran (2014) and author's compilation from Thuvienphapluat (2020)

2.2.3 Ownership reforms

During the central planning period, private domestic enterprises were considered "a source of personal enrichment and exploitation" (Le & Harvie, 2016, p.93). Limited forms of private economic enterprise existed, such as sole proprietorship and household enterprises, under strict regulations and operated in a highly hostile environment. Under Doi Moi, Vietnam started to accept the co-existence of different ownership sectors and began to open up international trade and economic relations. This change has been marked by a series of decrees[5] on the rights of the non-state sector to engage in industrial production. These policy guidelines have "brought the private sector out of the grey zone" by stipulating that the state accepted the positive role and long-term existence of private and individual sectors (Le & Harvie, 2016, p.93). The advent of the Law on Private Enterprises and the Company Law in 1990 played an essential role in shaping the formal domestic private sector. These laws' amendments and subsequent laws on enterprises, which aimed at improving the business environment, helped this sector flourish. The improvement lay in officially recognising the role of the private sector, simplifying the regulatory framework for private enterprises, and providing them with a wide range of incentives (Table 2-2).

[5] Council of Ministers Decree 27, 28 and 29-HDBT, 9 March 1988, on 'Rules and Policies on the Private Economic Sector in Industrial Production, Service Industries, Construction and Transport', on 'Rules and Policies on the Collective Economy in Industrial Production, Service Industries, Construction and Transport', and 'Rules and Policies on the Family Economy in Production and Service Activities', respectively. These decrees were reinforced by a Politburo Resolution 16/NQTW, 15 July 1988, on the 'Renovation of Management Policies and Mechanisms towards Non-state Economic Sectors'.

Table 2-2 Private domestic enterprise policies

Year	Policy highlights	Related regulations
1988	Accepting the positive role and long-term existence of private and individual sectors	- Decree 27, 28, and 29-HDBT, 9 March 1988 - Resolution 16/NQTW, 15 July 1988
1990	- Legally recognising sole proprietorships - Opening up for limited liability and joint-stock company - Introducing special sales taxes, turnover taxes, and profit taxes	- Law on Private Enterprises of 1990 - Company Law of 1990
1992	Officially recognising the role of the private sector	Constitution 1992
1994–1997	Simplifying the regulatory framework for private enterprises	- Amendments to the Law on Private Enterprises of 1990 - Amendments to the Company Law of 1990 - Commercial Law of 1997
1999	- Recognising rights of asset ownership and other interests and committing not to nationalise or expropriate assets or capital - Transforming business licensing into a business registration system	Law on Enterprises of 1999, replacing the Company Law of 1990 and the Law on Private Enterprises of 1990
2005–2014	- Eliminating ownership restrictions - Simplifying business registration - Offering an equitable business climate for SOEs, private enterprises, and FIEs	- Law on Enterprises of 2005[6] - Law on Investment of 2005
2014–now	- Declaring the principle of freedom of business - Business registration certificate will no longer record business lines of enterprises	- Law on Enterprises of 2014 - Law on Investment of 2014

Source: Hakkala and Kokko (2006) and author's compilation from Thuvienphapluat (2020)

Alongside the policies aimed at promoting the non-state sector, Vietnam has tried to preserve the "leading role" of the state sector in the economy despite its indisputable inefficiency (Vu-Thanh, 2019, p.14). The leading role of the SOEs means that they are expected to provide essential goods and services, offer the tools to achieve macroeconomic stabilisation, lead the development of strategic sectors, and contribute to fiscal revenue (Sixth Party Congress in 1986 and the Seventh Party Congress in 1991) (Fujita, 2017). SOEs operating inefficiently and in

[6] Two existing enterprise laws, including the Law on (private) Enterprises of 1999 and the Law on State Enterprises of 2003, were merged into the unified Law on Enterprises of 2005.

the non-essential industries need to be restructured through a wide range of SOE reform programs, such as commercialisation, re-registration, liquidation, and equitisation (Table 2-3). To implement a leading role in the economy, SOEs were provided with special treatment, such as capital from the government budget, loans with a low-interest rate, lower corporation tax rates, and priority in participating in government projects. The government even found various ways to subsidise and shield this sector from international competition after Vietnam had become a member of the WTO and joined CPTPP.

Table 2-3 State-owned enterprise reforms

Period	Elements of the SOE reforms	Related regulations and impacts
1986–1996	Commercialisation to increase efficiency	Decree 217-HDBT in 1987 placed SOEs on a commercial footing, with increased autonomy and financial responsibility
	Re-registration, restructuring, and liquidation	Decree 388/HDBT in 1991 forced SOEs to be dissolved or merged with another if they were judged to be inefficient or lacking capital or technology or did not have sufficient market demand for their outputs
	Pilot equitisation, establishing the basis for leasing and divestiture	- The National Assembly approved a pilot equitisation program in late 1991 - Decision 84-TTg in 1992 established Central Steering Committee for Enterprise Reform – CSCER – to oversee government initiatives in reforming SOEs
	Development of a legal framework	The Law on Bankruptcy of 1993 and the Law on State Enterprises of 1995 facilitated improved governance and the closure of non-viable SOEs
	Development of enterprise groupings (general corporations)	Decision 90-TTg and Decision 91-TTg in 1994 specified procedures for the registration of two categories of state corporations, commonly referred to as Decision 90 and Decision 91 General Corporations (GCs)
1996–2006	'Compulsory' equitisation, accelerating stage of equitisation	- Decree 28-CP in 1996 abolished the enterprise management's right to veto equitisation decisions and provided clearer guidelines on responsibilities for action - A Central Steering Committee on Equitisation was established under the Decree 28-CP in 1996 to oversee the equitisation process - Decree 25-CP in 1997 (to amend the Decree 28) and Decree 44-CP in 1998 (to replace the Decree 28) removed the voluntary nature of previous equitisation programs - Decree 64-CP in 2002 (to replace the Decree 44) introduced the formation of welfare funds to provide financial support and re-training for redundant labourers after equitisation. Non-strategic SOEs, if failed to equitise, were required to be transferred, sold, commercially contracted, or leased - Decree 187-CP in 2004 (to replace Decree 64) offered the application of market mechanisms in SOE valuation, e.g. public auction of shares, independent auditing with foreign professional services firms
	Divestiture, leasing, and contracting-out of SOEs	Decree 103-CP in 1997 provided procedures for divestiture, leasing, or contracting out of SOEs with legal capital of less than VND 1 billion, or up to VND 5 billion of loss-making enterprises
	Corporatisation: the transformation of SOEs to limited liability companies	- Law on Enterprises of 1999 included provision for SOEs to be corporatised as state-owned limited liability enterprises - Decree 63-CP in 2001 outlined the procedures for corporatisation - Circular 01/2002/TT-BKH in 2002 authorised ministers and the heads of provincial people's committees to approve the corporatisation of individual state enterprises - Under these regulations, the Prime Minister's approval was required for the corporatisation of any members of Decision 91 State Corporations

Period	Elements of the SOE reforms	Related regulations and impacts
2006–now	Restructuring, developing, and increasing the competitiveness of SOEs to make them the leading force in international economic integration	- Resolution 08-NQ/TW in 2007 specified equitisation as the first measure and the formation of economic groups as the second measure to achieve rapid and sustainable development of the economy when Vietnam becomes a member of WTO; while the first measure made limited progress, the second measure led to the establishment of some large and diversified state-owned conglomerates called 'State Economic Groups' (SEGs) among the largest GCs - SEGs acted as monopolies or dominant players in essential sectors and were provided a range of privileges by the state - Decision 929-TTg in 2012 approved the scheme of restructuring SOEs with a focus on SEGs and GCs for the 2011–2015 stage, including equitisation of SEGs and GCs that did not require 100 percent state ownership and divestiture of the state capital from their non-core businesses

Source: Arkadie and Mallon (2004) and Fujita (2017)

2.3 Data sources

Data sources used in this chapter can be categorised into two types. The first is published sources, such as: the Vietnam General Statistics Office – GSO; the United Nations Comtrade Database – UN COMTRADE; and the World Bank – World Development Indicators. A sufficient time coverage in these data sources allows us to examine the manufacturing performance since Doi Moi.

The second data source is the unpublished returns to the Vietnamese Enterprise Surveys (VES) conducted annually by the GSO. The period 2006–2017 is selected to capture remarkable policy reforms in the second half of the 2000s. The VES allows us to group manufacturing sectors into consistent sector categories at the 2-digit level of the Vietnamese Standard Industrial Classification (VSIC). This is sufficient for a systematic analysis of the manufacturing sector's commodity composition. In addition, the VES allows us to group establishments under five consistent ownership categories: state-owned enterprises (SOEs); private domestic enterprises (PDEs); fully owned foreign firms (FOFs); joint ventures of SOEs and FIEs (JV-SOEs); and joint ventures of PDEs and FIEs (JV-PDEs). These ownership categories are needed to analyse manufacturing performance by ownership structures.

2.4 Manufacturing performance

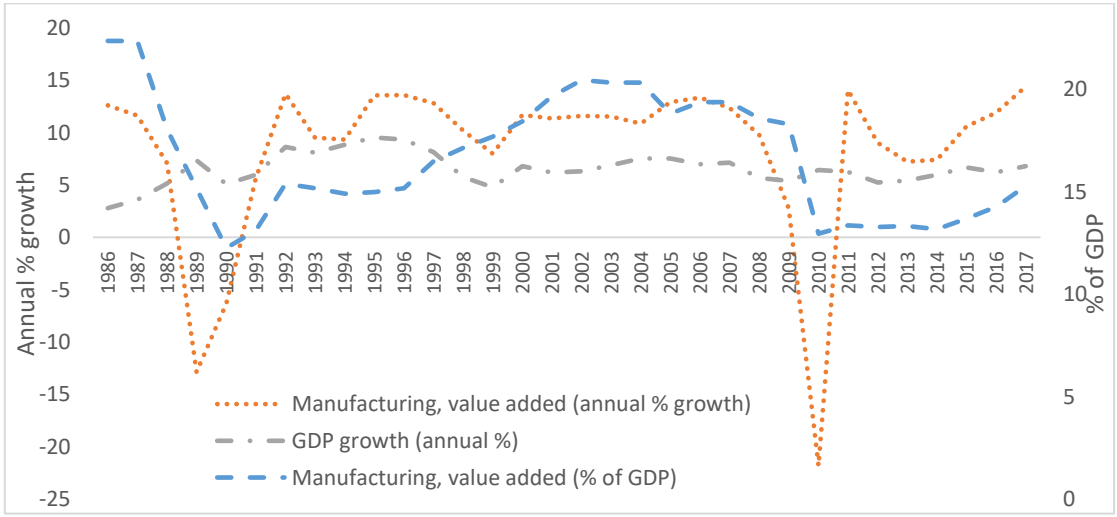
2.4.1 Output growth and structural change

Since Doi Moi, the manufacturing sector has experienced considerable expansion. Manufacturing value-added (MVA) growth – an indicator of a country's production capacity and overall competitiveness (UNIDO, 2019b) – in Vietnam has been maintained at around 10 percent since 1986 (Figure 2-3). A decline in MVA growth in 1989 was due to the collapse of

the Soviet Union Bloc and the open-door economic policy, which subjected the domestic industry to new global competition, and in 2010 due to the global financial crisis of 2008–2009. Recent increasing average MVA growth rates of more than 7 percent will help Vietnam to catch up with the other countries in the region over the next decade (UNIDO, 2019b).

The manufacturing sector has contributed significantly to economic growth in Vietnam in the last three decades (Figure 2-3). The contribution to GDP increased from 12.3 percent in 1990 to around 20 percent in the 2000s. The increasing GDP contribution of the manufacturing sector has been attributed to the substantial development of manufacturing firms in Vietnam, which resulted from the acknowledgement of private firms, encouragement of FIEs, and reforms of SOEs in the early 2000s (Vu, 2012). After a notable contraction during the global financial crisis (2008–2009), the contribution gradually increased and reached 15.3 percent in 2017. However, this figure has remained low compared to that of other countries in the region (UNIDO, 2019b).[7]

Figure 2-3 Manufacturing vs. GDP growth and its share in GDP (%)



Note: Share of manufacturing in GDP on right axis.

Source: World Development Indicators

[7] For example, the shares of MVA in GDP in the Republic of Korea and Thailand have been maintained at over 25 percent during the last three decades (UNIDO, 2019b).

The manufacturing sector has witnessed important changes in the commodity structure (Table 2-4). Industries, such as computer, electronic, and optical products (VSIC 26) and motor vehicles, trailers, and semi-trailers (VSIC 29), experienced a rapid increase in their output shares. These two sectors accounted for more than one-third of total manufacturing output in 2016–2017, compared to less than 1 percent in 2006–2007. The output share of some resource-based industries (rubber and plastic products – VSIC 22; and other non-metallic mineral products – VSIC 23), and some capital-intensive industries (basic metals – VSIC 24; and fabricated metal products – VSIC 25) has risen erratically since the late 2000s but has remained relatively small. Traditional labour-intensive industries (namely wearing apparel – VSIC 14; leather and related products – VSIC 15; furniture – VSIC 31; and food products – VSIC 10) have suffered a major loss in output share. However, these sectors continued to figure prominently in output performance, with their combined shares accounting for 22 percent in 2016–2017.

Table 2-4 Composition of manufacturing output by sector, 2006–2017[1] (%)

VSIC	Manufacturing industries	2006–2007	2010–2011	2016–2017
10	Food products	11.02	17.37	9.72
11	Beverages	5.67	4.22	2.54
12	Tobacco products	0.03	1.39	0.25
13	Textiles	2.12	3.37	2.74
14	Wearing apparel	10.13	11.59	5.49
15	Leather and related products	17.77	7.65	5.29
16	Wood and products of wood	1.95	1.90	0.87
17	Paper and paper products	6.50	2.47	1.62
18	Printing and reproduction of recorded media	6.45	1.28	0.41
20	Chemical and chemical products	8.76	5.47	4.89
21	Pharmaceuticals, medicinal chemicals, etc.	6.16	1.65	1.32
22	Rubber and plastic products	1.38	4.28	3.55
23	Other non-metallic mineral products	2.32	5.75	6.13
24	Basic metals	2.66	2.16	4.09
25	Fabricated metal products	1.77	4.47	5.71
26	Computer, electronic, and optical products	0.54	8.40	27.49
27	Electrical equipment	4.29	2.67	3.65
28	Unclassified machines, equipment	2.58	2.00	1.35

29	Motor vehicles, trailers, and semi-trailers	0.08	2.32	7.20
30	Other transport equipment	4.38	5.28	4.41
31	Furniture	3.44	4.31	1.29
	Total	**100**	**100**	**100**

Note: [1] 2-year average.

Source: Data compiled from the VES 2006–2017

Manufacturing output shares of different ownership types have seen contrasting trends between 2006 and 2017 (Table 2-5). On the one hand, SOEs' output share declined substantially from about 20 percent in 2006–2007 to around 4 percent in 2016–2017. This contraction reflects the impact of the SOE reforms, such as the restructuring program and privatisation, which have resulted in the gradual decrease of manufacturing SOEs. On the other hand, output shares of FIEs increased substantially, reaching approximately a third of Vietnam's total manufacturing output in 2016–2017. This upward trend implies the impact of the ownership reforms and the policy changes to attract FDI, especially during the period after Vietnam joined the WTO. Within FIEs, the role of JVs, particularly JV-SOEs, decreased gradually over the years. This trend was probably due to the relaxation of ownership restrictions that permitted FIEs to form FOFs.

Table 2-5 Ownership structure of manufacturing output (value-added), 2006–2017[1]

	2006–2007	**2010–2011**	**2016–2017**
State-owned enterprises (SOEs)	19.4	11.0	4.2
Private domestic enterprises (PDEs)	33.3	37.5	29.3
Foreign-invested enterprises (FIEs)	47.4	51.5	66.6
Fully owned foreign firms (FOFs)	32.6	41.8	58.7
Joint-venture (JVs)	14.8	9.7	7.9
JV-SOEs	12.6	7.2	5.5
JV-PDEs	2.2	2.5	2.5

Note: [1] 2-year average.

Source: Data compiled from the VES 2006–2017

Disaggregated data by 2-digit industries indicates notable changes in the ownership structure of manufacturing production over the period 2006–2017 (Table 2-6). The state sector reduced

its share in most sectors, especially in those in which SOE presence is not necessary, such as food products (VSIC 10), beverages (VSIC 11), textiles (VSIC 13), and wearing apparel (VSIC 14). However, SOEs continued their dominant share in intentionally protected industries, such as tobacco products (VSIC 12). SOEs also remained a significant output share in sectors using more natural resources, such as printing and reproduction of recorded media (VSIC 18), and chemical and chemical products (VSIC 20). The private domestic sector increased its share in various labour-intensive industries, such as the manufacturing of food (VSIC 10), beverages (VSIC 11), wood and products of wood (VSIC 16), paper and paper products (VSIC 17), and other non-metallic mineral products (VSIC 23). PDEs also increased their output shares and became dominant in several capital-intensive industries, such as pharmaceuticals and medicinal chemicals (VSIC 21), and basic metals (VSIC 24). The output contribution of FOFs increased in the sectors, in which the first-registered FIEs specialised, such as textiles (VSIC 13), wearing apparel (VSIC 14), leather and related products (VSIC 15), rubber and plastic products (VSIC 22), and furniture (VSIC 31). The output share of FOFs in computer, electronic, and optical products (VSIC 26) almost doubled between 2006 and 2017, accounting for about 99 percent. While JV-SOEs are likely to increase their output shares in upstream sectors, such as motor vehicles, trailers, and semi-trailers (VSIC 29), JV-PDEs tend to focus on downstream sectors, such as food products (VSIC 10), wood and paper products (VSIC 16), and pharmaceuticals (VSIC 21).

Table 2-6 Composition of output in each 2-digit manufacturing industry in 2006 and 2017 (%)

VSIC	Manufacturing industries	SOE		PDE		FOF		JV-SOE		JV-PDE	
		2006	2017	2006	2017	2006	2017	2006	2017	2006	2017
10	Food products	19.7	1.8	35.7	64.7	22.5	27.1	20.5	2.4	1.6	3.9
11	Beverages	49.4	11.7	7.2	67.0	8.7	16.4	34.7	3.6	0.0	1.3
12	Tobacco products	75.1	62.1	24.9	0.5	0.0	0.0	0.0	37.4	0.0	0.0
13	Textiles	25.5	3.8	25.2	23.3	34.4	71.8	13.3	0.0	1.6	1.1
14	Wearing apparel	15.3	1.4	39.0	39.5	42.4	57.5	2.0	0.0	1.3	1.6
15	Leather and related products	3.8	0.1	24.1	15.4	63.9	81.7	1.0	0.0	7.0	2.8
16	Wood and products of wood	17.7	2.8	60.8	80.2	16.3	14.3	3.8	0.6	1.4	2.1
17	Paper and paper products	12.5	4.4	57.5	45.3	28.6	42.5	1.1	0.1	0.3	7.8
18	Printing and reproduction of recorded media	59.6	20.1	33.3	51.7	6.0	27.5	0.0	0.1	1.0	0.5
20	Chemical and chemical products	47.1	15.8	11.9	29.1	21.2	51.2	19.0	1.9	0.9	2.0
21	Pharmaceuticals, medicinal chemicals, etc.	32.8	2.5	43.6	75.2	12.0	16.3	8.2	0.5	3.4	5.5
22	Rubber and plastic products	10.2	3.3	31.4	37.1	56.7	56.8	1.0	1.1	0.7	1.6
23	Other non-metallic mineral products	8.1	15.2	60.2	60.2	9.3	14.1	22.2	7.3	0.2	3.2
24	Basic metals	35.5	10.1	36.8	59.0	11.7	23.8	15.5	3.8	0.5	3.4
25	Fabricated metal products	8.2	2.9	39.8	52.8	45.0	40.4	6.4	1.0	0.6	2.9
26	Computer, electronic, and optical products	14.0	0.1	12.3	0.7	58.0	99.2	11.7	0.0	4.0	0.1
27	Electrical equipment	16.6	1.4	23.8	28.6	57.5	65.7	1.0	1.8	1.1	2.5
28	Unclassified machines, equipment	16.6	1.3	32.8	27.2	49.4	68.7	0.5	0.5	0.7	2.2
29	Motor vehicles, trailers, and semi-trailers	50.9	4.6	5.1	22.2	37.3	42.8	0.0	25.8	6.7	4.5
30	Other transport equipment	10.7	1.6	5.1	5.7	19.1	23.7	61.8	62.5	3.2	6.5
31	Furniture	2.9	0.3	56.7	38.5	36.7	59.1	0.5	0.0	3.2	2.1
	Averages	**23.3**	**3.7**	**30.9**	**28.1**	**32.0**	**60.2**	**11.4**	**5.7**	**2.3**	**2.2**

Source: Data compiled from the VES 2006–2017

2.4.2 Export performance

Manufacturing exports have expanded continuously since the mid-1980s (Table 2-7). The value of manufacturing exports (in current USD) soared from only 87 million in the early years of reforms to 175 billion in 2015–2019. The share of manufacturing exports in total non-oil exports increased significantly, reaching over 80 percent in the late 2010s. These figures imply that manufacturing exports dominated other non-oil exports (including agricultural products). The average growth rate of manufacturing exports was around 30 percent per annum. The profound expansion of manufacturing export was attributed to the government's proactive FDI and trade policies, as well as the rapid integration into the world economy.

Table 2-7 Value, share in non-oil exports, and growth of manufacturing exports, 1985–2019

Period (*)	Export value (USD million)			Non-oil share in total export	Manufacturing share in non-oil exports	Export growth (%)	
	Total	Non-oil (**)	Manufacturing (***)			Non-oil	Manufacturing
1985–1989	1,065	888	87	83.1	---	39.7	35.9
1990–1994	2,822	2,109	746	74.4	32.3	18.5	61.5
1995–1999	8,542	7,119	4,312	83.1	59.5	24.9	30.9
2000–2004	19,119	15,197	10,874	79.0	70.9	19.8	23.7
2005–2009	48,332	39,618	26,794	81.4	68.1	17.6	15.6
2010–2014	113,184	104,611	79,608	92.1	75.1	23.4	27.8
2015–2019	212,405	208,533	175,942	98.1	84.2	13.1	14.6

Notes: (*) 5-year average.

(*) Total merchandise less oil and gas exports (Section 33 and 34 of the Standard International Trade Classification (SITC)).

(**) SITC 5 to 8 less SITC 68 (non-ferrous metals).

Source: The figure for the period 1985–2004 is from Athukorala (2009) with adjustments on the manufacturing share in the non-oil exports section; (---) data is unavailable for the adjustment; Figure for the period 2005–2019 compiled from GSO and UN COMTRADE

The data at a disaggregated level shows substantial compositional shifts in manufacturing exports (Table 2-8). Manufacturing exports were initially heavily concentrated in traditional labour-intensive products with food (VSIC 10), textiles (VSIC 13), wearing apparel (VSIC 14), leather (VSIC 15), and furniture (VSIC 31), accounting for about 2-thirds of total non-oil manufacturing exports. The share of food products in total manufacturing exports declined significantly from 21.1 percent in 2006 to 8.2 percent in 2017. The share of wearing apparel and furniture in total manufacturing exports also reduced by more than half. By contrast, the share of products belonging to the commodity class of computer (VSIC 26) alone accounts for 40.6 percent of total non-oil manufacturing exports in 2017. This category has recorded a notable growth of 39.3 percent, contributing 45.7 percent to the overall growth of manufacturing exports over 2006–2017. This compositional change in exports can be attributed particularly to the normalisation of economic relations with the US, major reforms of investment and trade policy regimes, and accession to membership of the WTO, which set the stage for linking Vietnamese manufacturing to global production networks (Athukorala, 2009; Athukorala & Nguyen, 2020).

Table 2-8 Manufacturing exports: Composition and growth in Vietnam, 2006–2017 (%)

VSIC	Manufacturing industries	Composition (%)			Average annual growth rate	Contribution to export increment
		2006	2012	2017	2006–2017	
10	Food products	21.11	14.51	8.22	10.01	6.19
11	Beverages	0.12	0.35	0.16	22.76	0.17
12	Tobacco products	0.43	0.29	0.14	7.95	0.09
13	Textiles	7.47	7.66	6.59	18.49	6.45
14	Wearing apparel	19.03	13.22	10.83	13.86	9.53
15	Leather and related products	16.21	10.33	10.14	14.85	9.18
16	Wood and products of wood	1.88	1.81	1.32	16.09	1.24
17	Paper and paper products	0.60	0.50	0.42	16.17	0.39
18	Printing and reproduction of recorded media	0.09	0.13	0.05	14.44	0.05
20	Chemical and chemical products	2.56	2.57	2.65	20.25	2.67
21	Pharmaceuticals, medicinal chemicals, etc.	0.42	0.27	0.15	8.75	0.10
22	Rubber and plastic products	2.56	3.30	2.41	19.17	2.38
23	Other non-metallic mineral products	1.88	2.12	1.48	17.28	1.42
24	Basic metals	1.64	3.36	3.16	27.25	3.40
25	Fabricated metal products	2.16	1.85	1.68	17.14	1.60
26	Computer, electronic, and optical products	7.76	25.23	40.55	39.29	45.73
27	Electrical equipment	3.65	3.78	3.22	18.48	3.15
28	Unclassified machines, equipment	1.24	1.68	1.48	21.76	1.51
29	Motor vehicles, trailers, and semi-trailers	1.25	1.05	0.69	13.58	0.61
30	Other transport equipment	0.80	1.84	1.28	25.03	1.36
31	Furniture	7.12	4.15	3.37	11.99	2.78
	Non-oil manufacturing exports	**100**	**100**	**100**	**19.85**	**100**

Source: UN COMTRADE

2.4.3 Employment

Manufacturing has played an increasing role in employment generation in the economy. Between 1990 and 2017, employment in manufacturing expanded by ten percentage points from 7.8 percent to about 17.3 percent (Table 2-9). This trend reflects the shift in the output composition towards labour-intensive manufacturing.

Table 2-9 Sectoral composition of total employment in the Vietnamese economy, 1990–2017 (%)

	1990	1995	2000	2005	2010	2015	2017
Agriculture	73.0	71.3	68.2	55.1	49.5	44	40.2
Industry (*)	11.2	11.4	12.1	21.3	35.2	38.5	41.9
Manufacturing	7.8	8.0	8.7	11.8	13.5	15.3	17.3
Services	15.7	17.4	19.6	13.6	15.3	17.5	17.9
All sectors	100	100	100	100	100	100	100
Total employment (thousand)	29412	33031	36702	42775	49049	52840	53703

Note: (*) The industry sector consists of mining and quarrying, manufacturing, construction, and public utilities.

Source: GSO

Manufacturing employment has undergone major compositional shifts. Traditional labour-intensive products, including food products (VSIC 10), wearing apparel (VSIC 14), leather and related products (VSIC 15), and furniture (VSIC 31), together contributed nearly 60 percent of Vietnam's total manufacturing employment in 2006–2007 (Table 2-10). These industries are also export-oriented industries (Table 2-8), which exploit the comparative advantage of a cheap and abundant labour force. Between 2006 and 2017, computer, electronic, and optical products (VSIC 26) emerged as one of the job-creation sectors, creating 10 percent of total manufacturing jobs. This sector's important employment share can probably be attributed to its large involvement in labour-intensive assembly and packaging activities. This is why the sector can be considered a labour-intensive industry in Vietnam (Nguyen, 2015). It is worth noting that the labour-intensive industries figured

prominently in export performance. The positive relationship between export and employment implies that export expansion could translate into higher employment in manufacturing in Vietnam (Nguyen, 2015). In other words, a policy shift towards export promotion has contributed to employment transformation of the manufacturing sector.

Table 2-10 Composition of manufacturing employment by sector, 2006–2017[1]

VSIC	Manufacturing industries	2006–2007	2010–2011	2016–2017
10	Food products	12.0	11.4	8.2
11	Beverages	1.0	1.1	0.7
12	Tobacco products	0.4	0.3	0.2
13	Textiles	4.7	4.1	4.2
14	Wearing apparel	19.6	20.3	21.7
15	Leather and related products	17.7	17.1	18.5
16	Wood and products of wood	3.0	2.6	2.0
17	Paper and paper products	2.1	2.1	1.8
18	Printing and reproduction of recorded media	1.2	1.3	1.1
20	Chemical and chemical products	2.0	2.0	2.0
21	Pharmaceuticals, medicinal chemicals, etc.	0.8	0.8	0.8
22	Rubber and plastic products	4.0	4.5	4.7
23	Other non-metallic mineral products	6.7	6.5	4.4
24	Basic metals	1.4	1.6	1.4
25	Fabricated metal products	4.5	5.2	5.2
26	Computer, electronic, and optical products	2.2	4.5	10.0
27	Electrical equipment	3.3	3.0	2.7
28	Unclassified machines, equipment	1.3	1.3	1.2
29	Motor vehicles, trailers, and semi-trailers	1.3	1.6	2.0
30	Other transport equipment	2.9	2.4	1.8
31	Furniture	7.7	6.3	5.4
	Total	**100**	**100**	**100**

Note: [1] 2-year average.

Source: Data compiled from the VES 2006–2017

The ownership structure of manufacturing employment shared the same pattern with that of manufacturing output. There were also two contrasting trends within ownership types between 2006 and 2017 (Table 2-11). The SOEs' employment share continuously declined from 13.4 percent to 3.5 percent due to government efforts to restructure state manufacturing enterprises. By contrast, FIEs have emerged as a sector attracting the most manufacturing

workers. This change can be attributed to the rapid expansion of the foreign-invested sector, thanks to a consistent legal framework and a congenial investment environment created by new legislation on enterprises since 2006. Between 2006 and 2017, FIEs increased their manufacturing employment share by half, from 41.2 percent to 56.4 percent. Among FIEs, FOFs have been outstanding in terms of job creation, generating 53.5 percent of the total manufacturing labour force in 2016–2017. While JV-PDEs maintained their employment share over the years at about 2.0 percent, JV-SOEs reduced the share from 2.4 percent in 2006–2007 to 0.7 percent in 2016–2017.

Table 2-11 Ownership structure of manufacturing employment in Vietnam, 2006–2017[1]

	2006–2007	2010–2011	2016–2017
State-owned enterprises (SOEs)	13.4	6.8	3.5
Private domestic enterprises (PDEs)	45.4	47.3	40.1
Foreign-invested enterprises (FIEs)	41.2	45.9	56.4
Fully owned foreign firms (FOFs)	36.6	42.3	53.5
Joint-ventures (JVs)	4.6	3.6	3.0
JV-SOEs	2.4	1.5	0.7
JV-PDEs	2.2	2.0	2.2

Note: [1] 2-year average.

Source: Data compiled from the VES 2006–2017

The employment share of each ownership type in all manufacturing sub-sectors has undergone remarkable changes (Table 2-12). Firstly, the employment share of SOEs has declined in all industries over 2006–2017. SOEs' share in the labour-intensive industries reduced more than in the capital-intensive industries, reflecting the increased role of the private sector in export-oriented manufacturing. Secondly, PDEs increased employment shares in several industries between 2006 and 2017, especially those that are labour-intensive and do not require much technology, such as food products (VSIC 10), beverages (VSIC 11), and wood and products of wood (VSIC 16). Thirdly, the contribution of FOFs' employment in total employment increased in all industries. By 2017, FOFs' employment dominated other

ownership types in manufacturing sectors that require high technology, such as computer, electronic, and optical products (VSIC 26), and motor vehicles, trailers, and semi-trailers (VSIC 29). FOFs also held the highest employment shares in some labour-intensive industries, which were specialised by the first-registered FIEs, including wearing apparel (VSIC 14) and leather and related products (VSIC 15). Lastly, the contribution to total employment of JVs, especially JV-SOEs, is reduced in most sectors.

Table 2-12 Share in total employment of each manufacturing industry by ownership in 2006 and 2017 (%)

VSIC	Manufacturing industries	SOE		PDE		FOF		JV-SOE		JV-PDE	
		2006	2017	2006	2017	2006	2017	2006	2017	2006	2017
10	Food products	17.0	2.8	66.4	73.7	11.9	20.9	3.0	0.8	1.6	1.8
11	Beverages	27.4	9.4	51.7	68.1	16.0	19.3	4.6	1.7	0.3	1.5
12	Tobacco products	96.1	92.3	1.0	1.8	0.0	---	2.9	5.9	0.0	---
13	Textiles	28.1	4.6	36.9	39.6	30.2	54.1	3.7	0.1	1.2	1.6
14	Wearing apparel	13.5	2.0	38.5	39.8	45.0	56.5	1.3	0.1	1.7	1.6
15	Leather and related products	5.3	0.3	29.4	19.0	59.6	76.8	0.8	0.1	4.9	3.9
16	Wood and products of wood	12.8	2.0	72.9	81.5	11.6	14.8	1.5	0.3	1.2	1.4
17	Paper and paper products	9.7	3.7	67.9	61.3	21.7	31.4	0.2	0.1	0.5	3.4
18	Printing and reproduction of recorded media	36.8	9.2	53.6	69.8	8.2	20.7	0.1	0.1	1.4	0.2
20	Chemical and chemical products	37.4	20.0	37.2	50.1	19.6	27.2	4.7	0.8	1.0	2.0
21	Pharmaceuticals, medicinal chemicals, etc.	29.3	2.3	54.7	76.0	10.0	16.0	3.6	0.7	2.5	5.0
22	Rubber and plastic products	10.1	4.2	44.8	46.5	41.2	47.6	1.5	0.4	2.4	1.3
23	Other non-metallic mineral products	23.9	9.4	65.1	76.9	6.2	10.4	3.8	1.4	1.0	1.9
24	Basic metals	39.7	13.7	46.8	53.0	9.9	28.4	3.0	2.1	0.7	2.8
25	Fabricated metal products	12.1	4.8	54.8	60.9	29.5	32.8	2.8	0.3	0.8	1.2
26	Computer, electronic, and optical products	7.1	0.2	12.6	3.5	71.7	95.9	8.1	0.0	0.6	0.3
27	Electrical equipment	10.4	1.4	19.6	26.1	66.0	70.5	3.5	0.6	0.5	1.5
28	Unclassified machines, equipment	23.6	3.1	51.3	45.9	22.9	48.6	1.1	0.4	1.0	2.0
29	Motor vehicles, trailers, and semi-trailers	21.4	4.2	21.8	15.3	49.1	71.3	7.0	3.0	0.7	6.1
30	Other transport equipment	33.9	14.3	20.5	19.5	22.9	40.1	17.7	20.6	5.0	5.5
31	Furniture	4.5	0.4	52.0	47.7	40.0	49.7	0.7	---	2.8	2.2
	Averages	**15.2**	**3.2**	**44.4**	**39.4**	**35.6**	**54.5**	**2.6**	**0.7**	**2.2**	**2.1**

Note: --- In this industry, there were no firms of this ownership type in operation during the entire period or in any year/s within this period.

Source: Data compiled from the VES 2006–2017

2.5 Conclusions

This chapter has examined the liberalisation reforms in Vietnam and set them as a backdrop for an examination of manufacturing performance and structural changes. Over the last three decades, Vietnam has conducted comprehensive reforms to transition the economy from a centrally planned to a market-based system. Key elements of these reforms included trade liberalisation, policies of FDI promotion, and ownership reforms. As the first step of liberalisation reforms, trade policy has shifted toward more liberalisation and transparency, eliminating quantitative restrictions, relaxation of control on foreign exchange, and reinforcing tariffs' role. Along with active integration into the regional and international economy, which accelerates the access to a broader market, Vietnam has gradually transformed from a long-standing protectionist, state-led trade regime with a deep-rooted import-substitution bias to that of supporting export-oriented activities. Like the trade area, the trend of policy toward FDI has been toward increasing liberalisation. Laws on FDI were mainly sought to simplify administration procedures for FIEs, remove restrictions and narrow the policy gap between foreign and domestic investors, and provide a more favourable investment environment through a wide range of government incentives to foreign investors. Liberalised FDI policies have turned Vietnam from an economy of total exclusion of foreign investment to one with an increasing role of FIEs in almost all industries. Lastly, ownership policies of Vietnam have seen dramatic changes with simplified registration procedures, the removal of investment restrictions, and have provided uniform investment incentives. The changes in ownership policies have brought about the greater involvement of sectors other than SOEs in the economy.

The above-mentioned liberalisation reforms have had significant effects on the performance and structural changes of the manufacturing sector. Since Doi Moi, the sector has grown at an impressive average rate, enabling the country to narrow the gap and catch up with the

other countries in the region. The output growth rate allowed manufacturing to contribute significantly to economic growth. Manufacturing export has expanded continuously and become the main driver of overall export growth. The manufacturing sector has also shown its great potential to generate employment, attracting the agricultural sector's labour surplus and new workers joining the labour market. Regarding ownership structure, the private sector, particularly, the foreign-invested sector has played an increasingly important role in the ownership structure, thanks to recognition of the non-state sector in a multi-sector economy and the policies on FDI promotion. Within the foreign-invested sector, the role of JV-SOEs decreased gradually because of the relaxation of ownership restrictions that permitted foreign investors to form fully owned subsidiaries. By contrast, the SOE reform programs, such as commercialisation, re-registration, liquidation, and equitisation, has led to the contraction of SOEs' contribution. In terms of commodity structure, the export-oriented commodities, such as computer, electronic, and motor vehicles have played an increasing role. This trend is possibly due to the policies on export promotion that have resulted in the expansion in output and export, and the policies of FDI promotion that have brought about the dominance of FIEs in these sectors.

The structural change in the manufacturing industry is expected to enhance the sector's productivity given the more effective allocation of resources and increasing exposure of manufacturing firms to higher competition. This will be examined in the next chapter.

Chapter 3 Trends and patterns of manufacturing productivity

Abstract

This chapter examines Vietnam's manufacturing performance with a focus on trends and patterns of total factor productivity (TFP) growth using data compiled from the Vietnamese Enterprise Surveys during 2006–2017. The generalised method of moments proposed by Ackerberg, Caves, and Frazer (2015) is employed to measure establishment-level TFP based on production functions estimated at the 2-digit level of the Vietnamese Standard Industrial Classification. After obtaining establishment-level productivity measures based on consistent estimates of the input coefficients, the chapter examines variations of aggregate and sectoral TFP by different ownership types. The results indicate a slightly upward trend in TFP growth across all ownership types. However, state-owned enterprises and their joint ventures with foreign firms recorded slower TFP growth compared to fully foreign-owned firms, local firms and private-sector joint venture firms. Sectors with high concentrations of foreign-invested enterprises experienced the highest rates of productivity growth.

3.1 Introduction

The liberalisation reform (Doi Moi) initiated in 1986 has transformed Vietnamese manufacturing industries in various aspects.[8] The manufacturing output growth rate was awe-inspiring, maintained at around 10 percent since 1986. The sector's output share in gross domestic products increased rapidly from about 10 percent in the 1990s to more than 20 percent in the early 2000s. In terms of employment, the manufacturing sector has created almost ten million jobs in recent years (nearly 20 percent of total employment). The manufacturing industry has become a key driver of export expansion and FDI attraction.

More importantly, the liberalisation reforms have had significant impacts on the structure of Vietnamese manufacturing. Thanks to the opening up of the economy to FDI and relaxing restrictions on the non-state sector, the private sector, especially the foreign investment sector, have experienced rapid growth since Doi Moi. The manufacturing industry has also witnessed

[8] See Chapter 2 for a detailed discussion.

significant changes in the commodity structure with an increasing role of export-oriented commodities, such as computers, electronics, and motor vehicles. This structural change in the manufacturing industry is expected to enhance the sector's productivity. This can be attributed to the fact that resources are allocated more effectively, and manufacturing firms have been increasingly exposed to higher competition, both domestically and internationally.

The availability of establishment-level data from the Vietnamese Enterprise Surveys (VES) and a wide range of methods for production function estimation have resulted in a number of studies on manufacturing's productivity in Vietnam (Appendix 3-1). The literature focuses mainly on the relationship between productivity and related policies, such as trade policy reforms and FDI reforms (Newman et al., 2017; Tran, 2011). Establishment-level TFP and its changes over time are usually set as backstage. At the aggregate level, Doan and Kiyota (2014) estimate TFP and examine how it changed when Vietnam joined the WTO, using the multilateral index number approach. The results show that the TFP of the Vietnamese manufacturing firms constantly grew from 2000 to 2009, with a significant increase when Vietnam joined the WTO. Tran et al. (2009), using the value-added TFP index, indicate that SMEs' productivity performance in Vietnam was minimal during 1996–2001 given most firms had lower TFP level than the mean. At the sectoral level, Newman et al. (2015) employ Ordinary Least Squares (OLS) estimation and the approaches of Wooldridge (2009) and Olley and Pakes (1996) to examine the manufacturing productivity performance in 14 manufacturing industries during 2009–2012. The Newman et al.'s study shows considerable inter-sectoral differences in productivity growth rates with the best-performing sectors including leather and related products, rubber and plastics, and furniture. Nguyen (2017), using the approaches of Petrin and Levinsohn (2012) and Wooldridge (2009), shows that TFP growth rates were uneven in the industrial sectors and geographic regions over time, with more cases falling than rising during the period 2000–2010. Most recently, Ngo and Nguyen (2020) use

establishment-level data for 2010–2015 and employ the Ackerberg, Caves, and Frazer (2015) approach to measure the TFP level of manufacturing industries. The results show that the best-performing sectors include apparel, leather and related products, and computer, electronic, and optical products, while the worst-performing sectors include beverages, chemicals and chemical products, and food products.

The productivity-related literature for Vietnam's manufacturing using establishment-level data has been facing some methodological problems. When estimating real value-added for estimating TFP, most literature has used the single-deflation method; that is, deflating nominal value-added by an index of manufacturing prices (the producer price index – PPI), for example, Doan and Kiyota (2014), Nguyen (2017), Ramstetter and Phan (2013), Truong, Jongwanich, and Ramstetter (2015). This method is appropriate only if the price of materials relative to the price of output is more or less constant for the period under study. According to Bruno (1984) and Stoneman and Francis (1994), when this relative price changes, estimated productivity would, ceteris paribus, vary inversely. Perhaps due to the enormous data requirements of such an exercise, there are few studies for the Vietnamese case that have taken into account any changes in the relative price of the material input (Nguyen, 2014; Nguyen, 2013). Furthermore, most of the current literature on TFP estimation relies on the approaches of Levinsohn and Petrin (2003) and Olley and Pakes (1996) for TFP estimates (some of those are Pham (2015), Thangavelu, Findlay, and Chongvilaivan (2010), and Tran, Pham, and Barnes (2016)). While these approaches have been widely used in the literature, the users may be aware of the identification issues stemming from non-dynamic implications of labour input. Lastly, the production function is mostly estimated for the whole sector with a strict assumption of the same technologies across manufacturing sub-sectors. Given the heterogeneity in technologies among manufacturing sub-sectors, estimating production functions for each sub-sector improves TFP estimates.

This chapter aims at analysing trends and patterns of manufacturing TFP growth using data compiled from the VES during 2006–2017. The chapter also conducts a comparative analysis of TFP growth between different ownership groups: state-owned enterprises (SOEs); private domestic enterprises (PDEs); fully owned foreign enterprises (FOFs); joint-ventures with state-owned enterprises (JV-SOEs); and joint-ventures with private domestic enterprises (JV-PDEs).

The contribution of this chapter is twofold. First, the chapter offers the first analysis of aggregate and disaggregate industrial productivity trends that encompass all major ownership forms. Given that the Vietnamese economy has undergone more than three decades of transforming ownership structure and attracting FDI, the comparative analysis on TFP growth across ownership types has become essential in assessing the effects of these policy reforms. Second, the chapter extends earlier results to provide consistent productivity measures for ownership types and manufacturing industries during the remarkable reform period since 2006. This is the time when enactment of the unified Law on Investment and Law on Enterprises in compliance with WTO commitments has resulted in a significant structural break in ownership patterns in manufacturing sectors.

In terms of methodological contribution, the chapter addresses a number of econometric issues that may have led to biased estimates in previous studies. First, TFP is estimated from real value-added using the double-deflation procedure, in which separate price indices are used to deflate output and material inputs. Second, TFP is estimated using the generalised method of moments proposed by Ackerberg, Caves, and Frazer (ACF) (2015). This method has the advantage of addressing identification issues involved in the methodology commonly used in previous studies. Third, I estimate a production function for each 2-digit manufacturing sector and use the estimated parameters to measure productivity. This separation assumes that enterprises share common technology within sectors, while technology is different across

sectors. Once the TFP measures are available, an attempt is made to analyse the trends and patterns of the TFP across ownership types.

The new estimates confirm earlier findings of a broad rise in TFP for Vietnamese manufacturing. Manufacturing TFP grew on average at 2.1 percent between 2006 and 2017, with significant heterogeneity in productivity among industries. While some industries, which operate within global production networks (GPNs), have experienced productivity growth, some other industries have seen productivity decline. Estimates for all five major ownership segments (SOEs, PDEs, FOFs, JV-SOEs, and JV-PDEs) show upward trends. However, productivity growth is weaker for SOEs and JV-SOEs. PDEs closely follow (or even perform slightly better than) the productivity patterns of FOFs and their joint ventures with private firms – JV-PDEs. In the context of a significant increase in the role of foreign-invested enterprises (FIEs) in Vietnamese manufacturing, these patterns suggest technology spillovers from the foreign firms to their domestic rivals.

The chapter is structured as follows. Section 3.2 distinguishes TFP from other productivity concepts, such as labour productivity. This section also previews different approaches available for TFP measurement with a focus on semi-parametric techniques. Section 3.3 describes production function estimation using the chosen method – ACF. This section also discusses the dataset and construction of variables necessary for measuring TFP using the ACF's approach, followed by reporting and discussing the production function estimates for each 2-digit sector. Section 3.4 and Section 3.5 analyse the trends and patterns of manufacturing TFP growth at sectoral aggregated and disaggregated levels, respectively. The last section concludes and raises some research issues that will be examined in subsequent chapters.

3.2 Literature review

3.2.1 Productivity in concept

The concept of productivity has been applied in different circumstances on various aggregation levels in the economic system, such as the process, plant, firm, industry, or economy levels. Regardless of the different circumstances, the basic concept is the relationship between the quantity and quality of goods or services produced and the number of resources used to produce them. Productivity does not reflect how much we value the outputs – it measures how effectively and efficiently production inputs, such as labour, capital, land, materials, energy, and information are being used to produce a given output level. As productivity refers to the relationship between output and inputs, it is generally expressed as an output-input ratio (Syverson, 2011). The most frequently used concept of productivity encompassed partial productivity and TFP. While partial factor productivity indicates outputs and single inputs, especially the relationship between labour and capital, TFP means the relationship among multiple inputs and outputs. Table 3-1 shows productivity types categorised based on the type of input and output measures.

Table 3-1 Different productivity measures

Type of output measure	**Type of input measure**				
	Labour	Capital	Materials	Capital and labour	Capital, labour, and materials
Gross output (GO)	Labour productivity (based on GO)	Capital productivity (based on GO)	Materials productivity (based on GO)	Capital-labour TFP (based on GO)	Capital, labour, and materials TFP
Value-added (VA)	Labour productivity (based on VA)	Capital productivity (based on VA)	Materials productivity (based on VA)	Capital-labour TFP (based on VA)	N/A
Type of productivity measure	Partial factor productivity			TFP	

Source: Syverson (2011) and Schreyer (2001)

The choice between partial and total factor productivity is fundamental for assessing productivity. Labour productivity, the most widely used partial factor productivity measure, can be "misleading" because of the substitution between different inputs (Rogers, 1998, p.7). If a firm obtains higher output because of using capital input much more intensively, labour productivity can increase even though there is no actual increase in the productivity of labour.[9] TFP, which takes into account multiple inputs in the production process, is therefore considered the "preferred concept" in the literature (Bartelsman & Doms, 2000, p.575).

While TFP can be measured at the macro-level, recent years have seen a surge in studies on TFP at the micro-level, thanks to the increasing availability of establishment-level data and the improvements in methods for production function estimation (Van Beveren, 2012). The micro studies on productivity can be categorised into two groups. The first group documents some stylised facts on productivity dispersion and evolution, such as Bartelsman and Dhrymes (1998), Fox and Smeets (2011), Hsieh and Klenow (2009), López-Córdova et al. (2003), and Wagner (2007). The second group seeks to answer the most fundamental question in productivity analysis: What factors are behind the patterns of productivity growth? To answer this question, current literature has related productivity with various policy variables, such as ownership changes, technology transfers, and international exposure (see Bartelsman and Doms (2000) and Harrison and Rodríguez-Clare (2010) for the literature survey).

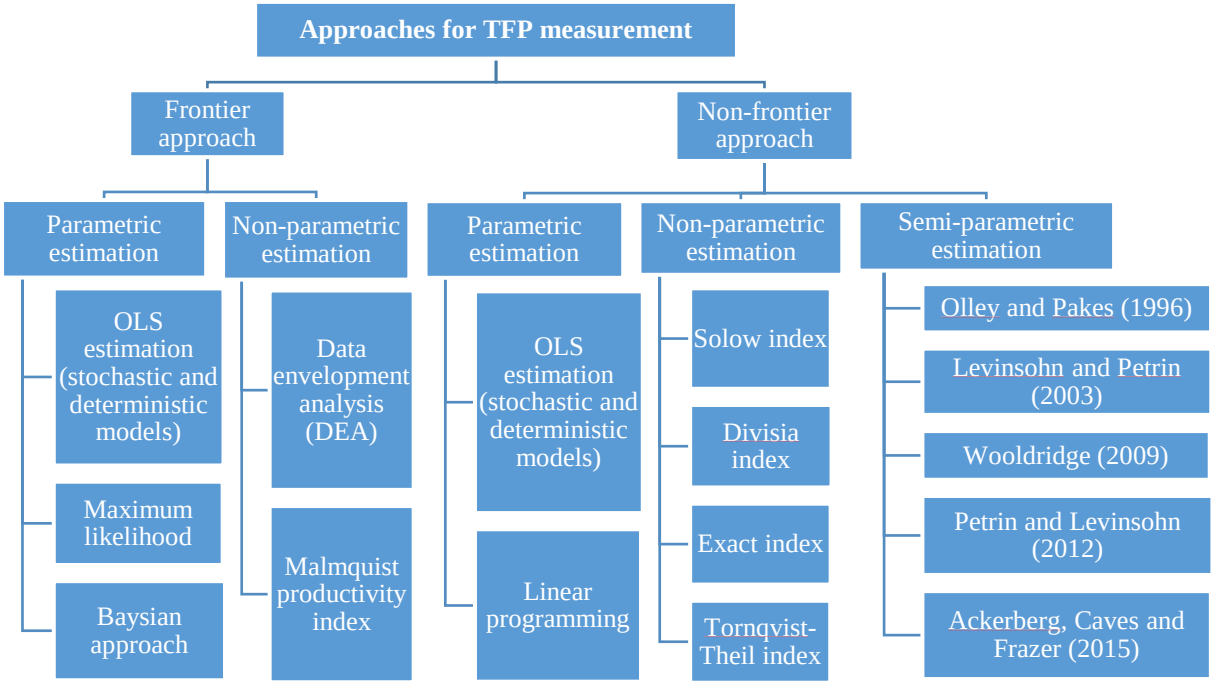
3.2.2 Productivity estimation

While productivity has long been a subject of empirical analysis, there is no generally accepted method for measuring productivity level or growth. Figure 3-1 presents various TFP

[9] Labour productivity can be an appropriate concept for certain limited purposes, such as for comparing welfare and unit labour costs of production across establishments. Labour productivity also can be sufficient if establishments have the same capital (Bartelsman & Doms, 2000).

measurement methods grouped into the frontier and non-frontier approaches (see Mahadevan (2004) for reviewing characteristics of these two approaches). The former is employed when we want to decompose productivity growth into "technological progress and changes in technical efficiency" (Nishimizu & Page, 1982, pp.920-921). Both frontier and non-frontier approaches can be further categorised into parametric and non-parametric estimations. The main difference between the parametric and non-parametric categories is that, while the former is an econometric estimation of a specific model that allows for statistical testing to validate the chosen model, the latter does not require any functional form (Mahadevan, 2004).

Figure 3-1 Approaches for TFP measurement



Source: Author's compilation based on Mahadevan (2004)

Semi-parametric estimation, which uses proxy variables to control for unobserved variables when estimating a production function, has gained popularity in empirical studies. The literature has developed different extensions and modifications of the original semi-parametric framework (Ackerberg et al., 2015; Manjón & Mañez, 2016; Van Beveren, 2012; Wooldridge,

2009). Initially, Olley and Pakes (1996) suggest using investment as the proxy for unobserved productivity. In the case of lumpy investment, Levinsohn and Petrin (2003) propose using intermediate inputs, such as materials and energy, as the alternative proxy. However, the multicollinearity issue of these approaches is claimed to affect the identification of production function coefficients. To overcome this issue, Wooldridge (2009), and later Petrin and Levinsohn (2012), suggests applying an instrumental variable (IV) estimator using the own lags of labour for its instruments. Ackerberg et al. (2015) suggest a method that builds upon the ideas forwarded by Olley and Pakes (1996) and Levinsohn and Petrin (2003), which is to use investment or intermediate inputs to 'proxy' for productivity shocks in order to avoid collinearity problems. The choice of these alternative extensions and modifications crucially depends on the data availability.

3.3 Measuring establishment-level TFP

3.3.1 Production function estimation – ACF method

In this study, I estimate a Cobb–Douglas production function separately for each 2-digit manufacturing sector following the ACF's modification to the Levinsohn and Petrin (2003) technique. The estimating equation is given by:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + \varepsilon_{it} \quad \text{(Equation 3-1)}$$

where y_{it} is the log of value-added, l_{it} is the log of labour input, and k_{it} is the log of capital input, all of which are observed for firm i at period t. Two econometric unobservables include ω_{it} and an iid error ε_{it}. The term ω_{it} represents 'productivity' shocks that are potentially observed or predictable by firms when they make input decisions. The term ω_{it} can be innate technology or the managerial ability of a firm, expected production disruption due to machine breakdown, or expected defect rates in a manufacturing process. The term ε_{it}

represents shocks to production or productivity that are not observable (or predictable) by firms before making their input decisions at time t. The term ε_{it} might represent deviations from expected breakdown, defect, or rainfall amounts in a given year.

Firm productivity ω_{it} can be correlated with input choices (k_{it}, l_{it}). For example, more productive firms can hire more workers and invest in capital in response to higher current and expected future profitability. An OLS estimation, assuming no correlation between (k_{it}, l_{it}) and ω_{it}, will give inconsistent estimates of the input coefficients. The OLS estimates will be biased upwards if there is a positive correlation between firms' input choices and productivity, and vice versa.

To address the correlation between firm productivity input choices, Levinsohn and Petrin (2003), basing on the approach proposed by Olley and Pakes (1996), use a firm's intermediate inputs as a proxy variable for its productivity. According to Levinsohn and Petrin (2003), inputs are assumed to be of two types: variable inputs such as labour, the choice of which in the current period does not have an impact on their cost of use in the future periods; and state variables such as capital input, the choice of which has an impact on the future cost of input. Firms' intermediate inputs decisions are given by the demand function, which is a function of productivity shocks ω_{it} and the state variable k_{it}:

$$m_{it} = m_t(k_{it}, \omega_{it})$$

This intermediate input function is assumed to monotonically increase in productivity, conditional on capital input; thus, it can be inverted to express the unobserved productivity as a function of observables (capital and intermediate inputs):

$$\omega_{it} = \omega_t(k_{it}, m_{it})$$

Levinsohn and Petrin's 2-stage procedure is conducted as follows:

Stage 1: Insert the inverse of the demand function for the proxy variable into Equation 3-1:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_t(k_{it}, m_{it}) + \varepsilon_{it} \quad \text{(Equation 3-2)}$$

to obtain the estimate of the labour coefficient β_l and the composite term $P_t(k_{it}, m_{it}) = \beta_0 + \beta_k k_{it} + \omega_t(k_{it}, m_{it})$ using semi-parametric techniques.

Stage 2: With the estimate of $\widehat{\beta_l}$ and $\widehat{P_t}(k_{it}, m_{it})$, estimate β_k using generalised method of moments techniques with the identifying assumption that productivity follows a Markov process and capital adjusts to productivity with a lag:

$$y_{it} = \beta_0 + \widehat{\beta_l} l_{it} + \beta_k k_{it} + \tilde{g}\left(\widehat{P_{t-1}} - \beta_0 - \beta_k k_{i,t-1}\right) + \xi_{it} + \varepsilon_{it} \quad \text{(Equation 3-3)}$$

The main modification introduced by ACF to Levinsohn and Petrin's (2003) technique is the way they treat the labour variable. Levinsohn and Petrin (2003) assume that labour has "no dynamic implications", which can lead to "identification problems" (Ackerberg et al., 2015, p.2422-2423). Through hiring or firing costs, the choice of l_{it} not only affects current profits, but future profits. Thus, while relying on aspects of Levinsohn and Petrin's 2-stage procedure, ACF propose an estimation procedure that allows labour to have a potential dynamic impact on productivity by including labour input in the intermediate input function:

$$m_{it} = m_t(k_{it}, \omega_{it}, l_{it})$$

This intermediate input function is assumed to monotonically increase in productivity, conditional on capital and on the labour input; thus, it can be inverted to express the unobserved productivity as a function of observables (capital, intermediate inputs, and labour):

$$\omega_{it} = \omega_t(k_{it}, m_{it}, l_{it})$$

Inserting this expression for productivity into Equation 3-1 results in the first stage semi-parametric equation:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_t(k_{it}, m_{it}, l_{it}) + \varepsilon_{it} \quad \text{(Equation 3-4)}$$

to obtain the estimate of the composite term: $\theta_t(l_{it}, k_{it}, m_{it}) = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_t(k_{it}, m_{it}, l_{it})$ using semi-parametric techniques. While this stage of the estimation does not identify any input coefficient like in Levinsohn and Petrin's technique (in which labour coefficient is identified), it still obtains an unbiased estimate for $\theta_t(.)$ since the error term in Equation 3-4 is uncorrelated with the regressors. With an unbiased estimate for $\theta_t(.)$, all input coefficients are estimated at the second stage.

The estimation is done using the Stata (*acfest*) subroutine developed by Manjón and Mañez (2016). The 'predict post estimation' command provides an estimate of the (log of) the productivity with the Wald test to test joint significance of the explanatory variables, and the Sargan-Hansen J test for over-identification to confirm the validity of instruments.

After obtaining the production function coefficients, the TFP measures for firm i at time t is computed as:

$$\widehat{\omega}_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it}$$

Once firm-level TFP is estimated, aggregate TFP of industry j at time t can be obtained as the weighted average of firm-level TFP:

$$\widehat{\omega}_{jt} = \sum_{i=1}^{N_t} s_{it}\, \widehat{\omega}_{it}$$

where s_{it} is a firm-specific weight, equal to $S_{it}/\sum_i S_{it}$ and S presents either output or employment. Normalising this index to 100 in the base year allows us to trace the evolution of aggregate TFP.

3.3.2 Data and variables

This analysis uses data compiled from the unpublished returns to the Vietnamese Enterprise Surveys (VES) conducted annually by the General Statistics Office (GSO) during 2006–2017. Twenty manufacturing sectors coding at the 2-digit level of the Vietnamese Standard Industrial Classification (VSIC) from 10 to 31 are kept in the dataset. The manufacturing of tobacco (VSIC 12) is excluded from the TFP estimation due to too few firms available. This analysis also excludes the petroleum and gas industry (VSIC 19) due to this sector's unique features.

To estimate TFP using the ACF approach, I extract data on output, inputs, and the proxy for unobserved productivity. Regarding data on output, value-added is used instead of gross output. As value-added excludes the cost of intermediate consumption, it can be free of the double-counting problem (Cobbold, 2003; Narjoko, 2010; UNIDO, 2018). In addition, value-added is recommended to be used for TFP measurement under the ACF approach to deal with identification problems (Ackerberg et al., 2015; Manjón & Mañez, 2016). Typically, value-added is measured by subtracting total output and the cost of raw materials, energy, and other intermediate inputs (Baptist & Hepburn, 2013). Unfortunately, data on production costs are not available in the dataset. In this analysis, value-added is measured based on the factor income approach, which is approximated by the sum of wages and pre-tax profits. Another component of value-added under the factor income approach is indirect taxes less subsidies, which are available in the VES. However, this component is not included because of many missing or conflicting values.

Data on inputs consist of labour and capital. For labour input, the total number of labour hours is preferred to measure labour input as it takes into account part-time employees. However, labour hours are not available in the VES. Given that part-time jobs in which labour is paid per hour are not typical in Vietnam, the number of full-time employees at the end of the year is likely appropriate for measuring labour input.

Regarding capital input, the perpetual inventory method is widely employed to measure capital input because of its accuracy, more than other alternatives (Miller, 1990; Nehru, Swanson, & Dubey, 1995; Young & Musgrave, 1980). Estimates and assumptions on three parameters are required in this method: service life, discard pattern, and depreciation method (Meinen, Verbiest, & Wolf, 1998; OECD, 2009a). However, the limited information on the amount of capital disappearing each year hinders us from using the perpetual inventory method. Therefore, this study uses total fixed assets at the end of the year to proxy firms' capital stock.

Lastly, the information on intermediate inputs is required in the ACF's modification to the Levinsohn and Petrin (2003) technique to proxy unobserved productivity. To calculate intermediate inputs, we need production costs such as raw materials, fuel, and electricity. However, this information is collected in separate subsample surveys with randomly selected establishments for some selected years. Therefore, this study deducts value-added from gross output to compute intermediate inputs.

The computation of performance indicators (gross output, capital, wages, intermediate inputs, and value-added) requires the deflation into real terms (at 2010 prices) (see Appendix 3-2 for selecting appropriate deflators). Appendix 3-3 summarises statistics for the variables used to estimate production functions of the 2-digit manufacturing sectors.

The study groups enterprises into five ownership categories: state-owned enterprises (SOEs); private domestic enterprises (PDEs); fully owned foreign firms (FOFs); joint ventures of SOEs and FIEs (JV-SOEs); and joint ventures of PDEs and FIEs (JV-PDEs). Appendix 3-4 summarises descriptive statistics on enterprises according to ownership form.

3.3.3 Productivity estimates

The production function coefficients for twenty 2-digit manufacturing sectors are presented in Table 3-2. The estimates using OLS and Levinsohn and Petrin's (2003) approach are also provided for comparison.

As the diagnostics show, the estimates obtained are economically sensible and pass tests of the instruments' validity. The majority of the cases (12 out of 20) pass the Hansen test for over-identification at the 5 percent level or better, suggesting the validity of the moment conditions used to construct the model. For most sectors (19 out of 20), the Wald test rejects the hypothesis of constant returns to scale.

The elasticities of value-added to labour and capital display significant heterogeneity among various industries, but almost all are positive and significant at the 1 percent level. The exceptions are: pharmaceuticals, medicinal chemicals (VSIC 21), where the coefficient of capital is positive yet insignificant; motor vehicles, trailers, and semi-trailers (VSIC 29), where the coefficient of labour is positive yet insignificant; and other transport equipment (VSIC 30), where the coefficient of labour is positive and significant at 5 percent.

As compared with OLS, the coefficient of capital using the preferred approach is lower in all sectors. This lower coefficient makes sense if we expect a positive correlation between firms' capital choices and productivity. Therefore, OLS leads to an upward bias in the capital coefficient. The labour coefficient is also lower in almost all sectors, implying that these sectors

experience a positive correlation between labour choices and productivity. At the same time, the labour coefficient is higher in the remaining sectors (VSIC 14, 15, 21, and 31), showing that labour choices negatively correlate with productivity. The latter is consistent with the idea that more productive enterprises tend to employ fewer labour units per unit of output.

The parameters using the approach of Levinsohn and Petrin (2003) tend to under-correct for the extent of the bias in the capital coefficients. The labour coefficient's bias is generally estimated in the opposite direction to what we find using our approach (4 out of 20). This bias is consistent with the idea that the identification of the labour coefficient in the first stage is hampered by multicollinearity (Ackerberg et al., 2015).

Table 3-2 Production function estimates for twenty 2-digit manufacturing sectors

	ACF	LP	OLS		ACF	LP	OLS
	10: Food products				11: Beverages		
k	0.145***	0.346***	0.138***	k	0.131***	0.297***	0.154***
	(0.006)	(0.005)	(0.010)		(0.014)	(0.012)	(0.019)
l	0.438***	0.819***	0.482***	l	0.386***	1.043***	0.452***
	(0.025)	(0.007)	(0.009)		(0.074)	(0.018)	(0.024)
Observations	14515	25800	25800	Observations	2428	6006	6006
Wald test	0.000			Wald test	0.000		
Hansen J-statistic	0.000			Hansen J-statistic	0.097		
	13: Textiles				14: Apparel		
k	0.104***	0.195***	0.0668***	k	0.0260***	0.0901***	0.0495***
	(0.006)	(0.006)	(0.013)		(0.004)	(0.005)	(0.009)
l	0.745***	0.908***	0.771***	l	1.051***	0.942***	0.836***
	(0.018)	(0.009)	(0.013)		(0.048)	(0.006)	(0.009)
Observations	4569	9112	9112	Observations	10130	20192	20192
Wald test	0.000			Wald test	0.086		
Hansen J-statistic	0.386			Hansen J-statistic	0.341		
	15: Leather and related products				16: Wood and products of wood		
k	0.0686***	0.0956***	0.0406*	k	0.0831***	0.219***	0.0813***
	(0.006)	(0.008)	(0.020)		(0.005)	(0.005)	(0.008)
l	1.011***	0.938***	0.847***	l	0.547***	0.886***	0.598***
	(0.012)	(0.009)	(0.014)		(0.023)	(0.007)	(0.010)
Observations	3274	6212	6212	Observations	8012	17503	17503
Wald test	0.000			Wald test	0.000		
Hansen J-statistic	0.827			Hansen J-statistic	0.000		
	17: Paper and paper products				18: Printing and reproduction of recorded media		
k	0.0914***	0.199***	0.0686***	k	0.0226***	0.0641***	0.0391***
	(0.006)	(0.007)	(0.012)		(0.004)	(0.007)	(0.009)
l	0.452***	0.903***	0.544***	l	0.853***	1.115***	0.853***
	(0.037)	(0.011)	(0.017)		(0.018)	(0.009)	(0.014)
Observations	5091	9121	9121	Observations	5195	13122	13122
Wald test	0.000			Wald test	0.000		
Hansen J-statistic	0.013			Hansen J-statistic	0.216		

	ACF	LP	OLS		ACF	LP	OLS
	20: Chemical and chemical products				21: Pharmaceuticals, medicinal chemicals, etc		
k	0.198***	0.391***	0.170***	k	0.0440	0.189***	0.0993**
	(0.009)	(0.009)	(0.015)		(0.028)	(0.016)	(0.032)
l	0.243***	0.842***	0.335***	l	1.383***	1.133***	0.510***
	(0.052)	(0.013)	(0.019)		(0.055)	(0.023)	(0.043)
Observations	4457	9304	9304	Observations	1151	1813	1813
Wald test	0.000			Wald test	0.000		
Hansen J-statistic	0.005			Hansen J-statistic	0.038		
	22: Rubber, plastic products				23: Other non-metallic mineral products		
k	0.0702***	0.228***	0.0730***	k	0.140***	0.397***	0.175***
	(0.004)	(0.006)	(0.008)		(0.009)	(0.007)	(0.011)
l	0.697***	0.896***	0.655***	l	0.207***	0.677***	0.257***
	(0.021)	(0.008)	(0.013)		(0.048)	(0.010)	(0.010)
Observations	8391	16147	16147	Observations	9462	17056	17056
Wald test	0.000			Wald test	0.000		
Hansen J-statistic	0.011			Hansen J-statistic	0.000		
	24: Basic metals				25: Fabricated metal products		
k	0.158***	0.369***	0.121***	k	0.112***	0.280***	0.115***
	(0.013)	(0.014)	(0.020)		(0.004)	(0.004)	(0.006)
l	0.364***	0.729***	0.308***	l	0.496***	0.821***	0.469***
	(0.091)	(0.022)	(0.028)		(0.019)	(0.006)	(0.009)
Observations	1665	3536	3536	Observations	16238	36254	36254
Wald test	0.000			Wald test	0.000		
Hansen J-statistic	0.303			Hansen J-statistic	0.000		
	26: Computer, electronic, and optical products				27: Electrical equipment		
k	0.0992***	0.274***	0.173***	k	0.0496***	0.286***	0.104***
	(0.018)	(0.012)	(0.041)		(0.013)	(0.011)	(0.019)
l	0.560***	0.861***	0.587***	l	0.505***	0.819***	0.491***
	(0.095)	(0.016)	(0.024)		(0.080)	(0.015)	(0.021)
Observations	1494	3796	3796	Observations	2551	5018	5018
Wald test	0.000			Wald test	0.000		
Hansen J-statistic	0.228			Hansen J-statistic	0.049		

	ACF	LP	OLS		ACF	LP	OLS
	28: Unclassified machines, equipment				29: Motor vehicles, trailers, and semi-trailers		
k	0.157***	0.229***	0.144***	k	0.217***	0.490***	0.210***
	(0.013)	(0.009)	(0.016)		(0.030)	(0.023)	(0.036)
l	0.379***	0.886***	0.493***	l	0.0339	0.641***	0.111**
	(0.054)	(0.014)	(0.025)		(0.186)	(0.030)	(0.041)
Observations	2838	5664	5664	Observations	938	1820	1820
Wald test	0.000			Wald test	0.000		
Hansen J-statistic	0.004			Hansen J-statistic	0.184		
	30: Other transport equipment				31: Furniture		
k	0.0946***	0.255***	0.161***	k	0.0559***	0.119***	0.129***
	(0.017)	(0.016)	(0.023)		(0.004)	(0.007)	(0.012)
l	0.455***	0.921***	0.416***	l	1.053***	0.936***	0.726***
	(0.107)	(0.025)	(0.030)		(0.091)	(0.009)	(0.018)
Observations	1234	2586	2586	Observations	5183	11510	11510
Wald test	0.000			Wald test	0.230		
Hansen J-statistic	0.339			Hansen J-statistic	0.384		

Notes: LP: Levinsohn and Petrin (2003); ACF: Ackerberg, Caves, and Frazer (2015); Robust standard errors are presented in parenthesis; Wald test: the test for constant returns to scale; Hansen J-test: the test for overidentifying restrictions; ***, **, * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively; Standard errors are obtained by using the nonparametric block bootstrap with 200 replications; Lag of the state variables and the second lag of the labour variables are used as additional instruments; *Prodest* command is used to estimate TFP using LP approach.

3.4 An analysis at industrial aggregate level

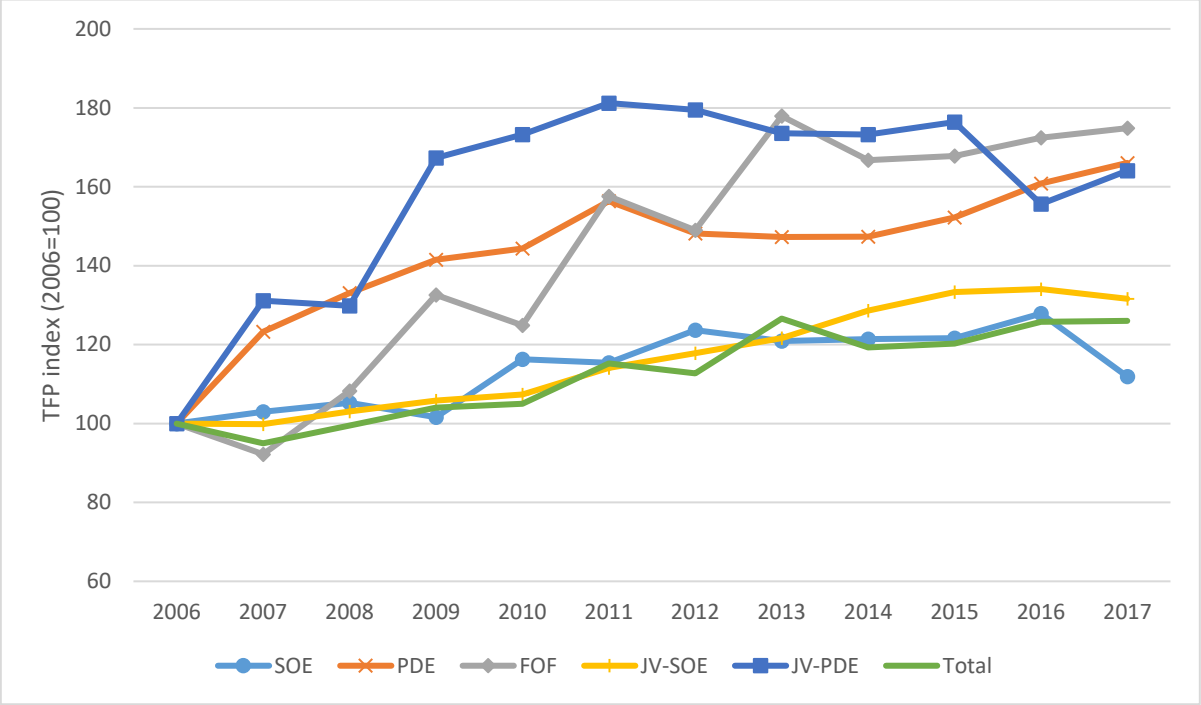
The index of TFP from 2006 to 2017 for the whole manufacturing sector and the five ownership groups – SOEs, PDEs, FOFs, JV-SOEs, and JV-PDEs – is plotted in Figure 3-2. Estimates are shown as indices (2006 = 100) to facilitate comparison.

In general, TFP of the manufacturing industry records much higher growth during 2006–2017. The index of TFP in total manufacturing increases from 100 to 126, with an average annual growth rate of 2.1 percent during 2006–2017. This increasing trend implies that manufacturing enterprises have become more efficient as a result of the further liberalisation reforms in the second half of the 2000s. The results confirm earlier findings of a broad rise in TFP for Vietnamese manufacturing (Doan & Kiyota, 2014; Nguyen, 2017; Tran, 2014).

Estimates for all five major ownership groups show upward trends during 2006–2017. Three ownership groups – FOFs, PDEs, and JV-PDEs – record the highest growth rates of 5.2 percent, 4.7 percent, and 4.6 percent, respectively. TFP growth is weaker for SOEs and JV-SOEs. While the TFP growth rate of SOEs is 1.0 percent, this figure for JV-SOEs is 2.1 percent.

TFP growth of different ownership groups show interesting patterns. PDEs closely follow or even perform slightly better than FOFs and JV-PDEs. This performance has occurred in the context of a significant increase in the role of foreign firms (both foregoing ventures and fully owned MNE subsidies) in Vietnamese manufacturing (Chapter 2). At first blush, these patterns suggest that "superior technology or productivity imported by the subsidiaries progressively spills into their domestic rivals" (Caves 2007, p.214).

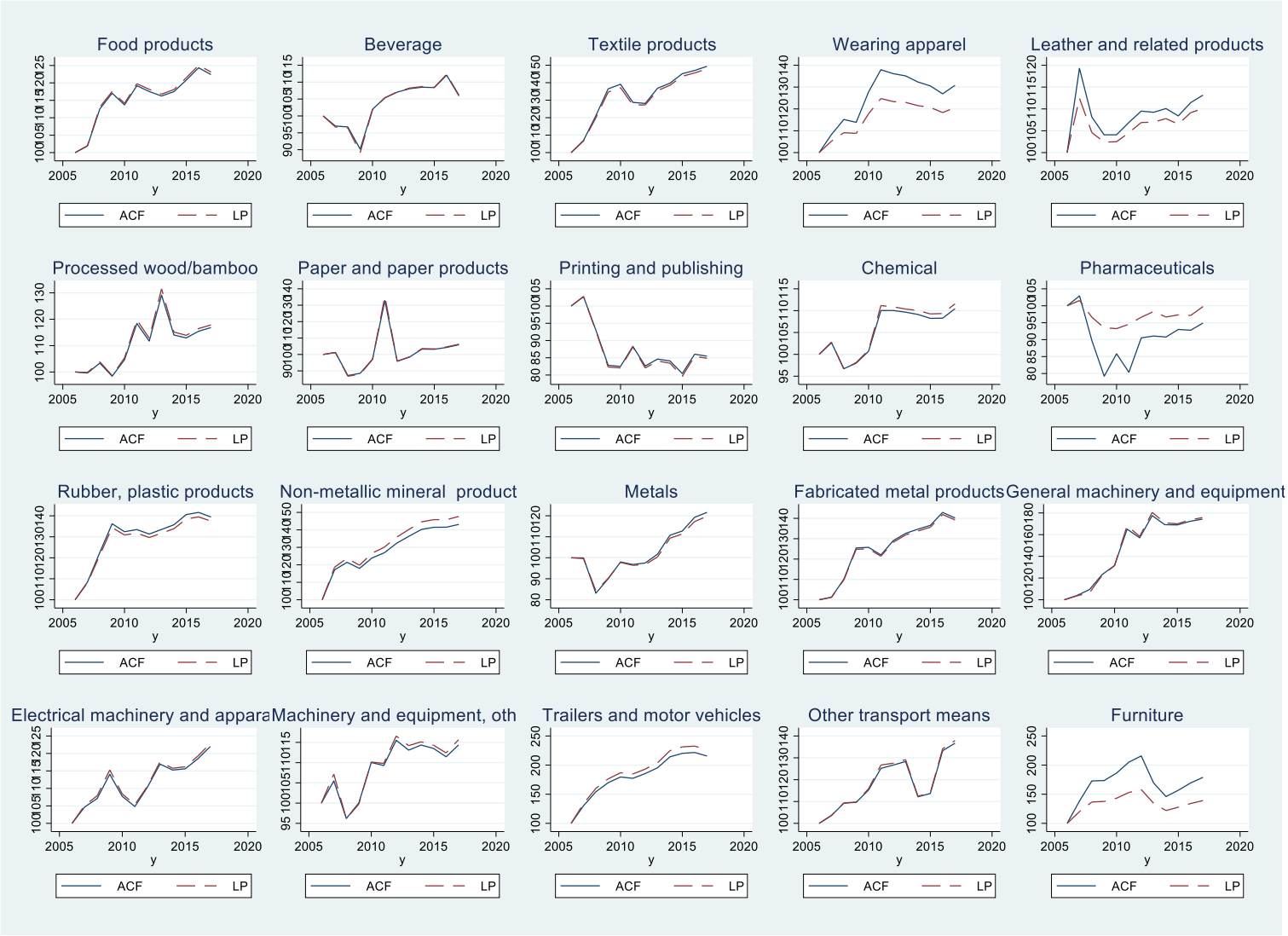
Figure 3-2 Manufacturing TFP growth by ownership



3.5 An analysis at industrial disaggregate level

Figure 3-3 shows TFP growth of twenty 2-digit manufacturing sectors. The TFP growth using the approach of Levinsohn and Petrin (2003) serves as a comparison. A decomposition into 2-digit industry level shows wide discrepancies of aggregate TFP growth across industries. The average TFP growth ranges from -1.4 percent per annum for printing and reproduction of recorded media (VSIC 18) to 7.2 percent per annum for motor vehicles, trailers, and semi-trailers (VSIC 29). Productivity growth is relatively higher in industries that operate within GPNs: computer, electronic, and optical products (VSIC 26); electrical equipment (VSIC 27); and motor vehicles, trailers, and semi-trailers (VSIC 29). These are also the industries with heavy concentrations of FIEs (Athukorala & Nguyen, 2020). By contrast, sectors experiencing negative productivity growth over the period include printing and publishing (VSIC 18) and pharmaceuticals (VSIC 21). These are the sectors with less concentration of FIEs (Chapter 2).

Figure 3-3 Trend in productivity growth 2006–2017



The estimates of TFP by ownership type at the 2-digit level of the VSIC are summarised in Table 3-3. JV-PDEs had the highest TFP growth in many industries belonging to both labour-intensive and capital-intensive industries. These included the manufacture of beverages (VSIC 11), textiles (VSIC 13), wearing apparel (VSIC 14), paper and paper products (VSIC 17), rubber and plastic products (VSIC 22), other non-metallic mineral products (VSIC 23), fabricated metal products (VSIC 25), unclassified machines and equipment (VSIC 28), and furniture (VSIC 31). PDEs had the highest average TFP growth rates in six industries, including food products (VSIC 10), leather and related products (VSIC 15), wood and products of wood (VSIC 16), basic metals (VSIC 24), motor vehicles, trailers, and semi-trailers (VSIC 29), and other transport equipment (VSIC 30). FOFs recorded highest TFP growth in two capital-intensive sectors, including chemical and chemical products (VSIC 20) and computer, electronic, and optical products (VSIC 26). While JV-SOEs had the highest TFP growth in electrical equipment (VSIC 27), SOEs recorded the highest TFP growth in pharmaceuticals and medicinal chemicals (VSIC 21).

Table 3-3 Vietnamese manufacturing: Output (value-added) share and TFP growth by ownership type, 2006–2017 (%)

VSIC	Manufacturing industries	Average output (value-added) share 2006–2017						TFP average growth 2006–2017					
		Total	SOE	PDE	FOF	JV-SOE	JV-PDE	Total	SOE	PDE	FOF	JV-SOE	JV-PDE
10	Food products	15.8	6.9	51.8	27.4	8.2	5.7	1.9	0.3	4.0	1.3	0.8	2.5
11	Beverages	4.1	37.0	17.0	13.7	31.8	0.5	0.5	-0.3	4.3	1.4	-0.9	8.1
13	Textiles	3.5	13.2	30.7	48.8	5.4	2.0	3.7	3.7	3.2	4.0	-2.6	6.7
14	Wearing apparel	11.6	6.9	38.7	52.3	0.8	1.3	2.5	0.6	2.5	2.6	-0.1	3.7
15	Leather and related products	9.5	1.4	19.5	73.0	0.4	5.6	1.1	1.5	1.7	1.3	-1.0	-1.5
16	Wood and products of wood	1.3	8.9	70.0	14.7	3.3	3.0	1.4	1.0	2.2	0.2	0.3	2.1
17	Paper and paper products	1.8	9.6	49.0	37.9	0.9	2.5	0.5	-0.1	0.0	0.3	-2.2	2.9
18	Printing and reproduction of recorded media	1.0	40.9	38.1	20.3	---	---	-1.4	-0.9	-1.0	-0.8	---	---
20	Chemical and chemical products	5.0	28.9	21.1	43.3	5.4	1.4	0.9	0.7	1.8	1.9	-0.6	0.5
21	Pharmaceuticals, medicinal chemicals, etc.	1.9	9.0	74.1	11.3	---	2.1	-0.5	1.7	-0.1	-2.4	-3.3	-0.8
22	Rubber and plastic products	4.4	8.5	36.4	51.4	1.2	2.6	3.1	3.0	1.2	4.1	6.8	7.8
23	Other non-metallic mineral products	5.1	20.8	52.3	13.3	12.1	1.4	3.3	4.6	3.7	3.0	2.6	6.7
24	Basic metals	1.3	33.0	44.5	18.6	---	3.0	1.8	0.9	5.6	-0.2	---	5.5
25	Fabricated metal products	4.3	6.4	37.5	47.1	5.8	3.2	3.1	3.4	3.8	2.5	2.8	4.9
26	Computer, electronic, and optical products	12.2	4.1	3.0	83.9	8.7	0.5	5.2	2.9	2.3	6.1	0.1	5.8
27	Electrical equipment	4.1	9.3	19.1	68.0	1.3	2.3	1.8	1.4	2.2	1.7	3.4	2.6
28	Unclassified machines, equipment	1.9	3.9	31.3	63.5	---	1.1	1.2	0.1	1.5	0.8	---	3.5
29	Motor vehicles, trailers, and semi-trailers	2.8	13.3	15.5	52.2	---	---	7.2	3.8	12.1	8.1	---	---
30	Other transport equipment	4.7	8.6	4.2	26.8	57.5	---	2.9	2.1	4.4	1.5	2.4	3.0
31	Furniture	3.6	2.9	39.7	55.0	---	2.2	5.3	6.0	5.4	4.6	---	20.7
		100	13.7	34.7	41.1	10.2	2.4	2.1	1.0	4.7	5.2	2.5	4.6

Note: --- In this industry, there were no firms of this ownership type in operation during the entire period or in any year/s within this period.

Source: Data compiled from the VES 2006–2017

3.6 Conclusions

This chapter has examined trends and patterns of manufacturing TFP growth using new datasets compiled from the VES during the period 2006–2017. The chapter has also compared the productivity growth among ownership categories at industrial aggregate and disaggregate levels. The ACF approach is employed to estimate consistent establishment-level time-varying TFP. The production functions are estimated at 2-digit sector level to allow for heterogeneity in technologies among manufacturing sub-sectors.

The results suggest several important trends and patterns in manufacturing TFP in Vietnam during 2006–2017. Firstly, manufacturing productivity shows an upward trend with the annual TFP growth rate of about 2.1 percent. Secondly, there is heterogeneity in productivity performance between ownership groups. The best performers are FOFs, JV-PDEs, and PDEs. By contrast, SOEs and JV-SOEs are at the bottom of the productivity ranking. Thirdly, while some sectors experience significant growth in TFP, some other sectors remain stagnant and are behind the leading sectors. Sectors with high concentrations of FIEs, such as computers and motor vehicles, have experienced the highest productivity growth rates. By contrast, printing and pharmaceuticals are the two sectors experiencing negative productivity growth.

The findings of this chapter have important implications for the subsequent chapters. Firstly, the productivity differential between ownership types suggests the importance of undertaking an empirical examination of how ownership transformation affects the improvement of manufacturing productivity. Secondly, the pattern that PDEs closely follow, or even perform slightly better than, the productivity trends of FOFs and JV-PDEs in the context of a significant increase in the role of foreign firms suggests that it is important to undertake an empirical examination on the potential productivity spillover from FIEs to domestic rivals.

Appendix 3-1 Productivity studies for Vietnam

Research (year)	Period	Primary data (source)/ Scale	Objectives	TFP estimation	Major findings on manufacturing TFP growth
Anwar and Nguyen (2014)	2000–2005	Firm-level data (VES)/ 23 manufacturing industries	Examining the impact of FDI and FDI generated spillovers on TFP in eight regions of Vietnam	OLS	Not reporting (only obtaining the parameter estimates for the production functions for eight Vietnamese regions)
Doan and Kiyota (2014)	2000–2009	Firm-level data (VES)/ 24 manufacturing industries	Examining the impact of trade liberalisation on firm productivity: estimate the TFP, and then examine how it changed when Vietnam joined the WTO	TFP index	TFP increased significantly when Vietnam joined the WTO
Huang and Yang (2016)	2000–2008	Firm-level data (VES)/ 24 manufacturing industries	Examining the interrelations among ownership, trade, and firm productivity	Levinsohn and Petrin	Firms of various ownership structures witnessed higher productivity after Vietnam joined the WTO
Huynh et al. (2021)	2011–2015	Firm-level data (VES)/ all manufacturing industries	Assessing productivity spillovers from foreign direct investment across six regions in Vietnam	Olley and Pakes	Not reporting
Le et al. (2019)	2001–2011	Firm-level data (VES)/ 24 manufacturing industries	Examining the role of ownership and market competition in Vietnamese firms' TFP	Wooldridge	Not reporting

Research (year)	Period	Primary data (source)/ Scale	Objectives	TFP estimation	Major findings on manufacturing TFP growth
Mai et al. (2018)	2011–2015	Firm-level data (SME)/ 16 manufacturing industries in 1996 and 17 in 2001	Assessing impact of investment climate on TFP	Levinsohn and Petrin	Not reporting
Newman et al. (2015)	2009–2012	Firm-level data (VES & TCS)/ 14 manufacturing industries	Estimating average productivity for each sector and the growth trajectory for the 2008–2012 period	Wooldridge, Olley and Pakes, and OLS	- Sectors experiencing declines in productivity growth include food products and beverages, wood and wood products, printing and production of recorded media, chemicals and chemical products and pharmaceuticals, etc, other non-metallic mineral products, and basic and fabricated metals - Sectors experiencing the fastest productivity growth include leather and related products, rubber and plastics, and furniture
Ngo and Nguyen (2020)	2010–2015	Firm-level data (VES)/ 20 manufacturing industries	Examining linkage between trade and productivity growth	Ackerberg, Caves and Frazer (modification to Levinsohn and Petrin)	- The best performing sectors are apparel, leather and related products, group of other manufacturing sectors, furniture, computer, electronic, and optical products, and fabricated metal products sectors - The worst-performing sectors are motor vehicles, trailers, and semi-trailers, beverages, chemicals and chemical products, electrical equipment, and food products

Research (year)	Period	Primary data (source)/ Scale	Objectives	TFP estimation	Major findings on manufacturing TFP growth
Nguyen (2017)	2000–2010	Firm-level data (VES)/ 17 manufacturing industries	Comparing annual growth rates of TFP by region, sector, and reform phases (2000–2005 and 2006–2010)	Wooldridge, Petrin and Levinsohn	- TFP gaps have narrowed in the second phase relative to the first phase - TFP growth rates were uneven by industrial sector and geographic region over time
Ni et al. (2017)	2002–2011	Firm-level data (VES)/ Whole economy grouping into 42 groups	Analysing productivity effects associated with FDI	Stochastic frontier and Olley and Pakes	Not reporting
Pham (2015)	2002–2008	Firm-level data from the World Bank Enterprise Survey/ 16 manufacturing industries	Examining causality between export participation and firm productivity	Levinsohn and Petrin and OLS	Not reporting
Thangavelu et al. (2010)	2002–2008	Firm-level data (VES)/ Whole economy	Analysing productivity effects associated with FDI and financial characteristics	Levinsohn and Petrin	Not reporting
Tran (2011)	2000–2005	Firm-level data (VES)/ Whole economy, distinguishing between agriculture, manufacturing, and services and between FDI and domestic owned firms	Analysing productivity effects associated with FDI	Stochastic frontier	The productivity change during 2001–2005 is considerably contributed by the application of new technology rather than the efficiency improvement or scale effects
Tran et al. (2009)	1996–2001	Firm-level data (SME)/ 16 manufacturing industries in 1996 and 17 in 2001	Decomposing the contribution of productivity, prices and firm size to a firm's value-added	Value-added TFP (VATFP) index	The productivity performance of SMEs in Vietnam during 1996–2001 is very low; Firms in 1996 have higher VATFP indexes than those in 2001

Source: Author's compilation

Appendix 3-2 Deflating performance variables

Performance indicators (gross output, capital stock, wages, intermediate inputs, and value-added) are converted to real values (at 2010 prices), using deflators (price indices) constructed at the 2-digit level of the VSIC 2007:

- Gross output is deflated by the output price indices (Table A-1). The output price indices are computed by taking the industrial output value at current prices divided by the industrial output value at 2010 constant prices.
- The capital stock is deflated by the gross domestic capital deflators (Table A-2). The gross domestic capital deflators are computed by dividing the value of gross fixed capital formation at current prices by that at 2010 constant prices.
- Wages are deflated by the consumer price indices (CPI) at 2010 constant prices (Table A-3).
- Intermediate inputs are deflated by the input price indices (Table A-4). Since the output of one industry is the input of another industry, the deflators for intermediate input (input price indices) of industry j are the weighted averages of the output price indices of industries i, in which the weights are the cost coefficients extracted from the input-output (IO) table of 2012 published by the GSO. The general formula for the input price indices is as follows:

$$P_{ij}^{input} = \sum_{i} a_{ij} P_i^{output}$$

where P_{ij} is the price index of all intermediate inputs i for the industry j. P_i is the output price index of industry i, which provides the intermediate input i for industry j. a_{ij} are the weights for output price indices of industry i, which are the cost coefficients of the intermediate input i for the industry j. The cost coefficients of intermediate inputs are

extracted from the IO table of 2012. The industries in the IO table are aggregated at the 2-digit level of the VSIC 2007. Then, each sector's input shares at the 2-digit level of the VSIC 2007 are computed based on the IO table.

- Real value-added is derived by deducting the real intermediate inputs from the real gross output. This method is called the 'double deflator' method, which involves using separate deflators for gross output and intermediate inputs. There is evidence that reforms have significantly altered the relative prices of gross manufacturing output and material inputs. Therefore, it is important to use separate price indices to deflate output and material inputs instead of directly converting nominal value-added into real-term based on the mistaken assumption of "fixed relative prices" (Jefferson, Rawski, Li, & Yuxin, 2000, p.791).

Table A-1 Output price indices, year 2010=100

VSIC	Manufacturing industries	2006	2007	2008	2009	2011	2012	2013	2014	2015	2016	2017
10	Food products	60.9	65.3	80.0	88.0	120.6	125.3	129.7	133.5	132.2	133.5	136.3
11	Beverage	61.7	66.2	81.1	93.2	107.2	109.5	112.4	114.4	118.8	122.1	124.3
13	Textiles	75.3	77.7	87.2	87.5	124.7	134.8	135.7	136.3	134.8	135.0	135.4
14	Apparel	77.9	79.4	88.4	94.2	111.8	124.8	132.7	141.8	147.8	155.8	155.0
15	Leather and related products	62.2	60.5	74.2	88.9	117.4	128.1	138.3	143.1	145.9	152.5	156.8
16	Wood, banjo, species of bamboo	56.9	64.7	81.3	90.6	112.1	120.3	124.9	129.0	131.4	133.1	136.8
17	Paper and paper products	47.4	54.4	85.0	94.5	111.5	123.1	124.6	126.0	127.8	130.2	128.8
18	Printing and service activities related to printing	43.9	46.8	72.3	93.3	107.2	121.3	128.3	136.0	143.3	140.4	139.6
20	Chemical	58.3	62.0	85.8	93.1	119.3	120.6	124.6	125.9	126.6	125.3	126.0
21	Manufacture of pharmaceuticals, medicinal chemicals and botanical products	45.5	48.3	66.9	86.4	115.9	112.1	114.1	117.6	121.0	121.1	121.9
22	Rubber, plastic products	75.3	73.1	85.8	89.5	117.9	127.3	128.0	129.2	128.3	128.3	131.1
23	Non-metal products	73.6	75.8	87.6	94.2	119.4	119.1	121.3	122.3	124.0	124.7	125.5
24	Metal	63.6	73.7	98.6	91.0	120.5	118.3	119.4	116.8	113.8	109.1	120.5
25	Fabricated metal products	75.2	80.6	98.6	91.0	120.5	118.3	119.4	116.8	113.8	109.1	120.5
26	Machinery and equipment (instruments)	105.0	104.0	102.0	100	101.2	109.5	113.6	113.5	113.2	111.4	110.2
27	Electrical equipment (machinery and apparatus)	72.6	75.5	90.2	84.9	122.6	118.7	119.1	118.7	117.3	113.3	117.0
28	Machinery and equipment n.e.c	72.3	75.2	91.2	96.4	108.1	105.3	112.6	114.9	115.9	116.9	117.6
29	Trailer and motor vehicles	97.9	97.2	95.2	100.0	107.7	106.2	105.5	105.1	104.2	103.3	103.1
30	Other transport means	74.1	78.3	90.0	99.7	103.3	107.1	114.8	119.1	120.7	120.1	120.4
31	Wardrobe, table, chair products	67.3	71.1	84.6	91.5	113.3	114.3	135.7	149.7	150.1	151.9	153.5

Source: Author’s calculation from GSO

Table A-2 Gross domestic capital deflators, year 2010=100

Year	Capital deflators
2006	73.5
2007	77.8
2008	88.0
2009	96.4
2011	114.8
2012	118.7
2013	121.7
2014	123.3
2015	124.2
2016	116.5
2017	118.1

Source: Author's calculation from GSO

Table A-3 Consumer price indices (CPI), year 2010=100

Year	CPI
2006	64.3
2007	69.7
2008	85.7
2009	91.6
2011	118.6
2012	129.5
2013	138.0
2014	143.7
2015	144.6
2016	148.4
2017	153.8

Source: Author's calculation from GSO

Table A-4 Input price indices, year 2010=100

VSIC	Manufacturing industries	2006	2007	2008	2009	2011	2012	2013	2014	2015	2016	2017
10	Food products	56.6	62.8	82.7	88.0	126.5	128.0	130.9	136.2	135.8	137.8	139.5
11	Beverage	60.9	66.8	85.4	89.3	120.5	124.7	128.4	131.4	130.5	130.4	135.4
13	Textiles	69.0	72.1	86.0	89.1	122.7	130.5	133.4	135.2	134.7	134.9	136.4
14	Apparel	73.0	75.9	86.7	88.6	122.6	132.5	135.2	137.3	136.8	137.9	139.1
15	Leather and related products	66.0	66.8	80.9	89.4	118.9	128.3	134.9	138.2	139.5	142.6	146.2
16	Wood, banjo, species of bamboo	56.0	63.0	83.4	88.7	123.9	126.4	129.3	134.5	134.8	136.5	138.6
17	Paper and paper products	54.9	60.7	84.3	92.2	115.2	125.2	129.0	132.0	133.1	134.7	136.4
18	Printing and service activities related to printing	57.5	62.5	84.6	92.3	115.7	125.6	129.7	132.6	134.1	135.6	137.2
20	Chemical	58.0	63.0	82.8	88.5	122.2	130.0	135.6	140.4	137.4	135.3	139.8
21	Manufacture of pharmaceuticals, medicinal chemicals and botanical products	52.3	55.9	74.3	88.0	117.8	118.7	122.3	126.2	128.3	128.9	130.9
22	Rubber, plastic products	63.4	66.3	85.6	91.1	119.5	124.3	128.1	130.3	130.3	129.7	132.3
23	Non-metal products	59.2	65.0	79.2	84.0	123.7	138.5	146.1	154.3	146.3	141.5	150.4
24	Metal	64.1	72.4	93.4	89.0	121.2	123.4	126.4	126.8	122.7	118.2	128.9
25	Fabricated metal products	65.9	73.6	94.8	90.5	120.4	121.1	123.7	123.1	120.5	117.0	126.9
26	Machinery and equipment (instruments)	93.5	94.4	98.1	97.1	106.6	114.0	118.2	118.7	118.5	117.3	118.2
27	Electrical equipment (machinery and apparatus)	69.3	74.7	92.8	89.0	120.8	120.5	122.4	122.0	120.4	117.3	124.5
28	Machinery and equipment n.e.c	73.9	78.1	93.8	93.2	114.3	114.4	118.9	119.4	118.6	117.2	122.4
29	Trailer and motor vehicles	72.4	76.9	90.3	96.2	109.2	112.9	119.8	123.4	123.9	123.2	126.2
30	Other transport means	70.0	74.6	89.9	92.5	115.2	119.4	124.3	126.5	126.3	125.3	130.2
31	Wardrobe, table, chair products	58.8	65.2	84.6	89.8	120.7	124.2	128.2	132.5	133.2	134.3	137.5

Source: Author’s calculation from GSO

Appendix 3-3 Summary statistics for 2-digit manufacturing sectors

Variable	Obs	Mean	Std. Dev.	Min	Max	Variable	Obs	Mean	Std. Dev.	Min	Max
10: Food products						22: Rubber, plastic products					
Value-added	25800	7.25	2.21	-1.34	16.34	Value-added	16147	7.21	1.94	-1.18	13.79
Capital	25800	8.07	2.19	-0.14	16.22	Capital	16147	8.29	2.07	0.56	15.77
Labour	25800	3.51	1.63	0.00	9.79	Labour	16147	3.39	1.50	0.00	8.40
Input	25800	9.15	2.66	-17.09	17.33	Input	16147	9.01	2.11	-0.78	15.89
11: Beverages						23: Other non-metallic mineral products					
Value-added	6006	5.64	2.24	-0.50	15.99	Value-added	17056	7.42	1.93	-1.09	14.45
Capital	6006	6.68	2.18	-0.14	15.78	Capital	17056	8.28	2.05	0.96	16.29
Labour	6006	2.22	1.39	0.00	8.39	Labour	17056	3.62	1.35	0.00	8.31
Input	6006	6.34	2.70	-1.88	16.87	Input	17056	8.34	2.09	-1.58	15.47
13: Textiles						24: Basic metals					
Value-added	9112	7.13	2.11	-3.14	14.88	Value-added	3536	7.50	2.02	0.30	15.60
Capital	9112	8.16	2.36	-0.44	16.78	Capital	3536	8.25	2.20	1.47	16.01
Labour	9112	3.65	1.66	0.00	8.85	Labour	3536	3.32	1.33	0.00	8.94
Input	9112	8.72	2.40	-2.57	16.57	Input	3536	9.38	2.24	1.39	16.36
14: Apparel						25: Fabricated metal products					
Value-added	20192	7.72	2.20	-1.42	14.07	Value-added	36254	6.57	1.73	-4.01	15.27
Capital	20192	7.59	2.28	-0.14	15.42	Capital	36254	7.04	1.93	-0.39	15.45
Labour	20192	4.42	1.97	0.00	9.87	Labour	36254	2.69	1.25	0.00	8.79
Input	20192	8.16	2.23	-1.93	15.43	Input	36254	7.99	2.03	-2.51	17.48
15: Leather and related products						26: Computer, electronic, and optical products					
Value-added	6212	8.32	2.39	-0.94	14.92	Value-added	3796	8.72	2.63	-1.52	18.36
Capital	6212	8.32	2.55	0.25	16.53	Capital	3796	9.11	2.80	0.48	18.47
Labour	6212	4.91	2.19	0.00	10.46	Labour	3796	4.45	2.02	0.00	11.11
Input	6212	8.97	2.43	-0.25	15.92	Input	3796	9.88	2.77	-1.09	19.87
16: Wood and products of wood						27: Electrical equipment					
Value-added	17503	6.43	1.63	-2.24	13.53	Value-added	5018	7.90	2.26	0.77	14.54
Capital	17503	6.98	1.81	-0.83	14.14	Capital	5018	8.45	2.45	0.56	14.83
Labour	17503	2.96	1.24	0.00	8.08	Labour	5018	3.78	1.75	0.00	9.47
Input	17503	7.93	2.01	-2.60	14.49	Input	5018	9.62	2.46	-0.02	16.64

Variable	Obs	Mean	Std. Dev.	Min	Max	Variable	Obs	Mean	Std. Dev.	Min	Max
17: Paper and paper products						28: Unclassified machines, equipment					
Value-added	9121	7.40	1.75	-1.78	14.95	Value-added	5664	7.16	1.79	0.36	15.18
Capital	9121	8.23	1.98	-0.14	15.85	Capital	5664	7.51	2.03	0.73	15.54
Labour	9121	3.40	1.35	0.00	8.11	Labour	5664	3.10	1.35	0.00	8.82
Input	9121	9.10	1.96	-1.49	15.15	Input	5664	8.62	1.98	-2.47	15.75
18: Printing and reproduction of recorded media						29: Motor vehicles, trailers, and semi-trailers					
Value-added	13122	6.01	1.72	-4.65	13.21	Value-added	1820	9.34	2.52	1.25	16.27
Capital	13122	6.64	1.79	-2.47	13.64	Capital	1820	9.91	2.44	2.34	17.37
Labour	13122	2.30	1.24	0.00	7.07	Labour	1820	4.54	1.77	0.00	9.92
Input	13122	7.19	1.89	-2.56	14.10	Input	1820	10.62	2.50	1.32	17.02
20: Chemical and chemical products						30: Other transport equipment					
Value-added	9304	7.43	2.22	-0.02	15.58	Value-added	2586	7.92	2.40	0.80	16.84
Capital	9304	7.85	2.20	0.25	16.29	Capital	2586	8.58	2.59	0.79	16.34
Labour	9304	3.09	1.43	0.00	8.12	Labour	2586	3.95	1.71	0.00	9.20
Input	9304	8.85	2.45	-1.52	16.63	Input	2586	9.29	2.56	0.47	17.74
21: Pharmaceuticals, medicinal chemicals, etc						31: Furniture					
Value-added	1813	8.83	2.29	2.00	14.32	Value-added	11510	6.81	2.05	-5.14	13.08
Capital	1813	9.26	2.29	-0.14	13.99	Capital	11510	7.47	2.14	0.57	14.54
Labour	1813	4.26	1.58	0.00	8.06	Labour	11510	3.64	1.74	0.00	8.98
Input	1813	9.97	2.39	1.57	15.29	Input	11510	8.33	2.26	-1.49	14.48

Notes: Mean is single average; Std. Dev. is standard deviation; Value-added, capital, labour, and input are the logarithmic transformation of their real value.

Source: Data compiled from VES 2006–2017

Appendix 3-4 Summary statistics on enterprises according to ownership form

Year	SOE	PDE	FOF	JV-SOE	JV-PDE	Total
2006	374	5,931	777	84	68	7,234
2007	409	9,552	1,127	88	109	11,285
2008	436	13,962	1,488	101	120	16,107
2009	426	9,134	1,716	102	149	11,527
2010	399	14,135	1,930	100	161	16,725
2011	374	15,762	2,201	96	170	18,603
2012	366	18,491	2,322	74	174	21,427
2013	355	18,555	2,510	68	188	21,676
2014	339	19,613	2,756	65	198	22,971
2015	303	21,553	3,067	57	227	25,207
2016	257	19,979	3,566	52	259	24,113
2017	216	20,315	3,860	50	255	24,696
Total	4,254	186,982	27,320	937	2,078	**221,571**

Source: Data compiled from VES 2006-2017

Chapter 4 Manufacturing productivity and firm ownership

Abstract

This chapter examines the relationship between firm ownership and industrial productivity in Vietnam. Using a new establishment-level panel dataset over the period 2006 to 2017, the analysis indicates that transformation of the ownership structure has significantly contributed to improvement of the manufacturing sector productivity. Firstly, the productivity of fully owned foreign firms is markedly higher than that of joint ventures, supporting the view that relaxing ownership restrictions on foreign direct investment has been instrumental in improving manufacturing productivity. Secondly, state-owned enterprises (SOEs) and joint-ventures with SOEs (JV-SOEs) are at the bottom of the productivity ranking by ownership type, implying that partial divestiture of SOEs through forming joint ventures is not immune to various productivity-retarding factors affecting SOEs. Thirdly, the better performance of JV-PDEs compared to JV-SOEs implies that the choice between the state and private entrepreneurs as joint-venture partners is essential in determining the productivity of joint venture operation of foreign-invested enterprises in Vietnam.

4.1 Introduction

The role of firm ownership in industrial performance is a subject of interest in many areas of economics and business studies. The subject has gained added impetus in recent decades, especially in the context of economic transition in the former socialist countries (Brown, Earle, & Telegdy, 2006). Unshackling the private sector from state dominance is central to the move from plan to market in many transition economies (Havrylyshyn & McGettigan, 1999). However, reflecting socio-economic resistance and strong vested interests, not only the timing and sequencing of these reforms, but also the choice of ownership modes in the divestiture of SOEs, have varied significantly among these countries. In most transition economies, SOEs and private domestic enterprises (PDEs) operate side by side with fully owned foreign firms (FOFs) and joint ventures with SOEs and PDEs, with different degrees of ownership among them. Understanding differences in performance among diverse ownership groups is vital for analysing the overall performance of the manufacturing sector and informing the debate on further reforms.

Early literature on the ownership–productivity nexus has focused chiefly on the difference among SOEs, public and private sector firms, and/or subsidiaries of multinational enterprises (MNEs) and domestic firms (both SOEs and PDEs) (Ehrlich, Gallais-hamonno, Liu, & Lutter, 1994; Görg & Greenaway, 2004; Griliches & Regevc, 1995; Haskel, Pereira, & Slaughter, 2007). The advent of transition economies calls for extending the analysis to account for ownership patterns' hybrid nature. However, the lack of good-quality firm and plant-level data has been a severe impediment for researchers to meet their quest for knowledge (Asaftei, Kumbhakar, & Mantescu, 2008; Chang, Chung, & Moon, 2013; Jefferson et al., 2000; Jindra, Giroud, & Scott-kennel, 2009; Konings, 1997).

The gradual transition from plan to market, commencing with the renovation reforms (Doi Moi) announced in 1986, has dramatically transformed Vietnamese manufacturing ownership over the past three decades (discussed in Chapter 2). On the one hand, Vietnam has actively opened the economy to foreign direct investment (FDI), resulting in an expansion of foreign-invested enterprises (FIEs) in the economy. The relaxation of ownership restrictions on FDI, in which FIEs have not been forced into joint ventures (JVs) with the state sector, has contributed to a diversity of foreign ownership structures. On the other hand, Vietnam has removed most restrictions on establishing PDEs and accelerated privatisation since 2006, leading to a significant increase in the share of PDEs among all ownership forms. Vietnam has also committed to preserving the dominant role of SOEs in the economy. As a result, similar to other transition economies, the market economy of Vietnam has been characterised by a mix of different types of ownership.

The notable ownership transition, coupled with the availability of establishment-level data from a comprehensive annual manufacturing survey covering a period of sufficient length, makes Vietnam an ideal case study for this subject. The studies of Ramstetter and Phan (2013),

and Le, Pieri, and Znomotto (2019), are some of the most recent studies on the Vietnamese experience with ownership transition and industrial productivity. Ramstetter and Phan (2013), using the establishment-level data from 2000 to 2006, show that the level of total factor productivity (TFP) of both FIEs and SOEs is higher than that of PDEs. In this analysis, SOEs and JV-SOEs have been lumped together under SOEs coverage. Le, Pieri, and Znomotto (2019) examine the role of ownership on firms' TFP from 2001 to 2011, showing that both FIEs and SOEs have performed better than PDEs in terms of TFP levels. In this study, the authors group both FOFs and JVs into FIEs. These ways of grouping may lead to biased effects of ownership structure on industrial productivity, given the hybrid nature of the ownership structure in Vietnam's manufacturing.

This chapter aims to examine the role of ownership on productivity of the manufacturing sector using an establishment-level panel dataset over the period 2006 to 2017. The contributions of this analysis are threefold. Firstly, it contributes to the current literature on firm ownership and industrial productivity in transition economies, drawing on the experience of Vietnam. Secondly, this chapter fills the gap in current literature by capturing the hybrid nature of ownership structure. I distinguish between fully SOEs and JV-SOEs as well as between FOFs and JVs with local firms. Thirdly, the analysis is based on a newly constructed dataset covering recent years (2006–2017). This time coverage helps us better capture structural changes resulting from the new phase of ownership structure in the second half of the 2000s.

There are several methodological improvements in measuring firms' TFP. For calculating real value-added (output), I use the double deflator method, which considers differences in price movements of final goods and intermediate inputs. There is evidence that reforms have significantly altered the relative prices of gross manufacturing output and material inputs. Therefore, it is essential to use separate price indices to deflate output and material inputs

instead of directly converting nominal value-added into real-term, based on the mistaken assumption of fixed relative prices. I use the generalised method of moments proposed by Ackerberg, Caves, and Frazer (2015) to estimate TFP. This method has the advantage of addressing identification issues involved in the other methodology commonly used in previous studies. Finally, deviating from the standard practice of estimating firm-level productivity based on a production function estimated by pooling all firms, I estimate the production function at the 2-digit level of the Vietnamese Standard Industrial Classification (VSIC) to allow for differences in technologies.

The results show that the transformation of ownership structure brought about by reforms over the past three decades has contributed significantly to improving the productivity of Vietnamese manufacturing. The productivity of FOFs is significantly higher than that of JV-PDEs, supporting the hypothesis that relaxing ownership restrictions on FDI has helped improve manufacturing productivity. Both SOEs and JV-SOEs have been recorded at the bottom of the productivity ranking by ownership mode. This comparison suggests that the choice between state and private entrepreneurs is essential in determining the productivity implications of joint venture operation of MNEs: state sector joint ventures are not immune to various productivity-retarding factors affecting SOEs.

The chapter proceeds as follows. Section 4.2 briefly discusses the analytics underpinning the ensuing inquiry into productivity differentials by ownership. This section is followed by model specifications, data sources, and estimation methods for the empirical analysis of productivity and firm ownership nexus. In Section 4.4, I present and discuss the regression findings of the analysis. Section 4.5 re-estimates the empirical model with alternative control variables, different subsamples, and various estimators for robustness checks. The concluding section summarises the main results and makes suggestions for further research.

4.2 Relationship between firm ownership and productivity

Firms with different ownership structures may differ in their technological capabilities, management knowledge, and incentive mechanisms, resulting in significant differences in productivity. This section briefly reviews the literature regarding the relationship between ownership structure and firm productivity.

The dominant model of the effect of public ownership on firm performance is the public choice or property right model (Boardman & Vining, 1989; Toninelli, 2000). According to this model, the property rights structures have significant effects on patterns of incentives. The owners of PDEs have the right to alter the form, place, or use of their property; thus, they have incentives to monitor managerial behaviour to ensure efficiency. By contrast, SOEs' ownership rights, which belong to the state, are non-transferable. Limits to transferability reduce the owner's incentives to monitor management's behaviour, leading to SOEs being less efficient and less profitable than PDEs (De Alessi, 1983).

Another important theory of the firm related to public ownership's effects on firm performance is agency theory (Jensen & Meckling, 1976). According to this theory, there are conflicts of interests between principals (the state) and agents (SOE managers and employees working for the state). While the agents have little incentive to strive for higher economic efficiency, the principals are likely to intervene in the enterprise's decision-making process. The intervention, which is rooted in nonmarket objectives, hinders SOEs' profitable operation. Partial divestiture of the state-owned industries in the process of economic transition could help perpetuate the 'agency problem' (Kornai, Maskin, & Roland, 2003; Roland, 2002; Schaffer, 1998). Economic reforms have not been synonymous with elimination of state intervention in enterprise decision making, which is a *sine qua non* for productivity improvement.

The performance of SOEs can also be linked to a well-known phenomenon called ‘soft budget constraint’, which appears when the government provides budgetary supports to cushion SOEs from competitive pressure (Kornai, 1986). SOEs have few concerns about efficiency because the government supports them through various channels, such as financing from state-owned banks and subsidies from different government agencies. The ‘soft budget constraint’ helps SOEs survive and enables them to engage in anti-competitive behaviour. The problem of the SOEs’ chronic soft budget constraint not only occurs in central planning but also persists during the period of market transition (Kornai et al., 2003).

The performances of SOEs and their joint-venture operations are also subject to ‘state capture’, which refers to the phenomenon where private agents use illicit and non-transparent methods to shape the development and implementation of reform programs (Hellman & Schankerman, 2000). The SOE sector’s performance can be enhanced through good governance, such as privatisation. However, if the privatisation method exacerbates the power of concentrated vested interests, it may impose severe impacts on subsequent institutional and regulatory developments that underpin good governance. Privatisation and other institutional reforms will effectively improve the performance of SOEs if these reforms constrain state capture by private interests (Hellman & Schankerman, 2000).

FIEs (MNE subsidiaries) tend to be relatively more efficient than other firms in a given host country. They possess intangible assets such as patents and other fruits of R&D, management know-how, and marketing resources. These intangible assets give FIEs a competitive advantage over domestic firms (Blomström & Kokko, 1997). Moreover, FIEs probably have the potential to avoid inefficiencies of small-scale operations more often than their rivals. This is because the subsidiaries can be free of the bondage of capital rationing, thanks to internally generated funds supplied by parent companies (Caves, 1974).

The ownership type JVs could be less productive than FOFs (Dimelis & Louri, 2002). A parent company has a greater incentive to transfer advanced technology if it has more significant control over its subsidiaries. Therefore, FOFs are likely to receive the most leading technology from their parent company. By contrast, the possibility that local partners can use knowledge-based assets of the parent company in the future encourages the parent company to transfer older and perhaps less efficient technology to its JVs. The FOFs, receiving more advanced technology from parent companies than JVs, are likely to operate more efficiently than JVs.

The performance difference between JV-SOEs and JV-PDEs in a given country is an empirical issue. On the one hand, JV-SOEs are expected to be more efficient and profitable than JV-PDEs. Having closer ties to governments, like SOEs, JV-SOEs can benefit more from accessing financial subsidies and indirect privileged treatment compared with JV-PDEs (Hoskisson, Eden, Lau, & Wright, 2000). On the other hand, the performance of JV-SOEs can be adversely affected by the productivity-reading factors common to pure SOEs, such as the agency problem, soft budget constraint, and state capture. This could make joint ventures with the state sector less productive compared to their private-sector counterparts.

4.3 Model specifications, data, and estimation methods

4.3.1 Model specifications

Instead of adopting a 1-step procedure in which the determinants of TFP are embodied within the production function, I adopt a 2-step procedure similar to that employed by Le et al. (2019) and Newman et al. (2015). In the first step, I estimate production functions at the 2-digit level (20 industries) using the generalised method of moments of Ackerberg, Caves, and Frazer (2015) (discussed in Chapter 3), and, in the second step, I regress productivity at the establishment level on firms' ownership. The advantage of this approach is that it allows

us to minimise potential estimation bias arising from the estimation of TFP. This is because we can choose the most appropriate method to estimate TFP. In this case, the ACF method – developed from Levinson and Petrin's (2003) and Olley and Pakes' (1996) approaches – can control most of the endogeneity issues in estimation production functions. In addition, in the 2-step procedure, we can estimate production functions for each 2-digit manufacturing sector, to allow for the differences in technology across sectors. As a result, we can obtain a better estimation of TFP.

After estimating TFP using heterogeneous, industry-specific production functions, I empirically analyse the effects of ownership types on TFP using the following estimation equation:

$$lnTFP_{ijt} = \beta_1 Own_{ijt} + \beta_2 X + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt} \quad \text{(Equation 4-1)}$$

where dependent variable $lnTFP_{ijt}$ is the log form of the TFP of firm i in sector j at time t. X is a vector of firm-specific characteristics, such as firm age, size, ownership, location, and sector-specific characteristics, such as market concentration, export orientation, and import dependence. α_i, α_j, and α_t are firm-, sector-, and year-fixed effects, respectively. ε_{ijt} is an error term assumed to be independent of explanatory variables.

The variable ownership (Own_{ijt}) is a firms' ownership dummy variable: SOEs, PDEs (base dummy), FOFs, JV-SOEs, and JV-PDEs. To examine the role of ownership on the productivity of the manufacturing sector, the coefficient β_1 is the key coefficient of interest. Accordingly, the coefficient β_1 captures the productivity differentials across ownership types.

The control variables (X), including firm-specific and sector-specific characteristics, are listed below with the expected sign of the regression coefficients in brackets:

$SIZE$ (+ or -)	Firm-size dummy variables: micro: 0-9 employees; small: 10-49 employees (base dummy); medium: 50-299 employees; and large: more than 300 employees[10]
AGE (+ or -)	Number of years of operation based on the year of entry
GLD (+ or -)	Geographical location dummies: Northeast and Mountainous region (base dummy); Red River Delta; North Central; South Central and Highland; Southeast; and Mekong Delta
EOR (+)	Export orientations (export-output ratio at 2-digit industry level)
MDR (+)	Import dependence (import-output ratio at 2-digit industry level)
HHI (+ or -)	Herfindahl-Hirschman Index of industry concentration measured at 2-digit industry level

Among the control variables, firm size ($SIZE$) is included to capture the impact of scale on firms' productivity. Large firms, with key features of diverse capabilities, abilities to exploit economies of scale, and formalisation of procedures, can perform better than smaller firms (Penrose, 1959). However, small firms, with their lean organisational structure, may be more productive than their larger counterparts (Utterback, 1994; Williamson, 1967).

Firm age (AGE) is included to control for the possibility that observed productivity-level differences could be a function of age distribution of the firms being compared. Operating time reflects firms' experience in the market and the learning process that could be either passive or active. Firms with longer operating times are expected to gain much more experience and learn more from the market, which in turn helps them to perform better (Stinchcombe, 2000). However, younger and more agile firms can outperform older ones, thanks to their flexibility in adapting quickly to changing circumstances (Marshall, 1920).

Geographical location dummies (GLD) are included in the model by dividing the firms into six regions of Vietnam: Northeast and Mountainous (base dummy); Red River Delta; North Central; South Central and Highland; Southeast; and Mekong Delta. Given that large historical, institutional, and economic differences persist over time between these areas, it is expected that

[10] In experimental runs, I used firm size measured by the number of variable as a continuous variable, but it was not possible to retain it because of high multicellularity.

firms' productivity is different across these regions. Of these six regions, South Vietnam (such as Southeast, and Mekong Delta) was under central planning for a much shorter period than those in the North. Presumably, this can have a significant impact on establishment-level productivity differences.

Export-output ratio is used to proxy for the export orientation (EOR) of a sector. Firms operating in export-oriented sectors may experience a sustained increase in productivity, thanks to new knowledge acquisition from overseas buyers (Pack & Saggi, 2001).

Import-output ratio proxies for import dependence (MDR) of a sector. Pavcnik (2002) points out that the domestic prices of import-competing products would be lower, so in order to survive, firms operating in import-dependent industries must remain efficient.

Market concentration – measured using the Herfindahl Hirschman Index (HHI_{jt}) – is included to capture the effects of market power on firms' productivity. Greater competition will pressure firms into adopting new technologies and operating more efficiently (Nickel, 1996). Also, endogenous growth theory postulates that monopoly rent from a low level of competition is invested in R&D, leading to innovation and improvements in TFP (Dixit & Stiglitz, 1977; Grossman & Helpman, 1991b). It has also been shown that, under some conditions, increased competition can lower managers' expected income and, therefore, their effort, which in turn reduces firm efficiency levels. The level of market concentration in industry j at time t is measured using the HHI_{jt}. Following Tirole (1988), I square the percentage share of each firm's output in an industry, and then sum these squares to calculate HHI_{jt}:

$$HHI_{jt} = \sum \left(\frac{y_{ijt}}{y_{jt}} \right)^2$$

where y_{ijt} is the output of firm i in sector j at time t. The Y_{jt} is total output of sector j. The lower the value of HHI_{jt}, the higher the level of a sector's competition.

In estimating Equation 4-1, control variables, including AGE, HHI, EOR, and MDR, are measured in natural logarithms.

4.3.2 Data

Data for all variables, other than the two trade exposure variables (EOR and MDR), are compiled from the unpublished returns to the Vietnamese Enterprise Surveys (VES) conducted annually by the General Statistics Office (GSO) of Vietnam. Data series for EOR and MDR are constructed at the 2-digit level by combining trade data from the UN COMTRADE database and gross manufacturing output data from VES database.

Data from 2006 to 2017 are selected, which corresponds to remarkable policy reforms undertaken since 2006. Notably, the enactment of the unified Law on Investment and Law on Enterprises in 2006, in compliance with WTO commitments, has resulted in a significant structural break in ownership patterns in manufacturing sectors. The chosen period from 2006 is also because the precise lining of firms and the relevant performance variables is not possible for the entire period due to changes in industry code, with effect from 2006. The related information for transforming variables into real terms (at 2010 prices) with the consistent 2-digit level of the VSIC 2007 is only available from 2006.

The VES allows for grouping ownership into five categories of interest. Firstly, SOEs encompass central SOEs, provincial SOEs, central state-owned limited liability companies, provincial state-owned limited liability companies, and shareholding companies with state capital of more than 50 percent charter capital. Secondly, PDEs consist of private enterprises, partnerships, private limited liability companies, shareholding companies without state capital,

and shareholding companies with state capital of less than 50 percent charter capital. The FIEs are separated into FOFs, JV-SOEs, and JV-PDEs. This separation allows for better capturing the hybrid nature of different ownership structures.

The panel data statistics are given in Appendix 4-2. Geographical location dummies are time-invariant variables since they have zero or close to zero within variation. For all the remaining variables, there is variation both across individuals (between variation) and over time (within variation).

Table 4-1 shows the correlation matrix of all independent variables. SOEs are likely older compared to the firms belonging to other ownership groups, given a high degree of correlation between SOE and age variables. In Vietnam, as in many other transition economies, the vintage nature of SOEs has been a result of the political system, past dominating policy views, and a colonialist past (Sjöholm, 2006). Another important point is that FOFs tend to be more export-oriented than other ownership groups given the high degree of correlation between FOF and EOR variables. This is consistent with the current structural shift in Vietnam's manufacturing, where one can observe a significant increase in the entry of FIEs to set up FOFs for export processing within global production networks – GPNs (Athukorala & Nguyen, 2020). In addition, PDEs are likely smaller compared to the firms belonging to other ownership groups, given the high degree of correlation between PDE and micro/small variables. In Vietnam, "… the development of the private sector is almost entirely associated with small and medium sized enterprises (SMEs), or more accurately, small and micro sized enterprises" (Kanaan & Kokko, 2007, p.1). The small size of PDEs in Vietnam can be explained by prolonged discrimination against the private sector and a series of policy challenges preventing PDEs from developing (Rand & Tarp, 2020; T. C. Tran, Le, & Nguyen, 2008). The correlation matrix shows that although these correlations are statistically significant, the correlation coefficients are either low or moderate, which may rule out multicollinearity.

Table 4-1 Correlation matrix of independent variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	SOE	1.00																		
2	PDE	-0.33*	1.00																	
3	FOF	-0.05*	-0.87*	1.00																
4	JV-SOE	-0.01*	-0.15*	-0.02*	1.00															
5	JV-PDE	-0.01*	-0.23*	-0.04*	-0.01	1.00														
6	micro	-0.09*	0.26*	-0.22*	-0.04*	-0.06*	1.00													
7	small	-0.09*	0.17*	-0.14*	-0.04*	-0.30*	-0.49*	1.00												
8	medium	0.07*	-0.19*	0.16*	0.04*	0.06*	-0.35*	-0.43*	1.00											
9	large	0.17*	-0.38*	0.32*	0.07*	0.05*	-0.21*	-0.25*	-0.19*	1.00										
10	lnage	0.19*	-0.20*	0.11*	0.07*	0.04*	-0.35*	-0.03*	0.23*	0.25*	1.00									
11	NTM	0.03*	0.01*	-0.02*	-0.01*	-0.01	-0.03*	0.02*	0.01	0.00	0.01*	1.00								
12	RRD	0.01	0.04*	-0.05*	0.01	-0.01	-0.03*	0.05*	-0.02*	-0.02*	-0.02*	-0.16*	1.00							
13	NC	0.01	0.06*	-0.07*	0.01	-0.01	0.00	0.03*	-0.01	-0.03*	0.00	-0.05*	-0.14*	1.00						
14	SCH	0.02*	0.07*	-0.08*	-0.01	0.00	0.01*	-0.01*	0.00	0.00	0.00	-0.07*	-0.19*	-0.06*	1.00					
15	ST	-0.03*	-0.14*	0.16*	0.01	0.01*	0.04*	-0.08*	0.03*	0.03*	-0.02*	-0.20*	-0.55*	-0.18*	-0.24*	1.00				
16	MKD	-0.01*	0.05*	-0.05*	-0.01*	0.00	-0.01*	0.03*	-0.03*	0.01	0.05*	-0.08*	-0.23*	-0.08*	-0.10*	-0.29*	1.00			
17	lnEOR	-0.04*	-0.12*	0.14*	-0.01	0.03*	-0.17*	-0.05*	0.08*	0.22*	0.02*	-0.02*	-0.05*	-0.04*	-0.01*	0.08*	-0.01*	1.00		
18	lnIOR	-0.01*	-0.05*	0.06*	0.01*	0.02*	-0.06*	0.09*	0.02*	-0.08*	0.04*	0.01*	0.07*	-0.02*	-0.03*	-0.04*	-0.01	0.04*	1.00	
19	lnhhi	0.04*	0.00	-0.02*	0.04*	0.00	0.10*	0.02*	-0.05*	-0.10*	0.01	0.02*	0.07*	0.01*	-0.02*	-0.07*	0.00	-0.35*	0.40*	1.00

Notes: SOE: state-owned enterprise, PDE: private domestic enterprise, FOF: fully owned foreign firm, JV-SOE: joint-venture with state-owned enterprise, and JV-PDE: joint-venture with private domestic enterprise; NTM: Northeast and Mountainous, RRD: Red River Delta, NC: North Central, SCH: South Central and Highland, ST: Southeast, and MKD: Mekong Delta; * indicates significance at the 1% level after Bonferroni adjustment.

4.3.3 Economic issues and estimation methods

One important estimation issue is omitted variables. There are likely vast firm-, sector-, and time-specific factors affecting ownership that cannot be observed by the econometrician but are observable to the firm. For example, a good management level of domestic enterprises may allow them to merge with FIEs, leading to changes in ownership. Fixed effects (FE) and random effects (RE) estimators are the common methods applied to control for unobservable individual heterogeneity. In this analysis, I use the correlated random effects (CRE)[11] method for estimating Equation 4-1 (details on the CRE method and its alternatives are provided in Appendix 4-1). The CRE approach is a mid-way house between FE and RE estimators, combining both these models' strengths (Schunck & Perales, 2017; Wooldridge, 2019). Similar to the FE estimator, the CRE approach provides within estimates by subtracting the cluster mean of time-variant variables. Moreover, similar to the RE estimators, the CRE approach can estimate the effects of time-invariant variables without restrictive assumptions of the absence of correlation between the unobserved heterogeneity term and other explanatory variables. The coefficients on the time-invariant variables (geographical location dummies) are estimated like those in a standard RE regression model. In addition, full sets of sector- and time-fixed effects are included to control for sector- and time-specific factors.

One potential econometric issue is the reverse causality between ownership and domestic firms' productivity. In the productivity–ownership nexus, arguably, causality may not necessarily go from the latter to former. For instance, private firms with low productivity may be more likely to come under state ownership for political reasons. Alternatively, the more efficient SOEs are privatised first to make the privatisation strategy more active to the private

[11] The CRE model is sometimes called the Mundlak (1978) model and is mathematically equivalent to the hybrid model (Schunck & Perales, 2017).

sectors. Accounting for this potential endogeneity, I replace the explanatory variables with their one-year lagged values. A one-year lag of ownership variable also enables us to observe the effects of ownership changes on firm's productivity.

4.4 Estimation results and discussions

This section discusses findings on the relationship between firm ownership and industrial productivity using the CRE estimate and one-year lag of ownership variables (Table 4-2).[12] Alternative RE and FE estimates are given in Appendix 4-3 for comparison. The results for the model in which only the ownership variables enter as the explanatory variables are reported in column (1). The results for the full model are reported in column (2). The last column expands the full model by including two interaction terms: between SOE and age variables ($SOE * AGE$) and between FOF and export orientations variables ($FOF * EOR$). On the one hand, the interaction term $SOE * AGE$ is included to examine the vintage effect on the productivity of SOEs. On the other hand, the interaction term $FOF * EOR$ is included to capture the productivity impact of structural shift, in which FOFs tend to export processing within GPNs.

Table 4-2 Total factor productivity in Vietnamese manufacturing: CRE estimates

Dependent variable: Log TFP	(1)	(2)	(3)
Ownership (with PDE as the base dummy)			
L.SOE	0.091**	0.038	0.0135
	(0.028)	(0.028)	(0.033)
L.FOF	0.179***	0.156**	0.140**
	(0.048)	(0.048)	(0.048)
L.JV-SOE	0.126*	0.068	0.080
	(0.062)	(0.061)	(0.061)
L.JV-PDE	0.154**	0.124**	0.127*
	(0.050)	(0.047)	(0.050)
Log Age		0.182***	0.182***

[12] All specifications are estimated using the $xthybrid$ command with the cre option. In the CRE output, variables with the W prefix denote within-effects and variables with the R prefix are those for which their effects are estimated the same as those in a standard RE model. This analysis reports the within-effects for all variables, except for the geographical location dummies.

		(0.012)	(0.012)
Plant-size dummies (with Small as the base dummy)			
Micro		-0.179***	-0.179***
		(0.008)	(0.008)
Medium		0.093***	0.094***
		(0.008)	(0.008)
Large		0.101***	0.102***
		(0.015)	(0.016)
Regional dummies (with Northeast and Mountainous as base dummy)			
Red River Delta		0.155***	0.142***
		(0.019)	(0.019)
North Central		-0.058*	-0.063*
		(0.026)	(0.026)
South Central and Highland		0.028	0.014
		(0.022)	(0.023)
Southeast		0.406***	0.387***
		(0.019)	(0.019)
Mekong Delta		0.154***	0.147***
		(0.022)	(0.021)
Log Export orientation (EOR)		0.352***	0.360***
		(0.012)	(0.012)
Log Import dependence (MDR)		0.176***	0.175***
		(0.013)	(0.013)
Log Herfindahl-Hirschman Index (HHI)		-0.035***	-0.032***
		(0.004)	(0.005)
FOF*EOR			-0.055**
			(0.018)
SOE*AGE			0.014
			(0.012)
Constant	4.840***	5.888***	5.889***
	(0.0210)	(0.077)	(0.076)
Observations (N)	154317	154317	154317
AIC	360395	346597	345639
BIC	361081	347472	346554

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies; All regressions include sector fixed effects and year fixed effects; AIC: Akaike information criterion; BIC: Bayesian information criterion. These are standard alternative measures of overall explanatory power of maximum likelihood estimate of the model – when comparing alternative specification of the model, smaller values of AIC and BIC indicate better overall explanatory power.

As reported in column (1), all four ownership variables' coefficients are positive and statistically significant at the 5 percent level or better. However, the magnitude ('economic'

significance) of SOE and JV-SOE coefficients is smaller than that of the other two ownership categories. This result is consistent with the relatively low productivity performance of SOEs and JV-SOEs, by viewing the productivity estimates in Chapter 3.

The statistical significance of SOE and JV-SOE coefficients disappears in the full model, as reported in column (2). This result suggests that, when factors commonly affecting productivity performance across all firms regardless of the particular ownership model are appropriately controlled for, the productivity of both types of firms is not significantly different from that of PDEs. This is in contrast with the theory arguing that SOEs and their joint ventures should be less productive relative to PDEs. However, the result is similar to that of Huang and Yang (2016), confirming that there is no significant productivity gap between SOEs and PDEs. This can be explained by the Vietnamese government's attitude toward privatisation: of which targets are SOEs operating inefficiently and in the non-essential industries (pages 26-29). As a result, privatised firms are probably less productive than incumbents, leading to an insignificant result. Another possible reason is that the tremendous number of new entrants with lower productivity has lowered the productivity performance of PDEs (Huang & Yang, 2016). Therefore, the evidence favouring PDEs over SOEs is inconclusive.

In addition, column (2) shows that coefficients on the FOF and JV-PDE variables are significantly positive, implying that FOFs and JV-PDEs outperform their domestic counterparts. This finding is strongly supported by the theory that: foreign firms tend to be more advanced in technology and management, thus, might have higher productivity levels. The finding is also consistent with most studies on productivity differentials across firms' ownership in Vietnam; for example, Huang and Yang (2016), Le et al. (2019), and Ramstetter and Phan (2013). They found that the estimated coefficients on the FIE variable are always significantly positive even after controlling for firm-specific and other factors.

The results in column (2) also show that, both FOFs and JV-PDEs stand out for higher productivity performance. The coefficient of the former (0.156) is larger than that of the latter (0.124) (and the two coefficients fall well beyond two standard error bands), supporting the hypothesis that FOFs are characterised by higher manufacturing productivity compared to their joint-venture counterparts. Additionally, the fact that the JV-SOE coefficients are statistically insignificant while those of JV-PDE are significant and much larger suggests that the choice between the state and private entrepreneurs as joint-venture partners is essential in determining the productivity of joint venture operations of FIEs. This result is consistent with our analytical prior that JV-SOEs are not immune to various productivity-retarding factors affecting SOEs in general.

In column (3), the coefficient of $SOE * AGE$ is not statistically different from zero, suggesting that SOEs' productivity is not susceptible to the vintage effect. In addition, the coefficient of $FOF * EOR$ is statistically significant with the negative sign. The results could reflect lower productivity gains at the formative stage of engagement in simple assembly processes within GPNs. This is an interesting issue that deserves further investigation.

Besides firm ownership, some other firm-specific characteristics are behind the productivity gains of the manufacturing sector. First, firm size plays an important role in determining TFP. Relative to the small-sized firms (10-49 workers), firms of larger sizes have higher TFP. Specifically, large-sized firms (more than 300 workers) are the most productive, followed closely by medium-sized firms (50–299 workers). Micro firms (less than 10 workers) are the least productive. The results are consistent with literature that the larger firms seem to exploit economies of scale, which helps them to operate more efficiently. Second, the results show a positive relationship between age and TFP, supporting the hypothesis that older firms may be more productive due to learning-by-doing and accumulation of capital, technology, and skills.

Some sector-specific characteristics are also behind the productivity gains of the manufacturing sector. First, our findings highlight a positive association between export orientation and firm TFP. The TFP advantage of firms operating in the export-oriented industry may be due to competition with other firms involved in export. Second, the coefficients of import dependence variables display a significant positive sign at a 1 percent level. This finding is also consistent with the view that firms operating in a sector with relative dependence on imports may perform better because of learning from technology embodied in the imports. Third, the estimated coefficients of the competition index (HHI) are statistically significant with negative signs. These results suggest that firms in more competitive industries could obtain higher productivity growth. This is consistent with the theoretical prediction that the increased competition level forces firms to be more efficient to survive in the markets.

Lastly, geographical location plays a significant role in determining manufacturing TFP. The coefficients of Southeast and Mekong Delta (South regions) dummies are highest in the specifications, implying that firms operating in these areas are, on average, the most productive. This can be attributed to the fact that South Vietnam was under central planning for a much shorter period than those regions in the North; thus, South-based firms can enjoy more freedom in doing business than those in other regions. In addition, with as much as 50 percent of the total industry firms and the dominant share of FIEs (Appendix 4-4), the South region is expected to offer its firms significant productivity spillovers. Another important observation from the location coefficients is that firms located in more developed regions are more productive than those in other regions. These include the Red River Delta and Southeast regions, where the two biggest cities, Ho Chi Minh city and Ha Noi capital city, are located, respectively. These two regions offer a more favourable climate and geography, more developed infrastructure, more trained and qualified human resources, and better governance, which presumably contributes to the productivity differences.

4.5 Robustness checks

I run several robustness checks with alternative control variables and different subsamples. First, I use the four-firm concentration ratio[13] ($top4$) as an alternative to HHI, the square of AGE in addition to AGE to test possible non-linearity of the vintage effect (Appendix 4-5). Next, I re-estimate the model after excluding micro-firms from the dataset due to concerns about the quality of data reported by these firms (Appendix 4-6). I also undertake alternative estimation after truncating the time coverage to 2010–2017 to allow for production disruptions during the global financial crisis (2008–2009) (Appendix 4-7). The results are remarkably resilient to these alternative estimates, suggesting that ownership serves as a predetermined variable in our regressions.

Furthermore, to address potential endogeneity issues in the benchmark model – for example, the omitted variable issue and the selection issue – I use alternative estimators. First, I estimate the model using the Hausman-Taylor instrumental variable estimator (HT) (Hausman & Taylor, 1981), aiming to minimise endogeneity by using instruments derived within the model (Appendix 4-8). Second, I check the robustness of the results using the difference-GMM estimator developed by Arellano and Bond (1991) (Appendix 4-9). This approach employs within-firm differencing to control for unobserved and time-invariant firm heterogeneity, together with internal instruments (lag levels) for all endogenous explanatory variables. The results are robust to these alternative estimators.

4.6 Conclusions

This chapter has examined the role of ownership in manufacturing productivity in Vietnam in the context of policy reforms undertaken over the past three decades. The ownership structure

[13] The four-firm concentration ratio is the sum of total sales or the top four firms divided by the industry total.

of Vietnamese manufacturing has undergone a dramatic transformation, thanks to significant opening up of the economy to FDI and relaxing restrictions on domestic private enterprises, notwithstanding the government's commitment to preserving the role of SOEs in the economy.

The analysis results, using an establishment-level panel dataset over the period 2006 to 2017, indicate that transformation of the ownership structure has had significant effects on the productivity of the manufacturing sector. Firstly, the productivity of FOFs is higher than that of JV-PDEs, implying that relaxing ownership restrictions on FDI has helped improve manufacturing productivity. Secondly, both SOEs and JV-SOEs are at the bottom of the productivity ranking by ownership type. The low performance of SOEs is possibly due to various productivity-retarding factors affecting SOEs in Vietnam, such as 'agency problem' and 'soft budget constraint'. Partial divestiture of SOEs through forming joint ventures is not immune to various productivity-retarding factors affecting SOEs in general. Thirdly, JV-PDEs perform better than JV-SOEs, suggesting that the choice between state and private entrepreneurs as joint-venture partners is essential in determining the productivity of joint venture operations of FIEs in Vietnam.

This analysis contributes to the current literature on firm ownership and industrial productivity in transition economies, drawing on the experience of Vietnam. It is expected that the findings may contribute to an intensive debate on the role of FIEs in the transition from a centrally planned economy to a market economy, given their superior productivity performance. However, in assessing national gains from the presence of FIEs in the economy, a crucial issue is the extent to which the productivity generated by FIEs spills over to domestic enterprises. This is an important subject, which is discussed in the next chapter.

Appendix 4-1 RE, FE, hybrid, and CRE models

The RE model is given by

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 c_i + \mu_i + \epsilon_{it} \qquad \text{(A1)}$$

where subscript i denotes firm and t denotes year. x_{it} are time-variant variables and c_i are time-invariant variables. μ_i is random intercept, and ϵ_{it} is iid error. The standard distributional assumption is $\mu_i|x_{it},\ c_i \sim N(0, \sigma_\mu^2)$. The model provides consistent effect estimates if $E(\mu_i|x_{it}, c_i) = 0$.

The FE model is given by subtracting the between model $\bar{y}_i = \beta_0 + \beta_1 \bar{x}_i + \beta_2 c_i + \mu_i + \bar{\epsilon}_i$ from (A1):

$$(y_{it} - \bar{y}_i) = \beta_1 (x_{it} - \bar{x}_i) + (\epsilon_{it} - \bar{\epsilon}_i) \qquad \text{(A2)}$$

The subtraction removes μ_i from the equation. As a result, the model's estimate of β_1 is unbiased even if $E(\mu_i|x_{it}, c_i) \neq 0$. However, the subtraction removes all variables that do not vary over time. FE models therefore cannot estimate the effect of time-invariant variables.

The hybrid model can estimate within-effects in RE models by decomposing time-variant variables into a between ($\bar{x}_i = n_i^{-1} \sum_{t=1}^{n_i} x_{it}$) and a cluster ($x_{it} - \bar{x}_i$) component. The model is given by:

$$y_{it} = \beta_0 + \beta_1 (x_{it} - \bar{x}_i) + \beta_2 c_i + \beta_3 \bar{x}_i + \mu_i + \epsilon_{it} \qquad \text{(A3)}$$

The estimates of β_1 from (A2) and (A3) are identical. As (A3) is a RE model, we can use it to estimate effects of time-invariant variables. However, for the estimate of β_2 to be unbiased, $E(\mu_i|x_{it}, c_i) = 0$ and $\mu_i|x_{it}, c_i \sim N(0, \sigma_\mu^2)$ still have to hold.

The CRE model relaxes the assumption $E(\mu_i|x_{it}, c_i) = 0$ and introduces the assumption $\mu_i = \pi \bar{x}_i + v_i$. Thus, (A1) becomes:

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 c_i + \pi \bar{x}_i + v_i + \epsilon_{it} \qquad \text{(A4)}$$

β_1 from (A4) is identical to the estimate obtained from (A3). However, the estimated effect of $\bar{x}_i$ will differ. In the hybrid model, this is the between effect. In the CRE model, this is the difference of the within and between effects: $\pi = \beta_3 - \beta_1$. This is because (A3) can be rewritten as: $y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 c_i + (\beta_3 - \beta_1)\bar{x}_i + \mu_i + \epsilon_{it}$.

Source: Schunck (2013)

Appendix 4-2 Panel data statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
lnTFP	overall	4.27	1.51	-10.11	13.09	N = 221571
	between		1.31	-5.36	13.09	n = 67254
	within		0.64	-7.06	10.55	T-bar = 3.29
lag_soe	overall	0.02	0.16	0.00	1.00	N = 154317
	between		0.11	0.00	1.00	n = 38953
	within		0.06	-0.88	0.93	T-bar = 3.96
lag_fof	overall	0.14	0.35	0.00	1.00	N = 154317
	between		0.30	0.00	1.00	n = 38953
	within		0.04	-0.77	1.05	T-bar = 3.96
lag_jv_soe	overall	0.01	0.07	0.00	1.00	N = 154317
	between		0.05	0.00	1.00	n = 38953
	within		0.03	-0.90	0.91	T-bar = 3.96
lag_jv_pde	overall	0.01	0.10	0.00	1.00	N = 154317
	between		0.08	0.00	1.00	n = 38953
	within		0.05	-0.90	0.92	T-bar = 3.96
micro	overall	0.29	0.45	0.00	1.00	N = 221571
	between		0.47	0.00	1.00	n = 67254
	within		0.19	-0.63	1.20	T-bar = 3.29
small	overall	0.38	0.48	0.00	1.00	N = 221571
	between		0.43	0.00	1.00	n = 67254
	within		0.25	-0.54	1.29	T-bar = 3.29
medium	overall	0.24	0.43	0.00	1.00	N = 221571
	between		0.32	0.00	1.00	n = 67254
	within		0.21	-0.68	1.15	T-bar = 3.29
large	overall	0.10	0.30	0.00	1.00	N = 221571
	between		0.20	0.00	1.00	n = 67254
	within		0.11	-0.82	1.02	T-bar = 3.29
lnage	overall	1.65	0.90	0.00	4.29	N = 221571
	between		0.84	0.00	4.25	n = 67254
	within		0.35	-0.02	2.47	T-bar = 3.29
NTM	overall	0.05	0.23	0.00	1.00	N = 221571
	between		0.21	0.00	1.00	n = 67254
	within		0.00	0.05	0.05	T-bar = 3.29
RRD	overall	0.30	0.46	0.00	1.00	N = 221571
	between		0.46	0.00	1.00	n = 67254
	within		0.03	-0.61	0.97	T-bar = 3.29
NC	overall	0.05	0.21	0.00	1.00	N = 221571
	between		0.20	0.00	1.00	n = 67254
	within		0.00	0.05	0.05	T-bar = 3.29
SCH	overall	0.08	0.27	0.00	1.00	N = 221571
	between		0.27	0.00	1.00	n = 67254
	within		0.00	0.08	0.08	T-bar = 3.29

Variable		Mean	Std. Dev.	Min	Max	Observations
ST	overall	0.41	0.49	0.00	1.00	N = 221571
	between		0.49	0.00	1.00	n = 67254
	within		0.00	0.41	0.41	T-bar = 3.29
MKD	overall	0.11	0.31	0.00	1.00	N = 221571
	between		0.30	0.00	1.00	n = 67254
	within		0.03	-0.56	1.02	T-bar = 3.29
lnEOR	overall	-1.19	0.94	-3.89	0.66	N = 221571
	between		0.96	-3.89	0.66	n = 67254
	within		0.21	-4.40	1.90	T-bar = 3.29
lnIOR	overall	-1.58	1.30	-4.81	1.93	N = 221571
	between		1.31	-4.81	1.93	n = 67254
	within		0.33	-5.35	2.61	T-bar = 3.29
lnhhi	overall	-3.13	1.09	-5.07	0.00	N = 221571
	between		1.08	-5.07	0.00	n = 67254
	within		0.38	-6.32	0.57	T-bar = 3.29

Notes: Region dummies are time-invariant variables since they have zero or close to zero within variation. For all variables, there is both variation across individuals (between variation) and over time (within variation).

Appendix 4-3 Total factor productivity in Vietnamese manufacturing: Fixed effects and random effects estimates

Dependent variable: Log TFP	FE	RE
Ownership (with PDE as the base dummy)		
L.SOE	0.036	0.399***
	(0.028)	(0.023)
L.FOF	0.164***	0.627***
	(0.048)	(0.014)
L.JV-SOE	0.081	0.872***
	(0.061)	(0.044)
L.JV-PDE	0.132**	0.612***
	(0.050)	(0.031)
Plant-size dummies (with Small as the base dummy)		
Micro	-0.179***	-0.378***
	(0.008)	(0.007)
Medium	0.094***	0.348***
	(0.008)	(0.007)
Large	0.102***	0.516***
	(0.0154)	(0.012)
Log Age	0.183***	0.134***
	(0.012)	(0.005)
Regional dummies (with Northeast and Mountainous as base dummy)		
Red River Delta	0.193*	0.157***
	(0.077)	(0.020)
North Central		-0.102***
		(0.027)
South Central and Highland		0.008
		(0.024)
Southeast		0.367***
		(0.020)
Mekong Delta		0.110***
		(0.023)
Log Export orientation (EOR)	0.351***	0.420***
	(0.012)	(0.011)
Log Import dependence (MDR)	0.176***	0.167***
	(0.013)	(0.013)
Log Herfindahl-Hirschman Index (HHI)	-0.032***	-0.036***
	(0.005)	(0.004)
Constant	5.077***	5.049***
	(0.071)	(0.036)

Number of obs.	154317	154317
Number of firms	38953	38953
R^2	0.733	0.590

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies.

Appendix 4-4 Performance of manufacturing enterprises by region and ownership, 2017

Ownership	Northeast and Mountainous	Red River Delta (Ha Noi)[1]	North Central	South Central and Highland	Southeast (Ho Chi Minh city)[2]	Mekong Delta	Total
% Plants							
SOE	8.1	36.1 (20.3)	9.55	7.8	30.8 (17.3)	7.8	100
PDE	4.8	33.8 (17.5)	4.35	8.1	39.6 (24.1)	9.5	100
FOF	5.7	28.2 (4.4)	0.99	2.6	54.8 (10.4)	7.8	100
JV-SOE	3.9	39.7 (14.1)	5.13	3.9	38.5 (20.5)	9.0	100
JV-PDE	5.1	28.9 (10.7)	3.65	7.0	42.7 (14.3)	12.6	100
Total	5.0	33.1 (15.8)	3.96	7.3	41.5 (22.2)	9.3	100
% Output (value-added)							
SOE	8.6	29.6 (18.8)	3.86	10.7	40.7 (30.0)	6.6	100
PDE	4.5	27.0 (9.8)	2.29	8.0	45.5 (26.3)	12.8	100
FOF	15.8	34.7 (5.3)	1.22	1.6	41.6 (10.6)	5.2	100
JV-SOE	0.1	78.2 (18.4)	1.78	2.1	16.6 (8.1)	1.6	100
JV-PDE	2.8	42.9 (23.2)	1.70	3.4	33.6 (12.1)	15.6	100
Total	11.2	34.5 (8.1)	1.66	3.8	41.4 (15.8)	7.5	100
% Employment							
SOE	10.4	30.1 (17.4)	7.40	17.1	30.2 (21.6)	4.9	100
PDE	5.5	31.0 (10.8)	3.33	8.9	37.6 (18.9)	13.6	100
FOF	8.0	28.3 (3.9)	3.71	2.8	48.6 (11.1)	8.6	100
JV-SOE	3.5	66.0 (28.1)	2.32	7.0	18.1 (10.0)	3.3	100
JV-PDE	4.0	27.2 (12.4)	1.81	3.2	29.2 (12.1)	34.7	100
Total	7.0	29.6 (8.1)	3.62	5.5	43.3 (14.3)	10.9	100

Notes: (1) Figures for Ha Noi are given in brackets; (2) Figures for Ho Chi Minh city are given in brackets.

Source: Data compiled from the VES 2006-2017

Appendix 4-5 Total factor productivity in Vietnamese manufacturing: CRE estimates with 4-firm concentration ratio and age/age squared

Dependent variable: Log TFP	(1)	(2)
Ownership (with PDE as the base dummy)		
L.SOE	0.035	0.008
	(0.028)	(0.028)
L.FOF	0.166***	0.170***
	(0.048)	(0.048)
L.JV-SOE	0.085	0.098
	(0.061)	(0.061)
L.JV-PDE	0.135**	0.139**
	(0.050)	(0.050)
Log Age	0.182***	
	(0.012)	
Plant-size dummies (with Small as the base dummy)		
Micro	-0.179***	-0.180***
	(0.009)	(0.009)
Medium	0.092***	0.095***
	(0.008)	(0.008)
Large	0.100***	0.102***
	(0.016)	(0.016)
Regional dummies (with Northeast and Mountainous as base dummy)		
Red River Delta	0.155***	0.155***
	(0.019)	(0.019)
North Central	-0.061*	-0.062*
	(0.026)	(0.026)
South Central and Highland	0.024	0.030
	(0.023)	(0.023)
Southeast	0.404***	0.406***
	(0.019)	(0.019)
Mekong Delta	0.149***	0.152***
	(0.022)	(0.022)
Log Export orientation (EOR)	0.352***	0.344***
	(0.012)	(0.012)
Log Import dependence (MDR)	0.148***	0.159***
	(0.014)	(0.013)
Log Herfindahl-Hirschman Index (HHI)		-0.030***
		(0.005)
Log 4-firm concentration ratio (top4)	-0.089***	
	(0.008)	
Age		-0.019
		(0.031)
Age squared		-0.001***
		(0.000)
Constant	6.226***	5.905***
	(0.084)	(0.077)
Observations (N)	154317	154317
AIC	346774.5	346839

BIC	347649.8	347724.3

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * $p<0.05$, ** $p<0.01$, *** $p<0.001$. All specifications include year and sectoral dummies.

Appendix 4-6 Total factor productivity in Vietnamese manufacturing: CRE estimates excluding micro firms

Dependent variable: Log TFP	(1)	(2)	(3)
Ownership (with PDE as the base dummy)			
L.SOE	0.039	0.037	0.012
	(0.026)	(0.026)	(0.027)
L.FOF	0.162***	0.163***	0.169***
	(0.047)	(0.046)	(0.047)
L.JV-SOE	0.082	0.083	0.100
	(0.059)	(0.059)	(0.059)
L.JV-PDE	0.135**	0.137**	0.142**
	(0.048)	(0.048)	(0.048)
Log Age	0.219***	0.217***	
	(0.013)	(0.013)	
Plant-size dummies (with Small as the base dummy)			
Medium	0.113***	0.112***	0.116***
	(0.008)	(0.008)	(0.008)
Large	0.137***	0.136***	0.139***
	(0.015)	(0.015)	(0.015)
Regional dummies (with Northeast and Mountainous as base dummy)			
Red River Delta	0.144***	0.145***	0.146***
	(0.020)	(0.020)	(0.020)
North Central	-0.088**	-0.088**	-0.089**
	(0.028)	(0.028)	(0.028)
South Central and Highland	0.041	0.040	0.046
	(0.025)	(0.025)	(0.025)
Southeast	0.362***	0.362***	0.365***
	(0.020)	(0.020)	(0.020)
Mekong Delta	0.114***	0.112***	0.116***
	(0.023)	(0.023)	(0.023)
Log Export orientation (EOR)	0.353***	0.365***	0.354***
	(0.012)	(0.012)	(0.012)
Log Import dependence (MDR)	0.078***	0.061***	0.074***
	(0.014)	(0.014)	(0.014)
Log Herfindahl-Hirschman Index (HHI)	-0.031***		-0.031***
	(0.005)		(0.005)
Log 4-firm concentration ratio (top4)		-0.103***	
		(0.009)	
Age			0.090***
			(0.007)
Age squared			-0.001***
			(0.000)
Constant	5.761***	5.911***	5.832***
	(0.089)	(0.095)	(0.089)
Observations (N)	122342	122342	122342

AIC	260378.8	260272.2	260393.7
BIC	261214.2	261107.7	261238.9

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies.

Appendix 4-7 Total factor productivity in Vietnamese manufacturing: CRE estimates for subsample 2010–2017

Dependent variable: Log TFP	(1)	(2)	(3)
Ownership (with PDE as the base dummy)			
L.SOE	0.048	0.045	0.029
	(0.035)	(0.035)	(0.035)
L.FOF	0.188***	0.190***	0.195***
	(0.051)	(0.051)	(0.051)
L.JV-SOE	0.098	0.098	0.108
	(0.070)	(0.070)	(0.070)
L.JV-PDE	0.139**	0.141**	0.146**
	(0.054)	(0.053)	(0.054)
Log Age	0.181***	0.181***	
	(0.014)	(0.014)	
Plant-size dummies (with Small as the base dummy)			
Micro	-0.150***	-0.150***	-0.151***
	(0.009)	(0.009)	(0.009)
Medium	0.066***	0.066***	0.068***
	(0.009)	(0.009)	(0.009)
Large	0.077***	0.075***	0.076***
	(0.017)	(0.017)	(0.017)
Regional dummies (with Northeast and Mountainous as base dummy)			
Red River Delta	0.157***	0.158***	0.159***
	(0.020)	(0.020)	(0.020)
North Central	-0.068*	-0.068*	-0.069*
	(0.027)	(0.027)	(0.027)
South Central and Highland	0.023	0.022	0.026
	(0.024)	(0.024)	(0.024)
Southeast	0.397***	0.398***	0.400***
	(0.020)	(0.020)	(0.020)
Mekong Delta	0.159***	0.157***	0.159***
	(0.023)	(0.023)	(0.023)
Log Export orientation (EOR)	0.305***	0.314***	0.314***
	(0.016)	(0.016)	(0.016)
Log Import dependence (MDR)	0.289***	0.276***	0.272***
	(0.015)	(0.015)	(0.015)
Log Herfindahl-Hirschman Index (HHI)	0.000		
	(0.005)		
Log 4-firm concentration ratio (top4)		-0.074***	-0.073***
		(0.009)	(0.009)
Age			-0.023
			(0.030)
Age squared			-0.001***
			(0.000)
Constant	5.612***	5.828***	5.889***
	(0.091)	(0.097)	(0.097)

Observations (N)	129943	129943	129943
AIC	281569.6	281491.5	281516.6
BIC	282371.1	282293.0	282327.9

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * $p<0.05$, ** $p<0.01$, *** $p<0.001$. All specifications include year and sectoral dummies.

Appendix 4-8 Total factor productivity in Vietnamese manufacturing: HT estimates

Dependent variable: Log TFP	(1)	(2)	(3)
Ownership (with PDE as the base dummy)			
L.SOE	0.075**	0.074**	0.045
	(0.026)	(0.026)	(0.026)
L.FOF	0.896***	0.897***	0.869***
	(0.038)	(0.038)	(0.038)
L.JV-SOE	0.617***	0.618***	0.608***
	(0.055)	(0.055)	(0.054)
L.JV-PDE	0.667***	0.669***	0.651***
	(0.043)	(0.043)	(0.043)
Log Age	0.173***	0.173***	
	(0.008)	(0.008)	
Plant-size dummies (with Small as the base dummy)			
Micro	-0.218***	-0.218***	-0.218***
	(0.008)	(0.008)	(0.008)
Medium	0.131***	0.130***	0.131***
	(0.008)	(0.008)	(0.008)
Large	0.172***	0.170***	0.169***
	(0.014)	(0.014)	(0.014)
Regional dummies (with Northeast and Mountainous as base dummy)			
Red River Delta	0.188***	0.191***	0.230***
	(0.033)	(0.033)	(0.035)
North Central	-0.087*	-0.087*	-0.050
	(0.044)	(0.044)	(0.046)
South Central and Highland	0.040	0.038	0.070
	(0.039)	(0.039)	(0.041)
Southeast	0.357***	0.359***	0.390***
	(0.033)	(0.033)	(0.035)
Mekong Delta	0.104**	0.102**	0.139***
	(0.037)	(0.037)	(0.040)
Log Export orientation (EOR)	0.348***	0.358***	0.358***
	(0.011)	(0.011)	(0.011)
Log Import dependence (MDR)	0.155***	0.140***	0.137***
	(0.013)	(0.013)	(0.012)
Log Herfindahl-Hirschman Index (HHI)	-0.030***		
	(0.005)		
Log 4-firm concentration ratio (top4)		-0.086***	-0.085***
		(0.008)	(0.008)
Age			0.033***
			(0.002)
Age squared			-0.001***
			(0.000)
Constant	4.223***	4.615***	4.689***

	(0.046)	(0.052)	(0.053)
Observations (N)	154317	154317	154317
Number of firms	38953	38953	38953
R square	0.808	0.809	0.828

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies.

Appendix 4-9 Total factor productivity in Vietnamese manufacturing: Two-step difference GMM[14]

Dependent variable: Log TFP	(1)	(2)	(3)
Lag dependent variable (Log TFP)	0.167***	0.168***	0.165***
	(0.011)	(0.012)	(0.012)
Ownership (with PDE as the base dummy)			
L.SOE	-0.045	-0.028	-0.039
	(0.038)	(0.037)	(0.037)
L.FOF	0.133*	0.124*	0.133*
	(0.063)	(0.059)	(0.064)
L.JV-SOE	0.134	0.126	0.139
	(0.083)	(0.078)	(0.085)
L.JV-PDE	0.140^{+}	0.124^{+}	0.141^{+}
	(0.073)	(0.068)	(0.074)
Log Age	0.203	0.1141	
	(0.108)	(0.102)	
Plant-size dummies (with Small as the base dummy)			
Micro	-0.159***	-0.154***	-0.162***
	(0.017)	(0.017)	(0.017)
Medium	0.053***	0.055***	0.058***
	(0.015)	(0.014)	(0.015)
Large	0.034	0.029	0.045
	(0.030)	(0.029)	(0.028)
Regional dummies (with Northeast and Mountainous as base dummy)			
Red River Delta	---	---	---
	---	---	---
North Central	---	---	---
	---	---	---
South Central and Highland	---	---	---
	---	---	---
Southeast	---	---	---
	---	---	---
Mekong Delta	---	---	---
	---	---	---
Log Export orientation (EOR)	1.711***	1.298***	1.858***
	(0.264)	(0.262)	(0.249)
Log Import dependence (MDR)	-0.733*	0.196	-0.903***
	(0.290)	(0.341)	(0.258)
Log Herfindahl-Hirschman Index (HHI)	0.029		0.023
	(0.039)		(0.039)
Log 4-firm concentration ratio (top4)		-0.088**	

[14] I employed difference-GMM instead of system-GMM because the coefficients for the lag dependent variable (L.Log TFP) lie well within the OLS upper bounds and FE lower bounds in all three models (Bond, Hoeffler, & Temple, 2001).

		(0.029)	
Age			0.045***
			(0.007)
Age squared			-0.000***
			(0.000)
Number of observations	68462	68462	68462
Number of firms	16123	16123	16123
No. of instruments	55	55	56
AR1 (p-value)	0.000	0.000	0.000
AR2 (p-value)	0.461	0.292	0.468
Hansen-J (p-value)	0.130	0.058	0.114

Notes:

(1) Robust standard errors in parentheses. +: $p < 0.1$, * $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$. All regressions include sector fixed effects and year fixed effects.

(2) AR1 is a test for first-order serial correlation. H0: first-order serial correlation does not exist. The null hypothesis of no first-order serial autocorrelation is rejected at order one.

(3) AR2 is a test for second-order serial correlation. H0: second-order serial correlation does not exist. As the p-value > 0.05, we confirm that no serial correlation exists at order two and that the model is well specified.

(4) Hansen is a test of the overidentifying restrictions for the GMM estimators. H0: instruments are valid. As the p-value > 0.05, we confirm the validity of instruments.

(5) ---: time-invariant variables are not estimated.

Chapter 5 Productivity spillover from foreign-invested enterprises to domestic firms

Abstract

This chapter investigates the evidence of productivity spillover from foreign-invested enterprises (FIEs) to local firms through horizontal, backward, and forward spillover channels, using establishment-level data from Vietnam in 2006–2017. The chapter also considers the effects of foreign ownership types on the existence and magnitude of the productivity spillover. In addition, the chapter examines whether the involvement of domestic firms in global production networks (GPNs) impacts on the nature of the spillover. The findings indicate that productivity from FIEs spills over to local firms through backward and forward channels, but not horizontal channels. Ownership structures of FIEs serve as an important determinant of productivity spillover: joint ventures tend to generate more significant positive productivity spillover to domestic firms than fully owned foreign firms. Lastly, local firms operating within GPNs benefit more from the presence of FIEs compared to those involved in horizontal specialisation.

5.1 Introduction

Most governments in emerging economies offer various incentives to attract foreign direct investment (FDI), such as preferential income tax rates, import duty exemption, or infrastructure subsidies. These special incentives to attract FDI can be justified not only by the increasing employment and capital inflows accompanying foreign investment, but also by the potential productivity spillover from foreign-invested enterprises (FIEs) to domestic firms in the host countries (Blomström & Kokko, 1998). The latter channel is important because it helps transition economies to raise aggregate productivity and narrow the gap with the technological frontiers. Many empirical studies has been devoted to the examination of productivity spillover effects in transition economies (Djankov & Hoekman, 2000; Javorcik, 2004; Konings, 2001; Li, Liu, & Parker, 2001).

Like other countries in transition, Vietnam has gone a long way in undertaking trade and foreign investment policy reforms, which have brought about an unprecedented expansion in FDI into the economy. Trade liberalisation took the form of removal of export taxes and non-tariff barriers and negotiation of various trade agreements with ASEAN, the US, and the EU, ultimately leading to WTO accession. FDI promotion was a gradual process that took place through successive revisions to investment laws since the late 1980s.[15] Over the past three decades of liberalisation reforms, FIEs have made significant contribution to the Vietnamese economy, particularly in the manufacturing sector. The contribution to output and employment of FIEs in 2016–2017 was 66.6 percent and 56.4 percent, respectively.[16] FIEs have been instrumental in linking the manufacturing sector of Vietnam to global production networks – GPNs (Athukorala, 2009).

In this context, many studies have examined the productivity effects of FIEs on domestic firms in Vietnam's manufacturing sector. In most of these studies, the centre of attention is horizontal spillover, which is proxied by the degree of foreign presence in each sector (Hoang & Pham, 2010). Some other studies use a dummy for FIEs to proxy for horizontal spillover (Athukorala & Tien, 2012). The focus on horizontal productivity spillover, rather than backward and forward productivity spillover, can be explained by the unavailability of data on the economic structure for intermediate input transactions. Only a few studies focus on different channels of productivity spillover, including horizontal, backward, and forward spillover (Huynh et al., 2021; Le & Pomfret, 2011), often with conflicting findings (see more literature on Vietnamese cases in Appendix 5-1). When the conditions of productivity spillover are considered, literature on the role of foreign ownership structure in determining spillover is still in its infancy. Moreover, most studies consider two types of foreign ownership (majority vs. minority or fully

[15] Detailed policy reforms are discussed in Chapter 2.
[16] Detailed manufacturing performance of the foreign-invested sector is examined in Chapter 2.

owned foreign firms vs. joint ventures) as the factors affecting the extent of productivity spillover. These two types of foreign ownership structure cannot capture the hybrid nature of foreign ownership in Vietnam.

This chapter aims at investigating the evidence of spillover from FIEs to local firms through horizontal, backward, and forward spillover channels, using establishment-level data from Vietnam in 2006–2017. This analysis makes several contributions. Firstly, it contributes to the current literature on productivity spillover effects in a transition economy that has been an investment hotspot for the past decade (Chamorro & Nguyen, 2018). Secondly, the chapter examines whether the extent of foreign ownership in FIEs affects the magnitude of spillover effects. This study goes beyond the existing literature to consider different types of foreign ownership by separating FIEs into fully owned foreign firms (FOFs), joint ventures (JVs) with state-owned enterprises (JV-SOEs), and JVs with private domestic enterprises (JV-PDEs). The separation is particularly essential in the context of Vietnam, given the hybrid nature of the foreign ownership structure that may affect the extent of spillover on domestic firms. Thirdly, this chapter examines the impacts of involvement of domestic firms in GPNs on productivity spillover. This issue is particularly important because of the recent patterns of Vietnamese manufacturing rapidly integrating within the China-centred GPNs. The study, thus, is distinguished from other studies by drawing on two strands of literature, which are the literature on FDI spillover and the literature on GPNs.

In terms of methodological contribution, the chapter addresses a number of econometric issues that may have led to biased results in previous studies. Firstly, I use more disaggregated data for spillover measurement, which improves the estimates and enhances understanding of productivity spillover and its determining factors. I also employ establishment-level panel data from 2006 to 2017, covering structural changes resulting from the new phase of FDI attraction

in the second half of the 2000s. Secondly, this chapter includes only domestic firms in econometric analysis to avoid potential aggregation bias. Foreign firms usually operate more productively than domestic firms, exaggerating the positive productivity spillover from FDI presence. Lastly, this is the first analysis to examine productivity spillover through backward, forward, and horizontal channels using a non-competitive input-output (IO) table. By excluding imports from the coefficient matrix in the non-competitive IO table, the linkages between sectors are better reflected, given the high dependence on imports in Vietnam.

The findings can be summed up as follows. There exists significant productivity spillover from FIEs to domestic firms. While horizontal spillovers translate into a decrease in productivity, increased backward and forward linkages result in increases in productivity for local firms. As far as the characteristics of multinational enterprises (MNEs) are concerned, I find that the productivity gains emanating from JVs are greater than those from FOFs. On the other hand, local firms operating within GPNs benefit more from the foreign presence compared to those involved in horizontal specialisation.

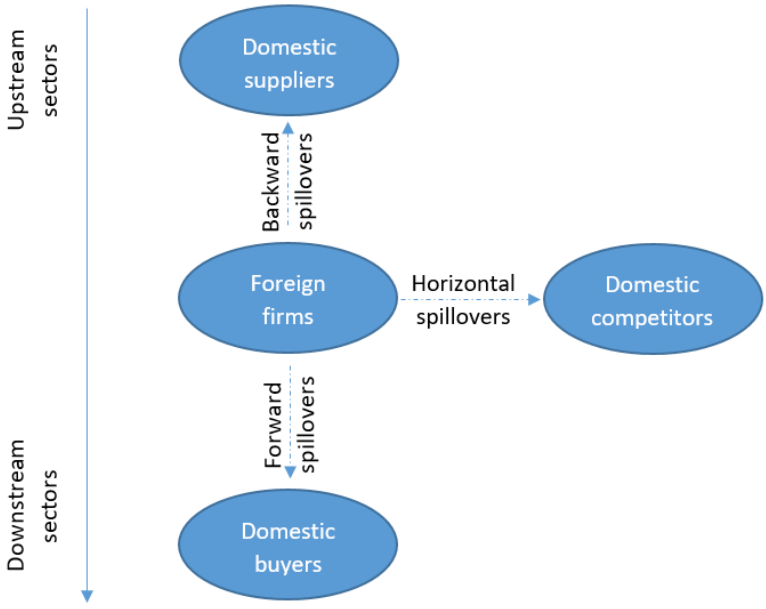
This chapter proceeds as follows. Section 5.2 overviews different channels of productivity spillover and their mechanisms affecting domestic firms' productivity. This section also reviews the literature on the foreign ownership and productivity spillover nexus, as well as the literature on the relationship between GPNs and productivity spillover. Section 5.3 describes the model specification, data sources, and estimation issues for the empirical analysis. Findings on the existence of productivity spillover, the effects of foreign ownership on spillover, and the influences of involvement in GPNs on spillover are presented and discussed in section 5.4. Following this, section 5.5 tests the robustness of the results using an alternative spillover measure, control variable, and estimation method. The last section concludes.

5.2 Related literature

5.2.1 Productivity spillover channels

Current theoretical literature on FDI commonly categorises channels through which productivity spillover may occur into horizontal, backward, and forward spillovers (illustrated by Figure 5-1). If the entry or presence of FIEs generates productivity gains to domestic competitors in the same industry, these phenomena are regarded as horizontal spillover. Backward spillover refers to spillovers occurring when FIEs use intermediate inputs produced by local enterprises operating in upstream sectors. On the other hand, forward spillover refers to spillovers taking place when FIEs sell intermediate inputs to domestic firms operating in downstream sectors.

Figure 5-1 Channels of productivity spillovers



Source: OECD (2009b)

Horizontal spillover can arise through three well-known mechanisms. Firstly, demonstration effects happen when domestic firms imitate and acquire new technologies and management skills from FIEs. As it can be costly and risky to introduce new technology, produce new

products, and enter new markets, local firms are encouraged to adopt products, technology, management, and marketing skills that are applied successfully by FIEs (Görg & Greenaway, 2004; Smeets, 2008). Secondly, competition effects occur when FIEs enter the host country and force domestic firms to protect their market share. Local firms will strive to use existing resources and technologies efficiently, reorganise their production process, and adopt new technology and management to be able to compete with FIEs (Aitken & Harrison, 1999; Blomström & Kokko, 1998; Javorcik, 2004). Thirdly, labour mobility effects take place when domestic firms can attract trained and skilled workers and managers from FIEs. Through this process, local firms expect to obtain positive spillover from FIEs (Crespo & Fontoura, 2007; Fosfuri, Motta, & Rønde, 2001; Görg & Greenaway, 2004).

However, there are reasons why horizontal spillover may not occur. First, demonstration effects are less likely to occur due to a possible technology gap between foreign and local firms. If domestic enterprises have an insufficient absorptive capacity, they are unable to recognise and adopt new technology of FIEs (Blalock & Gertler, 2008). Second, competition effects are unlikely to exist because the FIEs tend to produce for export, while local enterprises usually produce for domestic consumption. Besides, the differences in production methods between exported and domestically consumed goods may reduce technology transfer potential. Third, labour mobility effects can be minimal because FIEs typically pay higher wages than domestic firms do, preventing labour turnover and reducing technology leakage through former employees (Blalock & Gertler, 2008; Girma, Greenaway, & Wakelin, 2001; Javorcik, 2004).

While the existence of horizontal spillovers is very limited, current literature shows that backward and forward spillovers are far more likely (Blalock & Gertler, 2008; Crespo & Fontoura, 2007; Javorcik, 2004; Markusen & Venables, 1999). In the case of backward spillovers, FIEs have a stimulus to offer training and other technological support to increase

the quality of intermediate inputs they purchase from domestic suppliers. In addition, the presence of FIEs in downstream industries may increase the demand for local inputs, which in turn helps domestic firms exploit economies of scale in their production process. Besides, domestic suppliers in competition with other local providers may get better incentives to upgrade their production management and technology. Regarding forward spillover, there are two common ways domestic firms may benefit as input buyers from MNE subsidiaries. Firstly, local manufacturers may have the advantage of using high-quality or less costly intermediate inputs produced by foreign suppliers. Secondly, when purchasing advanced products from foreign manufacturers, local customers might be offered complementary services, which may be unavailable in connection with imports. Gaining access to higher quality of inputs complemented with assistance services is expected to improve domestic manufacturers' efficiency in downstream industries.

Productivity spillovers from the presence of FIEs to local firms can be negative. For the horizontal spillover channel, the presence of FIEs can decrease the productivity of local firms operating in the same industry due to the so-called "market-stealing effect" (Aitken & Harrison, 1999, p.606). More precisely, the entry of foreign firms can attract domestic demand, resulting in local competitors losing their market shares. As fixed costs of production spread over a less significant market, the average cost curve of local competitors is driven up. If this effect dominates, the foreign presence may lower productivity of local enterprises operating in the same industry. In addition, the presence of FIEs may negatively affect the productivity of domestic enterprises in the same industry by drawing on the most qualified workforces (Marcin, 2008). This means that the stock of human capital in the local firms is eroded, resulting in lower productivity of domestic firms.

Regarding the backward spillover channel, the presence of FIEs may lead to negative productivity spillover if they break existing supply chains with domestic firms. After acquiring a domestic company as an intermediate supplier, FIEs may change to source intermediate inputs abroad. The broken existing supply chains force former domestic suppliers to cut production, resulting in their lower productivity. In addition, the backward spillover effects can be negative when FIEs have more significant bargaining power than domestically owned firms. This is because the bargaining power helps FIEs to obtain more favourable contractual agreements against domestic firms and, thus, squeeze these firms' profit (Girma, Görg, & Pisu, 2008).

Lastly, negative forward spillover may arise. After merging with domestic firms in the upstream sectors, FIEs upgrade production facilities, produce more advanced products, and sell them at a higher price. Domestic enterprises in downstream sectors may have limited ability to benefit from more sophisticated inputs but have to pay a higher price (Javorcik, Saggi, & Spatareanu, 2004).

5.2.2 How can the foreign ownership structure affect productivity spillover?

It has been found that FOFs can generate more significant productivity spillover on local firms than JVs (Dimelis & Louri, 2002; Takii, 2005). A parent company has a greater incentive to transfer advanced technology if it has more significant control over its subsidiaries. FOFs are likely to be the most productive as the parent company will not be barred from transferring its leading technology to them. By contrast, the possibility that knowledge-based assets of the parent company can be used by local partners in the future encourages the parent company to transfer older and perhaps less efficient technology to its JVs. Receiving more advanced technology from parent companies, FOFs have a larger scope to generate productivity spillover to local firms than JVs.

However, it is generally believed that productivity spillover associated with JVs would be greater than that associated with FOFs (Blomström & Sjöholm, 1999; Javorcik & Spatareanu, 2008). FOFs with greater technological sophistication are less likely to generate spillover to local firms operating in the same sector. This is because local competitors may have insufficient absorptive capacity to imitate foreign firms' sophisticated technology. By contrast, JVs are more likely to generate productivity spillover to local competitors because of lower technological sophistication and involvement of the local partner. Regarding backward productivity spillover, due to technological sophistication, FOFs may require more complex inputs that may be more difficult for local firms to provide. As FOFs may be less likely to engage in local sourcing, they generate less productivity spillover to local providers than JVs. Lastly, forward productivity spillover is also likely to be greater from JVs than from FOFs. This is because JVs tend to be more domestic-oriented: their products are likely to be produced for domestic markets, generating a greater scope for forward spillover. By contrast, FOFs are likely to export intermediate inputs, limiting productivity spillover to domestic customers.

5.2.3 How can joining global production networks affect productivity spillover?

A GPN is a concept in developmental literature that refers to a network, which integrates parts of disparate nations and territories to produce, distribute, and consume a specific product or service (Coe, Dicken, & Hess, 2008). A GPN is of two types: buyer-driven production network; and producer-driven production network (Athukorala, 2019; Athukorala & Patunru, 2019; Gereffi, 1994, 1999). On the one hand, buyer-driven GPNs are common in consumer-goods sectors, such as textile products, apparel, and leather. In these networks, buyers (usually multinational retailers, brand-named merchandisers, and trading companies, such as Walmart, Marks & Spencer, and H&M) play the central role in controlling the production system. They set up decentralised production networks with the involvement of many exporting countries.

Joining these networks, local firms mainly produce finished goods to the specifications of foreign buyers under commercial subcontracting and have opportunities to export large volumes of goods. On the other hand, producer-driven GPNs are common in vertically integrated global industries such as electronics, electrical goods, and automobiles. In these networks, producers (usually multinational manufacturing enterprises, such as Intel, Motorola, Apple, and Samsung) play a pivotal role in controlling the production system. They coordinate multi-layered production systems that involve various firms in countries with different levels of development. Operating in producer-driven GPNs, local firms supply specific products or components for foreign producers under international subcontracting of components.

Domestic enterprises under subcontracting relationships can benefit from five primary forms of technological transfer (UNCTAD, 2001; UNCTC, 1981; Wisarn & Bunluasak, 1995; Wong, 1992). Firstly, multinational buyers are likely to commit to transferring technology to domestic suppliers to maintain and enhance the subcontracting relationships. Secondly, under the strict performance control system of the multinationals, subcontractors can learn from valuable feedback on their output. Thirdly, domestic subcontractors can be exposed to an unintentional provision of technology within the multinational environment, such as product design specification, performance requirements, prototype development, and informal sharing of technical information (the 'information-disclosure' process). Fourthly, the nature of the subcontracting relationships induces subcontractors to invest in technology (the investment inducement effect). In particular, the relationship may reduce the risk of investment decisions; for example, multinationals may commit to procuring products using new technology. The relationship may provide subcontractors with relatively stable, projected income to finance the investment. The relationship may allow subcontractors to access superior market demand information, resulting in improved investment decisions. Lastly, multinational buyers may threaten to switch to a different supplier, inducing subcontractors to invest in technological

improvement. The final form of technology transfer may arise when local suppliers can develop sophisticated technologies of their own. In exchange for approaching these technologies, the multinational buyers are likely to offer particular proprietary technology to their suppliers.

5.3 Model specifications, data, and estimation methods

5.3.1 Model specifications

Instead of adopting a 1-step procedure in which the determinants of TFP are embodied within the production function, I adopt a 2-step procedure similar to that employed by Newman et al. (2015). In the first step, I estimate production functions at the 2-digit level (20 industries) using the generalised method of moments of Ackerberg, Caves, and Frazer (2015) (discussed in Chapter 3); and, in the second step, the productivity spillover effects are investigated. The advantage of this approach is that it allows us to minimise potential estimation bias arising from the estimation of TFP. This is because we can choose the most appropriate method to estimate TFP. In this case, the ACF method – developed from Levinson and Petrin's (2003) and Olley and Pakes' (1996) approaches – can control most of the endogeneity issues in estimation production functions. In addition, in the 2-step procedure, we can estimate production functions for each 2-digit manufacturing sector to allow for the differences in technology across sectors. As a result, we can obtain a better estimation of TFP.

After estimating TFP using heterogeneous, industry-specific production functions, I relate the TFP of domestic firms to FDI spillover variables. Thus, the FDI spillover effects on domestic firms' productivity are estimated as follows:

$$lnTFP_{ijt} = \beta_1 HR_{jt} + \beta_2 BW_{jt} + \beta_3 FW_{jt} + \beta_4 X + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt} \quad \text{(Equation 5-1)}$$

where dependent variable $lnTFP_{ijt}$ is the log form of the TFP of domestic firm i in sector j at time t. FDI spillover effects in industry j at time t include horizontal spillover (HR_{jt}), backward spillover (BW_{jt}), and forward spillover (FW_{jt}). The coefficients β_1, β_2, and β_3 capture the productivity spillover effects through horizontal, backward, and forward channels, respectively, on domestic firms' productivity. X is a vector of firm-specific characteristics, such as firm age, size, ownership, and location, and sector-specific characteristics, such as market concentration, export orientation, and import dependence. α_i, α_j and α_t are firm-, sector-, and year-fixed effects, respectively. ε_{ijt} is the random error term.

Following recent literature (Blalock & Gertler, 2008; Javorcik, 2004) , I measure productivity spillover as follows:

- Horizontal productivity spillover in industry j at time t (HR_{jt}) is computed as the proportion of total output accounted for by FIEs in that industry:

$$HR_{jt} = \left[\sum_{i\ for\ all\ i \in j} FIE_{it} * Y_{it} \right] \Big/ \sum_{i\ for\ all\ i \in j} Y_{it}$$

where FIE_{it} is a dummy variable, equal to one for FIEs, otherwise zero, Y denotes firm output, and the subscripts i, j, and t denote firms, sectors, and years, respectively.

- Backward productivity spillover in industry j at time t (BW_{jt}) is computed as the proportion of that industry's output supplied to an industry k with foreign firm presence:

$$BW_{jt} = \sum_{k\ if\ k \neq j} \alpha_{jk}\, HR_{kt}$$

where α_{jk} is the proportion of industry j's output supplied to industry k, which will be calculated using the IO table. In the calculation of the proportion α_{jk}, I exclude products supplied for final consumption and imports of intermediate products. I also explicitly exclude inputs sold within the firm's industry ($k \neq j$) because this is captured by HR_{kt}. It is assumed that the value of backward spillover BW_{jt} will be larger if the foreign presence in sectors supplied by industry j (HR_{kt}) and/or the share of intermediate inputs supplied to industries with a multinational presence (α_{jk}) are getting bigger.

- Forward productivity spillover in industry j at time t (FW_{jt}) is computed as the proportion of that industry's inputs purchased from an industry l with foreign firm presence:

$$FW_{jt} = \sum_{l \; if \; l \neq j} \beta_{jl} \, HR_{lt}$$

where β_{jl} is the proportion of industry j's inputs purchased from industry l, which will be calculated using the IO table. In the calculation of the proportion β_{jl}, I also exclude inputs purchased within the industry (thus, $l \neq j$), since this is already captured by HR_{lt}. Similar to the backward spillover case, the value of forward spillover FW_{jt} will be larger if the foreign presence in sectors supplied to industry j (HR_{lt}) and/or the share of intermediate inputs purchased from industries with a multinational presence (β_{jl}) are getting bigger.

To examine how the degree of foreign ownership in FIEs matters for productivity spillover, I disaggregate FIEs into FOFs, JV-SOEs, and JV-PDEs. This is different from the current literature, which disaggregates FIEs into two different types, including FOFs (majority owned foreign firms) and JVs (minority owned foreign firms) (Dimelis & Louri, 2002; Javorcik, 2004; Javorcik & Spatareanu, 2008). By going further to disaggregate JVs into JV-SOEs and JV-

PDEs, I have nine productivity spillover measures, including FOF horizontal spillover (FOF_HR_{jt}), JV-SOE horizontal spillover ($JVSOE\_HR_{jt}$), JV-PDE horizontal spillover ($JVPDE\_HR_{jt}$), FOF backward spillover (FOF_BW_{jt}), JV-SOE backward spillover ($JVSOE\_BW_{jt}$), JV-PDE backward spillover ($JVPDE\_BW_{jt}$), FOF forward spillover (FOF_FW_{jt}), JV-SOE forward spillover ($JVSOE\_FW_{jt}$), and JV-PDE forward spillover ($JVPDE\_FW_{jt}$), in the following regression:

$$lnTFP_{ijt} = \beta_1 FOF\_HR_{jt} + \beta_2 JVSOE\_HR_{jt} + \beta_3 JVPDE\_HR_{jt} + \beta_4 FOF\_BW_{jt} + \beta_5 JVSOE\_BW_{jt} + \beta_6 JVPDE\_BW_{jt} + \beta_7 FOF\_FW_{jt} + \beta_8 JVSOE\_FW_{jt} + \beta_9 JVPDE\_FW_{jt} + \beta_{10} X + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt} \quad \text{(Equation 5-2)}$$

The spillover variables for FOF are measured as follows:

$$FOF\_HR_{jt} = \left[\sum_{i\ for\ all\ i \in j} FOF_{it} * Y_{it} \right] \Big/ \sum_{i\ for\ all\ i \in j} Y_{it}$$

$$FOF\_BW_{jt} = \sum_{k\ if\ k \neq j} \alpha_{jk}\, FOF\_HR_{kt}$$

and

$$FOF\_FW_{jt} = \sum_{l\ if\ l \neq j} \beta_{jl}\, FOF\_HR_{lt}$$

where FOF_{it} is a dummy variable, equal to one for firms with fully foreign ownership, otherwise zero.

The spillover variables for JV-SOE and JV-PDE are calculated analogously:

$JVSOE\_HR_{jt} = \left[\sum_{i\ for\ all\ i\in j} JVSOE_{it} * Y_{it}\right] / \sum_{i\ for\ all\ i\in j} Y_{it}$ and $JVPDE\_HR_{jt} = \left[\sum_{i\ for\ all\ i\in j} JVPDE_{it} * Y_{it}\right] / \sum_{i\ for\ all\ i\in j} Y_{it}$

$JVSOE\_BW_{jt} = \sum_{k\ if\ k\neq j} \alpha_{jk} JVSOE\_HR_{kt}$ and $JVPDE\_BW_{jt} = \sum_{k\ if\ k\neq j} \alpha_{jk} JVPDE\_HR_{kt}$

$JVSOE\_FW_{jt} = \sum_{l\ if\ l\neq j} \beta_{jl} JVSOE\_HR_{lt}$ and $JVPDE\_FW_{jt} = \sum_{l\ if\ l\neq j} \beta_{jl} JVPDE\_HR_{lt}$

where $JVSOE_{it}$ and $JVPDE_{it}$ are dummy variables, equal to one for JV-SOEs and JV-PDEs respectively, otherwise zero.

Lastly, to examine how joining GPNs impacts the productivity of domestic firms, I use the dummy variable for GPN-concentrated industries (GPN_{jt}), which are mainly electronics. GPN firms are those operating in these industries, and non-GPN firms otherwise.[17] Therefore, to examine whether local firms operating within GPNs benefit more from the foreign presence compared to those involved in horizontal specialisation, the following equations are estimated:

The equation with GPN intercept dummy is as follows:

$$lnTFP_{ijt} = \beta_1 HR_{jt} + \beta_2 BW_{jt} + \beta_3 FW_{jt} + \beta_4 GPN_{jt} + \beta_5 X + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}$$

(Equation 5-3)

and the equations with GPN slope dummies for the three spillover variables are as follows:

$$lnTFP_{ijt} = \beta_1 HR_{jt} + \beta_2 BW_{jt} + \beta_3 FW_{jt} + \beta_4 GPN_{jt} + \beta_5 GPN_{jt} * HR_{jt} + \beta_6 X + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}$$ (Equation 5-4)

[17]An ideal data for this categorisation is establishment-level data, which provides information on whether a firm participates or not in the GPNs. However, this information is not available in the VES for the studied period.

$$lnTFP_{ijt} = \beta_1 HR_{jt} + \beta_2 BW_{jt} + \beta_3 FW_{jt} + \beta_4 GPN_{jt} + \beta_5 GPN_{jt} * BW_{jt} + \beta_6 X + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}$$ (Equation 5-5)

$$lnTFP_{ijt} = \beta_1 HR_{jt} + \beta_2 BW_{jt} + \beta_3 FW_{jt} + \beta_4 GPN_{jt} + \beta_5 GPN_{jt} * FW_{jt} + \beta_6 X + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}$$ (Equation 5-6)

where GPN_{jt} is the dummy variable, which equals one if sectors are GPN concentrated and equals zero otherwise.

Control variables

The control variables (X), including firm-specific and sector-specific characteristics, are listed below with the expected sign of the regression coefficients in brackets:

$SIZE$ (+ or -)	Firm-size dummy variables: micro: 0-9 employees; small: 10-49 employees (base dummy); medium: 50-299 employees; and large: more than 300 employees
AGE (+ or -)	Number of years of operation based on the year of entry
OWN (+ or -)	Domestic firms' ownership dummy variables: state-owned enterprises (SOEs) and private domestic enterprises (PDEs) (base dummy)
GLD (+ or -)	Geographical location dummies: Northeast and Mountainous region (base dummy); Red River Delta; North Central; South Central and Highland; Southeast; and Mekong Delta
EOR (+)	Export orientations (export-output ratio at 4-digit industry level)
MDR (+)	Import dependence (import-output ratio at 4-digit industry level)
HHI (+ or -)	Herfindahl-Hirschman Index of industry concentration measured at 4-digit industry level

Firm size ($SIZE$) is included to capture the impact of scale on firms' productivity. Large firms, with key features of diverse capabilities, abilities to exploit economies of scale, and formalisation of procedures, can perform better than smaller firms (Penrose, 1959). However, small firms, with their lean organisational structure, may be more productive than their larger counterparts (Utterback, 1994; Williamson, 1967).

Firm age (AGE) is included to control for the possibility that observed productivity-level differences could be a function of age distribution of the firms being compared. Operating time reflects firms' experience in the market and the learning process that could be either passive or active. Firms with longer operating times are expected to gain much more experience and learn more from the market, which in turn helps them to perform better (Stinchcombe, 2000). However, younger and more agile firms can outperform older ones, thanks to their flexibility in adapting quickly to changing circumstances (Marshall, 1920).

Domestic firms' ownership dummy (OWN) is included to control for productivity heterogeneity among SOEs and PDEs. The SOEs are expected to be less efficient and less profitable than PDEs according to the property right model (Boardman & Vining, 1989; Toninelli, 2000), agency theory (Jensen & Meckling, 1976), and the 'soft budget constraint' (Kornai, 1986). (Detailed literature on the relationship between firms' ownership and productivity is discussed in Chapter 4.)

Market concentration is included to capture the effects of market power on firms' productivity. Greater competition will pressure firms into adopting new technologies and operating more efficiently (Nickel, 1996). Also, endogenous growth theory postulates that monopoly rent from a low level of competition is invested in R&D, leading to innovation and improvements in TFP (Dixit & Stiglitz, 1977; Grossman & Helpman, 1991b). It has also been shown that, under some conditions, increased competition can lower managers' expected income and, therefore, their effort, which in turn reduces firm efficiency levels. The level of market concentration in industry j at time t is measured using the Herfindahl Hirschman Index (HHI_{jt}). Following Tirole (1988), I square the percentage share of each firm's output in an industry, and then sum these squares to calculate HHI_{jt}:

$$HHI_{jt} = \sum \left(\frac{y_{ijt}}{Y_{jt}} \right)^2$$

where y_{ijt} is the output of firm i in sector j at time t. The Y_{jt} is total output of sector j. The lower the value of HHI_{jt}, the higher the level of a sector's competition.

Export-output ratio is used to proxy for the export orientation (EOR) of a sector. Firms operating in export-oriented sectors may experience a sustained increase in productivity, thanks to new knowledge acquisition from overseas buyers (Pack & Saggi, 2001).

Import-output ratio proxies for import dependence (MDR) of a sector. Pavcnik (2002) points out that the domestic prices of import-competing products would be lower, so in order to survive, firms operating in import-dependent industries must remain efficient.

Geographical location dummies (GLD) are included in the model by dividing the firms by six central regions of Vietnam: Northeast and Mountainous (base dummy); Red River Delta; North Central; South Central and Highland; Southeast; and Mekong Delta. Given that large historical, institutional, and economic differences persist over time between these areas, it is expected that firms' productivity is different across these regions. Of these six regions, South Vietnam (such as Southeast, and Mekong Delta) was under central planning for a much shorter period than those in the North. Presumably, this can have a significant impact on establishment-level productivity differences.

In estimating equations 5-1 to 5-6, control variables, including AGE, HHI, EOR, and MDR, are measured in natural logarithms.

5.3.2 Data

The main dataset used in this study comes from the unpublished returns to the Vietnamese Enterprise Surveys (VES) collected by the General Statistics Office of Vietnam (GSO). The data constitute an unbalanced panel covering the period 2006–2017. FIEs are defined as those belonging to the category of FOFs and JVs; both JV-SOEs and JV-PDEs. Approximately 16 percent – 30,335 of the total of 221,571 observations – meet this definition.

Besides the VES, I use the IO table of 2012 conducted by the GSO to implement the proposed methodology. The IO tables for different years would be preferred to capture the changing relationships between sectors, although a radical change is unlikely. However, the IO tables of Vietnam are available every 5 years during the studied period (2007, 2012, and 2017). Thus, I opt to use the IO table of 2012 for the whole period of 2006–2017. The IO table of 2012 has a dimension 164 x 164 of commodity by commodity and it is in the competitive type.[18]

The competitive IO table of 2012 is converted into a non-competitive one. The inclusion of imports in a competitive IO table does not reflect a correct relationship between sectors, especially in the countries that highly depend on imported inputs like Vietnam. In this case, a non-competitive IO table is preferable (Javorcik, 2004). While this matrix does not exist, I follow National Research Council (2006) and Nguyen (2021) to convert the competitive table to a non-competitive type, using the 'similarity' assumption. Accordingly, the distribution of intermediate imports is assumed to be similar to that of output in the corresponding industries.

[18] There are two types of IO tables, 'competitive' and 'non-competitive', which differ on their treatment of import data. In the competitive IO tables, both domestically produced and imported inputs are lumped together in a single interindustry IO matrix, assuming that these inputs are perfect substitutes. By contrast, non-competitive IO tables, inputs are clearly separated into two interindustry matrices: domestic input coefficients; and imported input coefficients. For most countries, including Vietnam, only competitive type IO tables are available.

By doing so, this study for the first time examines productivity spillover through backward, forward, and horizontal channels using a non-competitive IO table.

Instead of commonly aggregating IO data into the 2-digit level, I use more disaggregated IO data for spillover measurement. Particularly, 164 sectors in the IO table of 2012 are aggregated into 53 sectors to make it comparable with the 4-digit sector in the VES (Appendix 5-2). The total impact of foreign presence – regardless of the channel – is more considerable when using more disaggregated IO tables. This is because high aggregation of the IO tables may result in misclassifying a significant number of supplier-customer activities as a within-industry competitive activity, which underestimates the productivity spillover. By using more disaggregated IO data to calculate a proxy for productivity spillover, my analysis is distinguished from current literature on FDI spillover effects.

FDI spillover increased over 2006–2017 (Table 5-1). The horizontal spillover variable's average value increased from about 37.6 percent in 2006 to 41.9 percent in 2017. The average value of backward and forward spillover rose by about 5 percent and 1 percent, respectively.

Table 5-1 Summary statistics for spillover variables

Year	Number of sectors	Horizontal		Backward		Forward	
		Mean	S.d	Mean	S.d	Mean	S.d
2006	53	0.376	0.218	0.096	0.100	0.084	0.057
2007	53	0.390	0.198	0.096	0.101	0.079	0.052
2008	53	0.387	0.201	0.101	0.105	0.076	0.053
2009	53	0.407	0.203	0.111	0.109	0.076	0.056
2010	53	0.380	0.205	0.114	0.108	0.077	0.053
2011	53	0.388	0.199	0.118	0.111	0.080	0.053
2012	53	0.398	0.198	0.125	0.115	0.084	0.054
2013	53	0.413	0.200	0.129	0.118	0.087	0.055
2014	53	0.417	0.205	0.133	0.120	0.088	0.057
2015	53	0.413	0.205	0.134	0.119	0.090	0.057
2016	53	0.422	0.213	0.138	0.124	0.091	0.061
2017	53	0.419	0.218	0.143	0.126	0.091	0.062

Note: S.d denotes standard deviation.

Many IO sectors underwent a significant increase in FDI spillover over 2006–2017 (Appendix 5-3). Regarding horizontal spillover, 19 sectors experienced an increase of more than 10 percentage points and 8 sectors registered a rise of more than 5 percentage points. The most significant increase in the horizontal variable can be seen in textile products (IO 15) with more than 71 percentage points. For backward spillover, the changes were less significant with only one sector experiencing an increase of more than 10 percentage points (electronic device, computer, and peripheral (IO 36)), and two sectors registering an increase of more than 5 percentage points (fibre (IO 14) and car engines with tractor (IO 49)). Lastly, shoes and sandal (IO 18) led the ranking in the forward spillover with a more than 5 percentage points increase over 2006–2017.

5.3.3 Econometric issues and estimation methods

One important estimation issue is omitted variables. Many firm-, sector-, and time-specific factors affecting the correlation between firm productivity and foreign presence cannot be observed by the econometrician but are observable to the firm. For example, a company's high-quality management in a particular firm can enhance the firm's productivity and attract foreign investment. This omitted-variables problem in the model is addressed using the correlated random effects (CRE) method. This approach provides within-estimates, analogous to the fixed effects (FE) approach, by subtracting the cluster mean of time-variant variables in a random-effects model. Thus, CRE estimation can remove any fixed firm-, sector-, and time-specific unobservable variation. The choice of the CRE approach is also because it can estimate the effects of time-invariant variables, similar to the random effects (RE) approach, such as geographical location dummies. In addition, the unobservable can be controlled by including full sets of sector- and time-fixed effects to the specification. The sector-fixed effects capture, for example, not only a sector's attractiveness to FDI but also the changes in the attractiveness over time.

Endogeneity is a particular concern for the spillover variables. Foreign investors may choose to operate in a more productive industry to maximise their profits. Alternatively, foreign investors may prioritise investing into a slow-growing industry to obtain a more significant competitive advantage. These alternatives suggest that the analysis could overestimate or underestimate the effects of foreign presence in an industry on domestic firms' productivity. Accounting for this potential problem, the analysis replaces the explanatory variables with their one-year lagged values. The lags may be appropriate because the FDI spillover effects on domestic firms may take time to materialise (Javorcik, 2004).

Another estimation issue is selection bias. Supposing that foreign firms benefit domestic firms' productivity and survival, we are likely to observe all firms in regions or industries with a high foreign presence. In regions or industries with a low foreign presence, we probably observe only surviving firms. This selection suggests that the true relationship between FDI and firms' productivity could be underestimated. By contrast, if foreign firms harm domestic firms' productivity, we can only observe surviving firms in regions or industries with a high foreign presence and all firms in regions or industries with a low foreign presence. This selection results in overestimating the relationship between FDI and firms' productivity. While the coefficients of FDI spillover variables can be potentially biased, this bias should not be considered a severe problem but supports the main findings. The actual positive productivity spillover would be higher because of underestimation, while the actual negative productivity spillover would be smaller because of overestimation.

5.4 Estimation results and discussions

5.4.1 Productivity spillover

This section reports and discusses the results on the productivity spillover from FIEs to domestic firms, shown in Table 5-2, using the CRE estimates. Column (1) shows the results for the model in which only the spillover variables are entered as the explanatory variables. Column (2) reports the results for the full model. Results using the FE estimate are given in Appendix 5-4 for comparison.

Table 5-2 Productivity spillover from foreign-invested enterprises to Vietnamese manufacturing domestic firms: Correlated random effects estimates

Dependent variable = Log TFP	(1)	(2)
Productivity spillover		
L.Horizontal	-0.384***	-0.243***
	(0.033)	(0.033)
L.Backward	0.454***	0.407***
	(0.064)	(0.063)
L.Forward	0.449**	0.430**
	(0.154)	(0.153)
Log AGE		0.164***
		(0.013)
Ownership (OWN, with PDE as the base dummy)		
L.SOE		0.0370
		(0.028)
Plant-size dummies (SIZE, with Small as the base dummy)		
Micro		-0.181***
		(0.009)
Medium		0.0917***
		(0.009)
Large		0.0783***
		(0.018)
Geographical location dummies (GLD, with Northeast and Mountainous as base dummy)		
Red River Delta		0.118***
		(0.019)
North Central		-0.102***
		(0.025)
South Central and Highland		-0.00166
		(0.022)
Southeast		0.416***
		(0.019)

Mekong Delta		0.178***
		(0.022)
Log EOR		0.342***
		(0.013)
Log MDR		0.212***
		(0.010)
Log HHI		-0.0627***
		(0.007)
Constant	4.758***	5.881***
	(0.089)	(0.090)
Number of observations	129,498	129,498
Number of firms	34,570	34,570
AIC	305,178.6	289,876.6
BIC	306,478.2	291,381.4

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies. AIC: Akaike information criterion; BIC: Bayesian information criterion. These are standard alternative measures of overall explanatory power of maximum likelihood estimate of the model. When comparing alternative specification of the model, smaller values of AIC and BIC indicate better overall explanatory power.

The results indicate the existence of backward productivity spillover. The coefficient estimates on BW are found to be statistically significant and positive, consistent with positive productivity spillovers from FIEs to domestic suppliers. The results are in line with the current literature (Blalock & Gertler, 2008; Crespo & Fontoura, 2007; Javorcik, 2004), confirming that backward productivity spillover is the most likely channel through which spillover would manifest itself. This is because the presence of FIEs in the domestic market may increase the demand for local inputs, leading to domestic firms exploiting economies of scale. Domestic firms also can be offered training and other technological support from FIEs that raises the product quality or innovating ability of the suppliers. In addition, domestic firms in competition with other local providers have incentives to upgrade their production management and technology. The findings on positive backward productivity spillover are consistent with the current situation of FDI in Vietnam. FIEs have a tendency to invest in industries operating within GPNs, such as computer, electronic, and optical products (see Chapter 2). The

dominance of FIEs in these industries is likely to create significant demand for parts and components supplied by domestic firms.

The results on forward productivity spillover are also encouraging. The coefficient estimates on FW are found to be statistically significant and positive, consistent with positive productivity spillovers from foreign firms to domestic buyers. An evidence of forward productivity gains is consistent with Lin, Liu, and Zhang (2009), Nguyen el al. (2008), and Ni et al. (2017). These studies show that local manufacturing enterprises can improve their efficiency by gaining access to high quality intermediate inputs provided by FIEs. However, this is in contrast to the findings of Newman et al. (2015), which find evidence of negative forward spillover effects, and Le and Pomfret (2011), which find no evidence of forward spillover effects. An obvious difference between my study and these studies is the different datasets used. In addition, my study employs a matrix excluding imports that would change the relationships between sectors.

The estimated coefficient of the FDI horizontal spillover is negative and statistically significant, implying the existence of the 'market stealing effect'. This result is consistent with much of the literature on FDI spillover for developing and transition economies (Aitken & Harrison, 1999; Hu & Jefferson, 2002; Konings, 2001). The finding is also consistent with that of other studies for Vietnam's case (for example, Huynh et al., 2021; Le & Pomfret, 2011; Ni et al., 2017; Tran et al., 2016).

Turning to the control variables, the results show that most firm-specific and sector-specific control variables significantly affect domestic firms' productivity. The findings support the literature that older firms may be more productive. The productivity of SOEs is not significantly different from that of PDEs. The coefficients of medium and large size are significantly positive, implying that firms can benefit from scale economies. Geographical

location plays an important role in determining manufacturing TFP: firms located in the South region (Southeast and Mekong Delta) are more productive than those in other regions. The coefficients of export and import intensity are both positive and statistically significant, implying that firms operating in export-oriented and import-dependent industries are more productive. Lastly, the market concentration variable, capturing the effect of competition on firms' productivity, is negative and statistically significant, implying that competition helps increase domestic firms' productivity.

5.4.2 Foreign ownership structure and productivity spillover

Table 5-3 shows the results on the role of foreign firm ownership in determining the degree of productivity spillover. In general, ownership structures of FIEs serve as an important determinant of productivity spillover: JVs tend to generate more significant positive productivity spillover to domestic firms than FOFs.

Table 5-3 Productivity spillover from foreign-invested enterprises to Vietnamese manufacturing domestic firms: The role of foreign firm ownership structure

Dependent variable = Log TFP	(1)	(2)
Productivity spillover		
L.Horizontal FOF	-0.306***	-0.221***
	(0.0347)	(0.0346)
L.Horizontal JV-SOE	-1.262***	-0.801***
	(0.0728)	(0.0738)
L.Horizontal JV-PDE	0.230	0.296*
	(0.124)	(0.124)
L.Backward FOF	0.425***	0.307***
	(0.0810)	(0.0808)
L.Backward JV-SOE	-0.853***	-0.495**
	(0.179)	(0.178)
L.Backward JV-PDE	4.846***	4.550***
	(1.083)	(1.079)
L.Forward FOF	0.467**	0.345*
	(0.169)	(0.169)
L.Forward JV-SOE	3.180***	4.591***
	(0.644)	(0.643)

L.Forward JV-PDE	-0.426	-0.853
	(0.953)	(0.949)
Control variables	No	Yes
Constant	4.624***	5.755***
	(0.0921)	(0.0934)
Number of observations	129498	129498
Number of firms	34,570	34,570
AIC	304564.6	289393.1
BIC	305981.5	291015.2

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies.

Regarding backward productivity spillover, the results show that both FOFs and JV-PDEs positively influence domestic suppliers' productivity, with the effects from the latter being larger than those from the former. According to the literature on this matter, JVs tend to source domestically, resulting in greater scope for spillover to local suppliers. By contrast, FOFs may be more likely to import their intermediate inputs due to their relationship or familiarity with foreign suppliers; thus, generate less significant spillover to domestic suppliers. The results of my analysis lend support to this hypothesis for the case of JV-PDEs. The findings imply that domestic suppliers benefit from the presence of JV-PDEs, but not of JV-SOEs. In Vietnam, JV-PDEs are much more dominant in downstream sectors than JV-SOEs, such as food products, wood and paper products, and pharmaceuticals. JV-PDEs operating in these sectors may create more significant spillover to domestic firms, from which inputs are purchased.

Regarding forward productivity spillover, the results show that both FOFs and JV-SOEs positively influence domestic buyers' productivity, and the effects from the latter are more significant than those from the former. The literature on this matter explains that JVs' products are more likely to be supplied for domestic enterprises; thus, JVs may generate more significant forward spillover to local firms than FOFs. The results of my analysis are consistent with this hypothesis for the case of JV-SOEs. The findings indicate that JV-SOEs, not JV-PDEs, benefit

domestic buyers. This can be attributed to the fact that JV-SOEs in Vietnam are most dominant in 'input' sectors where forward spillovers are likely to occur, such as motor vehicles, trailers, and semi-trailers, and other transport equipment.

Lastly, the results indicate that while both FOFs and JV-SOEs negatively influence domestic firms' productivity in the same sector, the magnitude of negative impacts from the former is much smaller than that from the latter. This pattern suggests that JV-SOEs impose a more significant level of competition on domestic markets than FOFs. This can be attributed to the fact that JV-SOEs – similar to SOEs – have advantages in accessing land and capital and flexibility in meeting regulatory obligations. These advantages allow JV-SOEs to attract domestic demand, resulting in local competitors losing their market shares ('market-stealing effect'). However, there is a sign of positive horizontal productivity spillover from JV-PDEs to domestic firms. In other words, domestic firms are likely to benefit from the existence of JV-PDEs in the same sector. This is because JV-PDEs tend to invest in industries that do not require sophisticated technology. Domestic competitors find it is easier to imitate technologies and management skills from JV-PDEs (demonstration effects).

5.4.3 Global production networks and productivity spillover

This section reports and discusses the results on the effects of engagement in GPNs on the nature and magnitude of productivity spillover (Table 5-4). Column (1) shows these effects by comparing productivity between firms operating within and outside GPNs. Columns (2), (3), and (4) further investigate the channels through which the engagement in GPNs affects domestic firms' productivity.

The coefficients of the GPN variable in all specifications are positive and statistically significant, implying that domestic firms involved in GPNs have, on average, a higher level of

productivity than their counterparts. By becoming part of an international network, GPN firms are likely to have new opportunities to build their capacity and enhance competitiveness. The results are consistent with other studies on technology transfer from FIEs to domestic firms under contractural relationships (for example, Ivarsson & Alvstam, 2005; Kumar & Subrahmanya, 2010; Wong, 1992).

The interaction term between GPN and backward spillover variables is statistically insignificant, implying that GPN firms and non-GPN firms have no difference in benefiting from foreign firms' presence in downstream sectors. FIEs always have incentives to transfer technology to their suppliers, regardless of whether they have contractural relationships or not. The insignificant result can also be explained by the fact that Vietnamese suppliers to foreign firms have remained low. According to VCCI (Vietnam Chamber of Commerce and Industry) (2018), only 14 percent of domestic firms are suppliers to FDI businesses. Vietnamese firms supply less than 30 percent of intermediate inputs of FDI. The negligible portion of Vietnamese suppliers to foreign firms can be explained by local firms' inability to meet FIEs' requirements (Sturgeon & Zylberberg, 2016). For example, Samsung – one of the largest FIEs in Vietnam – relies mainly on Korean suppliers that have co-located in Vietnam.

Table 5-4 Productivity spillover from foreign-invested enterprises to Vietnamese manufacturing domestic firms: The role of joining global production networks

Dependent variable = Log TFP	(1)	(2)	(3)	(4)
Productivity spillover				
L.Horizontal	-0.172***	-0.245***	-0.171***	-0.183***
	(0.029)	(0.031)	(0.029)	(0.029)
L.Backward	0.347***	0.359***	0.355***	0.363***
	(0.053)	(0.053)	(0.054)	(0.053)
L.Forward	0.448**	0.493***	0.444**	0.345**
	(0.129)	(0.130)	(0.129)	(0.130)
GPN	0.867***	0.412***	0.868***	0.503***
	(0.085)	(0.027)	(0.027)	(0.027)

Interaction terms				
Horizontal*GPN		0.611***		
		(0.071)		
Backward*GPN			-0.150	
			(0.140)	
Forward*GPN				0.355***
				(0.045)
Control variables	Yes	Yes	Yes	Yes
Constant	5.745***	5.754***	5.739***	5.668***
	(0.077)	(0.078)	(0.078)	(0.078)
Number of observations	129,486	129,486	129,486	129,486
Number of firms	34,566	34,566	34,566	34,566
AIC	281,696.2	281,651.3	281,700.0	281,628.1
BIC	282,614.7	282,589.4	282,638.0	282,566.1

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies.

5.5 Robustness checks

Since the choice of the spillover variable can influence the obtained results, I estimate the baseline specification using an alternative measure for foreign firms' presence. Instead of using the share of total output accounted for by FIEs, I define horizontal spillover variable as the proportion of employees working in FIEs in an industry. The current literature has employed this spillover measure alongside the output measure (Aitken & Harrison, 1999; Le & Pomfret, 2011). Using this alternative measure, I can not only check the robustness of my results but also gain insights on a specific channel of spillover, which is the acquisition and movement of human capital (Abraham, Konings, & Slootmaekers, 2010). Foreign firms usually make considerable investments in the training of their employees. The inter-firm mobility of these trained workers and managers accelerates the dissemination of management skills and production techniques. Through this process, local firms are expected to obtain positive spillover from FIEs. Using an alternative measure for foreign firms' presence, I can still

confirm the original findings (Appendix 5-5). In other words, the technology spillover can occur through both output and labour capital with more or less similar magnitude.

In addition, I run several robustness checks with alternative control variables and different subsamples. First, the four-firm concentration ratio[19] ($top4$) is used as an alternative to HHI. Next, I re-estimate the model after excluding micro-firms from the dataset due to concerns about the quality of data reported by these firms. I also undertook alternative estimation after truncating the time coverage to 2010–2017, to allow for production disruptions during the global financial crisis (2008–2009). The results are resilient to these alternative control variables and different subsamples (Appendix 5-6).

Concerning any possible endogeneity bias, I use the difference-GMM estimator[20] developed by Arellano and Bond (1991) as an alternative estimation for robustness check. This GMM estimator is an effective way to tackle endogeneity problems caused by unobserved heterogeneity and reverse causality. This is because the GMM estimation employs within-firm differencing and internal instruments (lag levels) for all endogenous explanatory variables. The results support the main findings on the existence of backward and forward productivity spillover and lack of horizontal productivity spillover (Appendix 5-7).

5.6 Conclusions

This chapter has examined the productivity spillover from MNE affiliates to local firms. Using establishment-level data for Vietnam's manufacturing sector covering the period 2006–2017 and the 2012 IO table, the chapter sheds light on three different channels of productivity spillover: horizontal, backward, and forward. The latter two channels are found to have

[19] The four-firm concentration ratio is the sum of total sales or the top four firms divided by the industry total.
[20] Difference-GMM is employed because the coefficients for the lag dependent variable (L.Log TFP) lie well within the OLS upper bounds and FE lower bounds in all specifications (Bond et al., 2001).

significant and positive effects, implying the existence of technology diffusion from foreign firms to Vietnam's domestic firms along the supply chain. The results also show that the coefficient of horizontal productivity spillover is negative and statistically significant. Domestic firms, which are mostly smaller and less productive than foreign affiliates, face difficulties competing with FIEs in the same sector. The core results are robust to alternative measures for key regressors, control variables, and subsamples.

Moreover, the chapter considers the impacts of the ownership structure of FIEs on the extent of productivity spillover. Deviating from the previous studies, this analysis classifies multinational firms into FOFs, JV-SOEs, and JV-PDEs. The estimated results show that the extent of spillover is influenced by the ownership structure of FIEs. For horizontal spillover, the productivity of domestic firms is negatively associated with the presence of FOFs and JV-SOEs, but not with the entry of JV-PDEs. Domestic firms benefit from FOFs and JV-PDEs in the backward spillover channel and from FOFs and JV-SOEs in the forward spillover channel.

Lastly, there is evidence that domestic firms operating within GPNs benefit more from the presence of FIEs compared to those involved in horizontal specialisation. However, limited productivity spillover from FIEs to domestic GPN suppliers could explain why Vietnam, like many developing and transition economies, has made a significant attempt to intervene in the sourcing practice of FIEs.

Appendix 5-1 Recent studies on FDI linkages vs. productivity for Vietnam using firm-level panel data

	Studies	Data	Horizontal spillover	Backward spillover	Forward spillover	Identification strategy
1	Huynh et al. (2021)	Manufacturing firms, VES 2011–2015	(-) in all regions	(+) in all regions	(-) in all regions	2-stage estimation: (1) estimate TFP using the inputs of labour, capital, wages, cost of good sales, and investment; (2) measures the effects of horizontal and vertical spillover on the estimated TFP with the inclusion of other FDI-related and firm-related variables: market share, imports, and labour intensity
2	Nguyen and Diez (2019)	Domestic suppliers in the sub-survey of the Vietnam census data round 2013, mostly manufacturing SMEs in the Red River Delta region	N/A	Limited direct support	N/A	In-depth interviews to explore the extent of backward linkages
3	Ni et al. (2017)	Manufacturing firms, VES 2002–2011	(-) and significant for Asia, insignificant for Europe and North America	(+) and significant for Asia, insignificant for Europe and North America		- 2-stage approach: (1) the Stochastic frontier estimation and Olley and Pakes approach to measure TFP; (2) a standard panel regression - Divide investors into subgroups based on geographical location: Asia, Europe, and North America
4	Tran et al. (2016)	VES 2000–2005, aggregated into 8 industrial sectors	(-)	(+)	(-)	- Spatial Durbin model, distinguishing intra-regional and inter-regional effects - Control variables include two groups: agglomeration index and regional specifics

	Studies	Data	Horizontal spillover	Backward spillover	Forward spillover	Identification strategy
5	Newman et al., (2015)	4000 manufacturing firms, Vietnam Technology and Competitiveness Survey (TCS) 2009, 2010, 2011, and 2012	Indirect spillover insignificant	(+)	(-)	- 2-stage approach: (1) estimate production functions for each 2-digit subsectors, using Wooldridge (2009) 1-step GMM estimator; (2) models are estimated using first differences and include time, sector, and province fixed effects - Control variables: Herfindahl-Hirschman Index at 4-digit sector level, level of imports and exports from each 4-digit sector
6	Anwar and Nguyen (2014)	Manufacturing firms, VES 2000–2005	(+) in North East, Central Highland, and Mekong River Delta	(+) in Red River Delta, South Central Coast, South East, and Mekong River Delta (-) and mostly insignificant in other regions	(+) in North West and North Central Coast regions	- Taking into account 8 regions of Vietnam - 2-stage approach: (1) a standard Cobb-Douglas model to measure firms' productivity; (2) 2-stage least squares - Control variables: human capital, scale, concentration, and technology gap
7	Le and Pomfret (2011)	29 selected sectors from three industrial groups, VES 2000–2006	(-)	(+)	N/A	- Dependent variable: labour productivity of domestic firms - 1-stage approach: integrate FDI variables in production function - Fixed effects and random effects - Restricted to domestic firms - One-year lagged explanatory variables - Control variables: labour quality, scale, concentration, technology gap

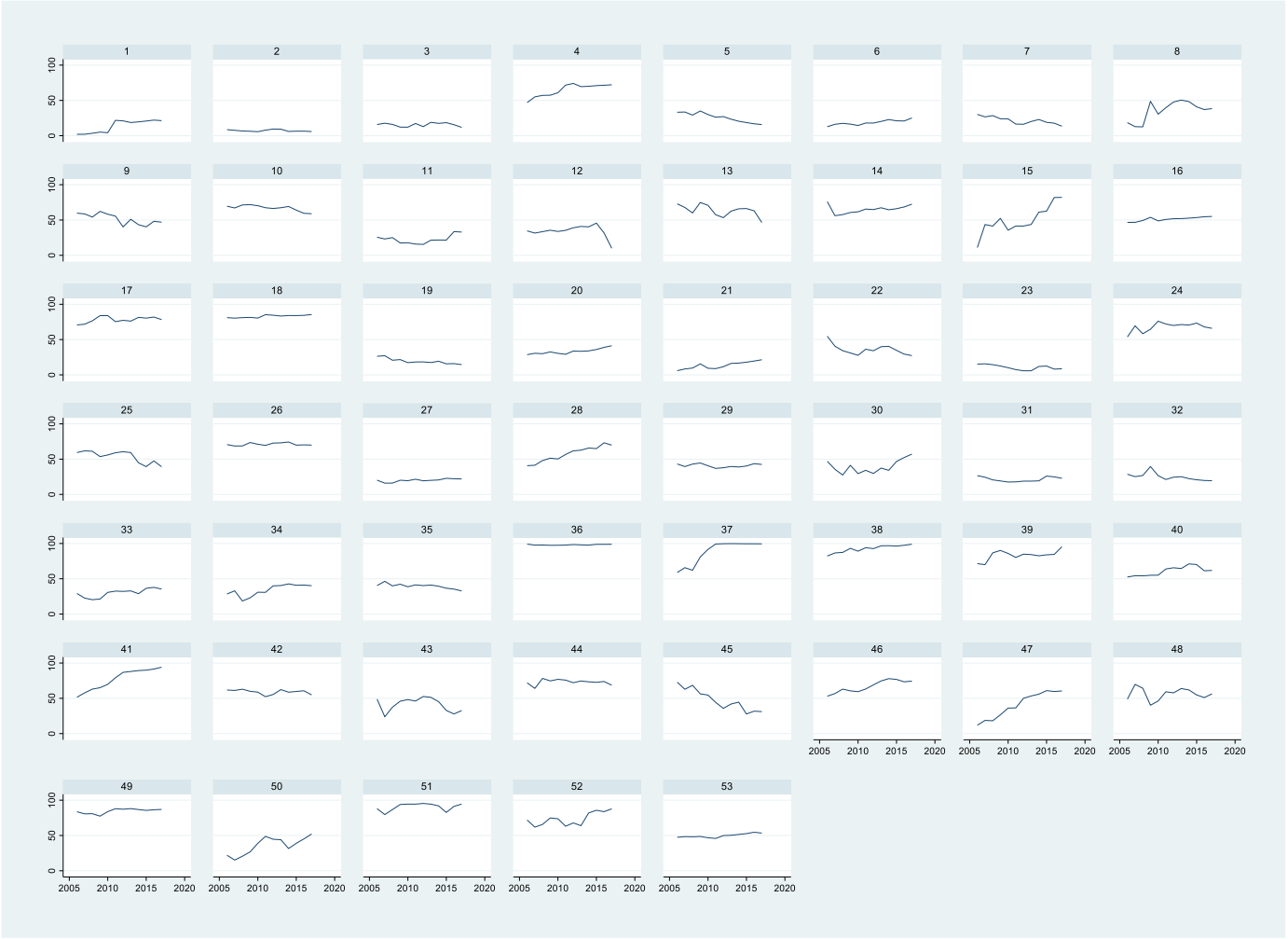
	Studies	Data	Horizontal spillover	Backward spillover	Forward spillover	Identification strategy
8	Tran (2011)	Whole sample, VES 2001–2005	(-) for technical change (+) for technical efficiency	(+)	(-)	- 2-stage approach: (1) stochastic frontier model to measure firms' productivity; (2) GMM procedure to measure effects - Control variables: labour quality, concentration, age, age squared, R&D, and export

Appendix 5-2 Industry classification

	IO 2012	Name of sector	4-digit level of the VSIC 2007
1	35	Processed, preserved meat and by-products	1010
2	36	Processed preserved fishery and by-products	1020
3	37	Processed preserved fishery Vegetables and fruit	1030
4	38	Vegetable and animals' oils and fats	1040
5	39	Milk and by-milk	1050
6	40	Rice, flour (all kinds)	1061+1062+1071
7	41	Sugar	1072
8	42	Cocoa, chocolate and candy, cake products from flour	1073
9	43-44-45	Coffee Tea Other remaining foods	1074+1075+1079
10	46	Animal feed	1080
11	47	Alcohol	1101+1102
12	48	Beer	1103
13	49	Non-alcohol water and soft drinks	1104
14	51	Fibber (all kinds)	1311+1312+1313
15	52	Textile products (all kinds)	1321
16	53	Costume (all kinds)	1322+1323+1324+1329+1410+1430
17	54	Leather, preliminary processed fur, suitcase, bags, saddle and other same kinds)	1420+1511+1512
18	55	Shoes, sandal (all kinds)	1520
19	56	Processed wood and by-wood products	1610+1621+1622+1623+1629
20	57	Paper and by-paper products	1701+1702+1709
21	58	Products of printing activities	1811+1812+1820
22	62	Basic organic chemicals	2011
23	63	Fertiliser and nitrogen compound	2012
24	64	Plastic and primary synthetic rubber	2013
25	65	Other chemical products;	2021
26	66	Man-made fibres	2022+2023+2029+2030
27	67	Medicine, chemical prophylaxis and pharmacy	2100
28	68	By-product rubber	2211+2212

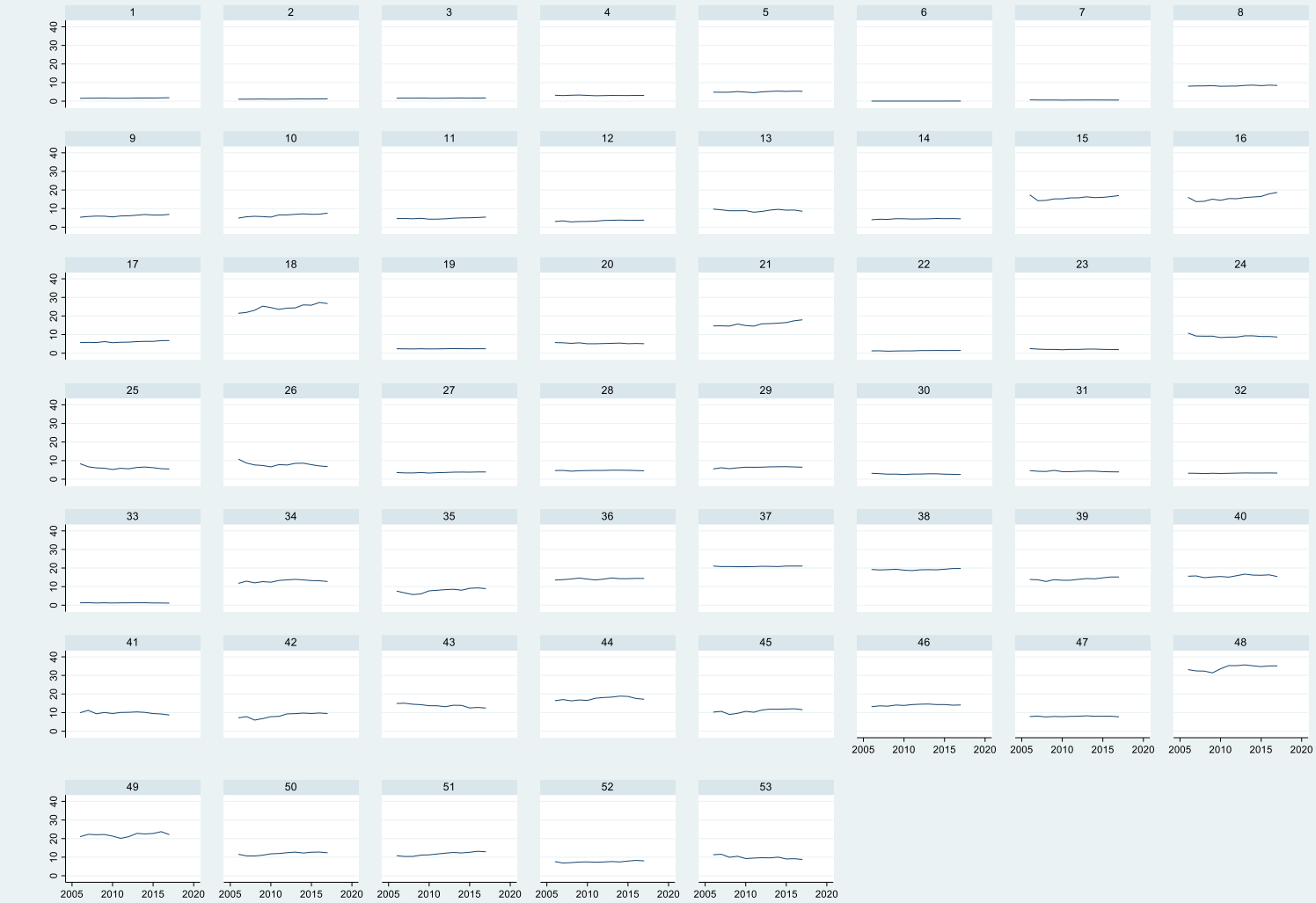
	IO 2012	Name of sector	4-digit level of the VSIC 2007
29	69	By-product plastic	2220
30	70	Glass and by-product glass	2310
31	71	Brick, tile, paving stone and baked clay building products	2391+2392+2393
32	72-73	Cement of all kinds, Non-metallic mineral products not classified in any category	2394+2395+2396+2399
33	74	Iron, steel, iron	2410
34	75	Ferrous metals, precious metals, metal casting services	2420+2431+2432
35	76	Products from prefabricated metal (except machines and equipment)	2511+2512+2513+2520+2591+2592+ 2593+ 2599
36	77	Electronic device, computer, and peripheral	2610+2620
37	78	Machinery & equipment used for broadcasting, television and information activities	2630
38	79	Electrical household appliance	2640
39	80	Other electronic products and optical products	2651+2652+2660+2670+2680
40	81	Motor, electric generator, power transformers	2710
41	82	Cell and battery	2720
42	83	Electric conductor	2731+2732+2733
43	84	Electric light equipment	2740
44	85	Consumer electronic equipment (refrigerator, dishwasher, washing machine, dust allayer)	2750
45	86	Other electric equipment	2790
46	87	General-purpose machinery	2811+2812+2813+2814+2815+2816+ 2817+2818+2819
47	88	Special-purpose machinery	2821+2822+2823+2824+2825+2826+2829
48	89	Cars (all kinds)	2910
49	90	Car engines with tractor (except automotive)	2920+2930
50	91	Ships and boats	3011+3012+3020+3030
51	92	Motor vehicles, motor bikes	3091
52	93	Other transport means	3092+3099
53	94	Bed, cabinet, tables, chairs	3100

Appendix 5-3 Evolution of productivity spillover proxies



Evolution of horizontal productivity spillover

Evolution of backward productivity spillover



Evolution of forward productivity spillover

Appendix 5-4 Productivity spillover from foreign-invested enterprises to Vietnamese manufacturing domestic firms: Fixed effects

Dependent variable = Log TFP	(1)	(2)	(3)
L.Horizontal	-0.384***	-0.378***	-0.243***
	(0.033)	(0.033)	(0.033)
L.Backward	0.454***	0.435***	0.406***
	(0.064)	(0.063)	(0.063)
L.Forward	0.449**	0.381*	0.430**
	(0.154)	(0.154)	(0.153)
L.SOE		0.0529	0.0369
		(0.028)	(0.028)
Log AGE		0.167***	0.164***
		(0.013)	(0.013)
Small		-0.180***	-0.181***
		(0.009)	(0.009)
Medium		0.0864***	0.0917***
		(0.009)	(0.009)
Large		0.0720***	0.0785***
		(0.019)	(0.018)
Log HHI			-0.0627***
			(0.007)
Log EOR			0.342***
			(0.013)
Log MDR			0.212***
			(0.010)
Constant	4.813***	4.443***	5.154***
	(0.123)	(0.126)	(0.127)
N (Level 1)	129498	129498	129498
N (Level 2)	34570	34570	34570
R_square	0.725	0.704	0.705
Hausman test	1153***	4405***	4691***

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies.

Appendix 5-5 Productivity spillover from foreign-invested enterprises to Vietnamese manufacturing domestic firms: Alternative measure for the presence of foreign firms

Dependent variable = Log TFP	(1)	(2)
Productivity spillover		
L.Horizontal	-0.232***	-0.141***
	(0.042)	(0.042)
L.Backward	0.687***	0.639***
	(0.068)	(0.068)
L.Forward	1.308***	1.259***
	(0.165)	(0.164)
Log AGE		0.163***
		(0.013)
Ownership (OWN, with PDE as the base dummy)		
L.SOE		0.0375
		(0.028)
Plant-size dummies (SIZE, with Small as the base dummy)		
Micro		-0.181***
		(0.009)
Medium		0.0913***
		(0.009)
Large		0.0788***
		(0.018)
Geographical location dummies (GLD, with Northeast and Mountainous as base dummy)		
Red River Delta		0.118***
		(0.019)
North Central		-0.102***
		(0.025)
South Central and Highland		-0.00223
		(0.022)
Southeast		0.415***
		(0.019)
Mekong Delta		0.176***
		(0.022)
Log EOR		0.351***
		(0.013)
Log MDR		0.215***
		(0.010)
Log HHI		-0.0623***
		(0.007)
Constant	4.629***	5.852***
	(0.092)	(0.093)
Number of observations	129498	129498
Number of firms	34,570	34,570
AIC	305319.5	289884.0
BIC	306619.1	291388.8

Notes: Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies.

Appendix 5-6 Productivity spillover from foreign-invested enterprises to Vietnamese manufacturing domestic firms: Alternative control variable and subsamples

Dependent variable = Log TFP	(1)	(2)	(3)
Productivity spillover			
L.Horizontal	-0.262***	-0.239***	-0.224***
	(0.033)	(0.036)	(0.037)
L.Backward	0.444***	0.306***	0.528***
	(0.063)	(0.068)	(0.066)
L.Forward	0.488**	0.182	0.968***
	(0.153)	(0.166)	(0.164)
Log AGE	0.166***	0.200***	0.145***
	(0.013)	(0.014)	(0.015)
Ownership (OWN, with PDE as the base dummy)			
L.SOE	0.0406	0.0424	0.060
	(0.028)	(0.027)	0.036
Plant-size dummies (with Small as the base dummy)			
Micro	-0.181***		-0.153***
	(0.009)		(0.009)
Medium	0.0920***	0.111***	0.0672***
	(0.009)	(0.009)	(0.010)
Large	0.0788***	0.112***	0.0502*
	(0.018)	(0.018)	(0.021)
Regional dummies (with Northeast and Mountainous as base dummy)			
Red River Delta	0.118***	0.103***	0.117***
	(0.019)	(0.020)	(0.020)
North Central	-0.101***	-0.127***	-0.111***
	(0.025)	(0.027)	(0.026)
South Central and Highland	-0.00129	0.00944	-0.00641
	(0.022)	(0.024)	(0.023)
Southeast	0.417***	0.376***	0.404***
	(0.019)	(0.020)	(0.020)
Mekong Delta	0.178***	0.148***	0.181***
	(0.022)	(0.024)	(0.023)
Log EOR	0.349***	0.325***	0.378***
	(0.013)	(0.013)	(0.017)
Log MDR	0.201***	0.202***	0.252***
	(0.010)	(0.011)	(0.011)
Log HHI		-0.0568***	-0.0260***
		(0.007)	(0.008)
Log top4	-0.212***		
	(0.013)		
Constant	5.971***	5.950***	5.505***
	(0.088)	(0.109)	(0.106)
N (Level 1)	129498	97861	108878
N (Level 2)	34,570	23,897	30,812
AIC	289677.8	206339.6	235678.8
BIC	291182.6	207782.3	237099.3

Notes: Column (1) replacing HHI by the four-firm concentration ratio ($top4$); column (2) excluding micro-firms from the dataset; and column (3) truncating the time coverage to 2010–2017. Heteroscedasticity robust standard errors are given in parentheses with the statistical significance of the regression coefficients denoted as * p<0.05, ** p<0.01, *** p<0.001. All specifications include year and sectoral dummies.

Appendix 5-7 Productivity spillover from foreign-invested enterprises to Vietnamese manufacturing domestic firms: Difference-GMM

Dependent variable = Log TFP	(1)	(2)	(3)
L.lnTFP_ACF	0.176***	0.176***	0.204***
	(0.013)	(0.013)	(0.014)
L.Horizontal	0.423	0.427	0.644
	(0.263)	(0.261)	(0.340)
L.Backward	0.371***	0.386***	0.243*
	(0.106)	(0.104)	(0.114)
L.Forward	2.051***	2.062***	2.110**
	(0.536)	(0.533)	(0.713)
Log AGE	0.229*	0.234*	0.188
	(0.116)	(0.115)	(0.117)
L.SOE	-0.00573	-0.00536	-0.00392
	(0.043)	(0.043)	(0.044)
Micro	-0.154***	-0.154***	
	(0.014)	(0.014)	
Medium	0.0746***	0.0746***	0.0838***
	(0.019)	(0.019)	(0.019)
Large	0.0361	0.0356	0.0449
	(0.028)	(0.028)	(0.027)
Log EOR	0.398***	0.410***	0.322**
	(0.081)	(0.087)	(0.114)
Log MOR	0.186*	0.171*	0.259**
	(0.074)	(0.078)	(0.090)
Log HHI	-0.0268*		
	(0.012)		
Log top4		-0.104**	-0.0943*
		(0.040)	(0.048)
N (Level 1)	71910	71910	60536
N (Level 2)	17040	17040	14096
AR1	0.000	0.000	0.000
AR2	0.658	0.561	0.775
Hansen	0.311	0.295	0.279

Notes:

- Spillover variables constructed from HR_{jt} with employment.
- Column (2) replacing HHI by the four-firm concentration ratio (top4); column (3) excluding micro-firms from the dataset.
- Robust standard errors in parentheses: * p < 0.05, ** p < 0.01, *** p < 0.001.
- AR1 is a test for first-order serial correlation. H0: first-order serial correlation does not exist. The null hypothesis of no first-order serial autocorrelation is rejected at order one.
- AR2 is a test for second-order serial correlation. H0: second-order serial correlation does not exist. As the p-value > 0.05, we confirm that no serial correlation exists at order two and that the model is well specified.
- Hansen is a test of the overidentifying restrictions for the GMM estimators. H0: instruments are valid. As the p-value > 0.05, we confirm the validity of instruments.

Chapter 6 (A supplement chapter) Intersectoral linkages and imports of Vietnam: An input-output approach

Abstract

This study traces the intersectoral linkages, or the interdependence of industries, in Vietnam's economy within the period of 2000–2012 using the input-output analysis. The total linkages – computed using Leontief inverse – are generally employed by policymakers in identifying critical industries for policy focus. However, for many countries like Vietnam that are heavily dependent on imported inputs, total linkages can give an erroneous result. The paper shows the importance of the domestic linkages, which are the inverse net of imports, in analysing the importance of industries in the economy. By constructing the non-competitive input-output tables, relying on the assumption that imports are distributed across industries in the same proportion as the gross domestic output of the corresponding industry, the paper finds that there are considerable divergences between total and domestic linkages. The results indicate that failure to take into account import dependence tends to overestimate intersectoral linkages of some key sectors in the Vietnamese economy.

6.1 Introduction

It has always been the goal of Vietnam's industrial policy to promote the development of prioritised sectors. In the recent Resolution 23-NQ/TW, dated 22 March 2018, issued by the Politburo on 'Developing the national industry until 2030, with a vision to 2045', further speeding up the development of industries with positive spillovers to other sectors has again been emphasised. This is to ensure choosing prioritised sectors in the sense of their potential stimulus, which will be induced in other industries. However, Vietnam still has a long way to go before materialising this goal, as a sufficient and consistent methodology to identify sources of induced economic development is lacking.

The most recent published books of input-output (IO) tables of Vietnam (GSO, 2010, 2015) recommended policymakers to employ linkages using the Leontief inverse as an important reference in choosing the key economic sector. Indeed, some policymakers have proposed

prioritised sectors basing on this index (Huynh, 2014). However, there have been some scholars that use 'domestic linkages', which are the exclusion of imported intermediate inputs in linkage measurements, to take into account the leakage to import (this term is sometimes referred as 'net linkages') (Bui et al., 2011, 2012; Nguyen & Bui, 2018; To et al., 2016). However, they show inconsistency in their measurement procedures. One cannot find how they construct related variables and what assumptions lie under their estimation process, given the unavailability of data supporting the calculation of domestic linkages.

The merit of my work lies in the use of a more recent procedure laid out by the National Research Council (2006) to determine critical sectors. A long time-period from 2000 to 2012 allows me to examine the manifestation of more profound variations in the intersectoral linkage, which is particularly relevant in the context of the rapidly changing economy of Vietnam. Finally, I use more disaggregated IO tables of 86 sectors, which leads to a more refined analysis of intersectoral linkages.

The chapter finds a significant difference between total and domestic linkages in the case of Vietnam. In terms of total linkages, key sectors include those from the manufacturing and other sectors within the services and construction groups of economic activity. However, in terms of domestic linkages, nonindustrial and some agricultural sectors tend to emerge as key sectors. The results imply that import plays a significant role in the intersectoral linkages in the Vietnamese economy. The strength of some sectors' linkages is due to the import utilisation effects, but not domestic sectors' real own ability to create linkages.

This chapter proceeds as follows. Section 6.2 discusses the conceptual issues surrounding the analysis of linkages in an open developing country. Section 6.3 reviews related works on ranking sectors based on domestic linkages. This section is followed by a procedure and data

for measuring domestic linkages. Section 6.5 presents and interprets the results. The last section concludes and offers some practical recommendations.

6.2 Total vs. domestic linkages, conceptual issues

The concept of linkages has attained a prominent place in the theoretical development literature. Linkages refer to the potential stimulus that one industry has on the economic activity of others. This inducement mechanism might generate a multiplier effect on growth, and countries pursuing growth paths that put more emphasis on high-linkage industries might achieve higher growth rates (Jones, 1976).

The linkage analysis, first developed by Hirschman (1959), is extensively employed as a planning tool in various developing countries. The crucial premise of Hirschman's policy advocacy lies in the fact that, given existing domestic demand, a country can direct investment flows towards key industries to maximise developmental gains (Athukorala & Santosa, 1997). A key industry refers the one that has maximum linkages with the rest of the economy in terms of potential sales to others (forward linkages) or purchases from others (backward linkages).

According to Hirschman (1959), linkages are measured using the Leontief technology matrix or the Leontief inverse (termed as 'total linkages' in this chapter). Hirschman (1959, p.105) argues that the linkages computation for a developed country would be a guide for less developed countries (LDCs) "on the condition that we expect the commodity composition of underdeveloped country's output to bear eventually some resemblance to that of the country on whose input-output statistics we perform the experiment". This implicitly assumes that both countries have the same technology. Subsequently, thanks to the rapid accumulation of national IO tables and literature on the measurement of linkages, a significant number of empirical estimates of linkages began to be published.

However, Acharya and Hazari (1971) claim that a LDC should have its own linkages because there is nothing to guarantee that its output composition will resemble that of the developed country. They show that linkages computed on the Leontief technology matrix or inverse could not give an accurate picture of the potential sources of induced economic development and distort the linkage measures that they are supposed to use for the case of LDC's economy. They explain that most of these countries exhibit a determined dependence on imported intermediate goods. When the linkage effects are considered, imports will induce economic expansion only in the exporting countries. Acharya and Hazari (1971) suggest that, instead of total linkages, 'domestic' ('net' in their chapter) linkages, which is the inverse net of imports, should be used for ranking sectors in LDCs.

Similarly, Riedel (1976) shows that the backward linkage indicates the actual existing linkages of a given sector if, and only if, all intermediate inputs are produced and supplied domestically. If, as is the more likely case, especially in developing countries, a significant proportion of intermediate inputs is imported, total backward linkages will be an entirely erroneous measure of existing linkages. For the economy that depends on imports, the domestic inverse may be more appropriate in measuring the linkages and identify the sources of induced economic development.

Jones (1976) shows another problem arising from the inclusion of imported and domestic intermediate inputs in linkage measurement. He explains that the industry would have high backward and low forward linkages if the inputs are domestically available and the outputs are for export purposes. Similarly, the industry would have low backward and high forward linkages if the inputs are mostly imported and the outputs are highly demanded domestically. Therefore, the measurement of linkages must be derived using only the domestic flow matrix, instead of the total flow matrix.

Indeed, for many countries increasingly integrating into the global economy, empirical studies show a significant divergence between gross and domestic linkages. Bulmer-Thomas (1978) with the case of Costa Rica, Kubo (1985) with the case of nine different countries, and Clements and Rossi (1991) with the case of Brazil, all indicate that in a higher import-dependent economy, domestic linkages are likely to provide a more realistic picture of inducement. Similarly, in a higher import-dependent sector, domestic linkages are likely to provide an appropriate industrial interdependence indicator.

Vietnam's domestic economy, like that in most other developing countries, is heavily dependent on imported inputs. The degree of import dependence would presumably have increased in recent years as the country is becoming progressively embodied within global production networks (Ferrarini & Hummels, 2014). For example, the proportion of imported intermediate inputs in total output of: machinery and equipment was 53 percent; electronic equipment was 44 percent (To & Lee, 2015). Total linkages, therefore, may create a misleading picture of the potential for inducing development through backward and forward linkages.

6.3 Related works on ranking sectors based on domestic linkages

Alauddin (1986) and Mujeri and Alauddin (1994) rank sectors in Bangladesh, distinguishing between gross (total) and net (domestic) linkages. In terms of total linkage, key sectors include those from the manufacturing industries and services, such as petroleum, miscellaneous industries, transport services, and basic metals. However, in terms of domestic linkage, most key sectors are nonindustrial and agricultural sectors, such as jute, rice, other crops, livestock, electricity, wood, and basic metals. The significant divergence in sectoral rankings comes from the inclusion of imports or not. Sectors with high import content, such as petroleum and cotton, are likely to rank low when linkages are computed net of imports. By contrast, less import-dependent sectors, such as agricultural sectors, appear to rank high when net linkages are

considered. In a highly import-dependent economy like Bangladesh, net linkages are likely to provide a more realistic industrial interdependence indicator.

Lekuthai (2006, 2007) compares the importance of the food industry with other sectors in the Thailand economy using IO tables of the years 1980, 1990, and 2000. Both total and domestic linkages were calculated based on the Leontief inverse matrix. Regarding the total linkages, the backward linkage of the food industry is lower than some leading industries. However, both backward and forward linkage indices of the food industry become noticeably higher when net linkages were used. Lekuthai (2006, 2007) explains that the food industry is less import-dependent, thus getting higher indices after employing net linkage. As the food industry has provided the most substantial contributions to the Thai economy, this industry needs more serious and continuous government support for development. Lekuthai (2006, 2007) also find a large difference in gross and net linkages in office equipment and electronic appliances, the sectors with high import content.

As for the literature on domestic linkages and key sectors regarding Vietnam, we can refer to the study of Nguyen and Bui (2018) and some related studies of Bui et al. (2011, 2012), Bui (2010), and To et al. (2016). The methodology used involves converting the existing IO table into a non-competitive import[21] type. Then the backward linkage and forward linkage are estimated, based on which the power of dispersion index and sensitivity for dispersion index are identified. The combination of the two latter indices indicates the relative importance of sectors in the economy. The authors find that four industry groups of agriculture, forestry and

[21] There are two types of IO tables – 'competitive' and 'non-competitive' – which differ in their treatment of import data. In the competitive IO tables, both domestically produced and imported inputs are lumped together in a single interindustry IO matrix, A, assuming that these inputs are perfect substitutes. This allows to compute total linkages using Leontief inverse $(I - A)^{-1}$. By contrast, in non-competitive IO tables, inputs are clearly separated into two interindustry matrices: A^d (domestic input coefficients); and A^m (imported input coefficients). This allows to compute domestic linkages using the inverse net of imports $(I - A + m)^{-1}$. For most countries, including Vietnam, only competitive type IO tables are available.

aquatic product; food processing, beverage, and tobacco; production of oil and gas products; and other manufacturing industries have strongly stimulated other industries of the economy, while service industries have low linkages with others industries.

Despite the extensive literature on ranking sectors based on domestic linkages, limited attention is paid to the computation procedure. Furthermore, some studies use a highly aggregated level, sacrificing a considerable amount of detail in the process. In this study, I take the denominator of Rasmussen's power of dispersion to measure inter-industry linkages and follow the National Research Council (2006) to construct the domestic linkages. Moreover, given that the current study is particularly interested in the linkage analysis of the most recent inter-industry structure, I employ the most disaggregated IO tables.

6.4 Methodology and data

6.4.1 Methodology

The Leontief standard equation at competitive-import type is:

$$AX + Y = X$$

where X is the gross output matrix, $A = (a_{ij})$ is the direct intermediate input coefficient matrix with $a_{ij} = \frac{X_{ij}}{X_j}$, and Y is the final demand matrix. Thus, $X = (I - A)^{-1}Y$ gives total inverse of $(I - A)^{-1}$, based on which the total linkages, backward and forward, are computed.

Under the IO framework of the non-competitive import type, we have:

$$A^d X + Y^d = X$$

where X is the gross output matrix, $A^d = a_{ij}^d$ is the domestic direct intermediate input coefficient matrix with $a_{ij}^d = \frac{X_{ij}^d}{X_j}$, X_{ij}^d is domestic coefficient matrix and Y^d is the domestic final demand matrix. Thus, $X = (I - A^d)^{-1}Y^d$ gives domestic inverse of $(I - A^d)^{-1}$, based on which the domestic linkages are computed.

This chapter employs the Rasmussen's indices (Rasmussen, 1956) of backward and forward linkages because these indices include both the direct and indirect effects of linkages.[22] Table 6-1 shows indices for total and domestic linkages.

Table 6-1 Linkage indices, total and domestic

Linkages		Definition	Notes
Total linkages	Backward	$U_j = \frac{\frac{1}{n}K_{.j}}{(\frac{1}{n^2}\sum_{j=1}K_{.j})^n}$	Where $K_{.j} = \sum_{i=1}^{n} K_{ij}$ is the sum of the column elements of the total inverse $(I - A)^{-1}$, which indicates the direct and indirect increase in supply of all sectors needed to sustain a unit increase in final demand of j^{th} sector. This index shows the importance of a sector as a user of inputs.
	Forward	$U_i = \frac{\frac{1}{n}K_{i.}}{(\frac{1}{n^2}\sum_{i=1}K_{i.})^n}$	Where $K_{i.} = \sum_{j=1}^{n} K_{ij}$ is the sum of the row elements of the total inverse $(I - A)^{-1}$, which indicates the direct and indirect increase in supply of i^{th} sector needed to sustain a unit increase in final demand of all sectors. This index shows the importance of a sector as a provider of inputs.
Domestic linkages	Backward	$\overline{U}_j = \frac{\frac{1}{n}\overline{K}_{.j}}{(\frac{1}{n^2}\sum_{j=1}\overline{K}_{.j})^n}$	Where $\overline{K}_{.j} = \sum_{i=1}^{n} \overline{K}_{ij}$ is the sum of the column elements of the domestic inverse $(I - A^d)^{-1}$, which indicates the direct and indirect increase in domestic output of all sectors needed to sustain a unit increase in final demand of j^{th} sector.
	Forward	$\overline{U}_i = \frac{\frac{1}{n}\overline{K}_{i.}}{(\frac{1}{n^2}\sum_{i=1}\overline{K}_{i.})^n}$	Where $\overline{K}_{i.} = \sum_{j=1}^{n} \overline{K}_{ij}$ is the sum of the row elements of the domestic inverse $(I - A^d)^{-1}$, which indicates the direct and indirect increase in domestic output of i^{th} sector needed to sustain a unit increase in final demand of all sectors.

Source: Rasmussen (1956)

[22] Rasmussen termed these indices as the Index of Power of Dispersion and the Index of Sensitivity of Dispersion.

Domestic linkages can only be calculated under the availability of non-competitive IO tables. This chapter follows the procedure laid out by the National Research Council (2006) to convert competitive IO tables to non-competitive ones, applying the import similarity assumption.[23] This assumption shows that intermediate imports are distributed in the same way of output in the corresponding industries, and the latter refers to the fractions of total output that are shipped to each sector. For example, concerning the agricultural sector, if 24.5 percent of total agricultural production was shipped to farmers and 51.6 percent to manufacturers, then 24.5 percent of intermediate agricultural imports are sold to farmers and 51.6 percent to manufacturers. The assumption is reasonable because we are dealing only with competitive imports of the same type as the output produced domestically (Hazari, 1967). We cannot work on a firmer basis than making this assumption, given the current data availability. This approach has been used in Athukorala and Patunru (2019) to separate domestic and imported inputs matrices.

Applying the assumption, steps to obtain rows representing imported intermediate goods and, thus, the import coefficients matrix m_{ij} are as follows:

1. Identify destination sales matrix:

   $\alpha_{ij} = \frac{X_{ij}}{X_i + M_i} \quad (ij = 1, \dots, n)$

2. Estimate import uses to produce domestic output by multiplying each row of the destination sales matrix by M_i:

[23] A similar approach is seen in Hazari (1967) and Acharya and Hazari (1971). This approach is based on assumption that there is a proportionality relationship between imports and gross domestic output levels (called 'proportionality assumption'). This alternative approach "does not make any significant difference to the quantitative results" (Hazari, 1967, p.168).

$$\begin{bmatrix} \alpha_{11}M_1 & \alpha_{12}M_1 & \dots & \alpha_{1n}M_1 \\ \alpha_{21}M_2 & \alpha_{22}M_2 & \dots & \alpha_{2n}M_2 \\ \dots\dots\dots & \dots\dots\dots & \dots & \dots\dots\dots \\ \alpha_{n1}M_n & \alpha_{n2}M_n & \dots & \alpha_{nn}M_n \end{bmatrix}$$

Each element of this matrix indicates the absolute magnitude of imports being absorbed by a particular sector.

3. Convert into import coefficients matrix m_{ij} where the elements are given by:

$$m_{ij} = \frac{\alpha_{ij*}\, M_i}{X_j} \quad (ij = 1, \dots, n)$$

To test whether a nation is import-dependent, the chapter uses the Spearman rank correlation method:

$$r_s = 1 - 6\frac{\sum {d_i}^2}{n(n^2 - 1)}$$

where r_s is the Spearman rank correlation coefficient, d_i is the difference in the ranks assigned to the two different total and domestic linkages indices of the i^{th} sector, and n is the number of sectors ranked.

If $0 \leq r_s \leq 0.4$ then the economy is heavily relying on imported intermediates (r_s is weak); if $0.4 < r_s \leq 0.7$ then the import requirements of the economy are relatively high (r_s is medium-strong); and if $0.7 < r_s \leq 1$ then the economy has strong domestic industrial linkages and low imports dependence (r_s is strong).

6.4.2 Data

This chapter makes use of the recently published IO tables for the years 2000, 2007, and 2012. In Vietnam, the General Statistics Office (GSO), under the Ministry of Planning and Investment, has been compiling and publishing IO tables. The IO table for the year 2000 was

published with 112 sectors and subsequently the tables were published at more disaggregated levels with 138 sectors for the year 2007 and 164 sectors for the year 2012 (Table 6-2).

Table 6-2 Vietnam input-output tables for 2000, 2007, and 2012: An overview

Reference year	Tables' size	Type	Methodology
2000	112x112	Competitive	Direct full survey, compiled from the Make and Use matrices
2007	138x138	Competitive	Direct full survey, compiled from the Make and Use matrices
2012	164x164	Competitive	Direct full survey, compiled from the Make and Use matrices

Source: Author's compilation from 2000, 2007, and 2012 IO tables

To assist interpretation, reporting, and comparison, official IO tables were aggregated to 86 sectors using concordance tables.[24] Appendix 6-1 shows the list of these 86 sectors.

The IO tables of Vietnam have no rows for imported inputs as distinct from Vietnamese output (competitive type). Thus, they cannot reveal how much of imports of a sector were used as intermediate inputs and how those intermediate imports were allocated across industries. This chapter applies the methodology developed above to convert the existing IO tables to non-competitive type.

Before turning to the results, it is pertinent to comment on the limitations of my estimation procedure. The procedure in which the import coefficient matrices are derived based on certain assumptions regarding the distribution of imports among industries involves the issue of stability of import coefficients. Given the fact that various policies and other considerations contribute to determining import activities, the adopted procedure could be a drawback of this research.

[24] Unlike the National Research Council (2006), which is based on a 9-commodity breakdown, this chapter disaggregates data into 86 sectors for more accuracy and validity of the content calculations. Most studies for the case of Vietnam also use instead an aggregated classification of industries (for example, 22 sectors in Bui et al. (2012), 19 sectors in Nguyen and Bui (2018)).

6.5 Empirical results

With the above data, the relevant set of matrices and vectors have been computed using the aforementioned methodologies. Table 6-3 and Table 6-4 record the values of U_j, $\overline{U}_j$, U_i, and $\overline{U}_i$ for 86 sectors of Vietnam in 2000, 2007, and 2012. In these tables, each industry has been ranked by each linkage index.

According to Table 6-3, the top-ranking backward-linking sectors change when shifting from a total linkage index to a domestic linkage index. For example, using total linkage index, sectors of motor vehicles, motorbikes (44), special-purpose machinery (46), machinery and equipment used for broadcasting, television, and information activities (51), iron and steel (52), other metal products (53), vegetable and animal oils and fats (20), and poultry (8) can be seen as highest-ranking backward-linking sectors across the years. However, using the domestic linkage index, the sectors that can induce growth in other input-supplying sectors the most are pigs (6), processed, preserved meat, and by-products (19), and processed preserved fishery and by-products (30).

Table 6-3 also shows that almost all of the agriculture sectors have experienced a better ranking when moved from total to domestic linkages, such as paddy (1), sugarcane and tea (4), pigs (6), buffaloes and cows (7), poultry (8), and fish farming (13). By contrast, the rankings have worsened for most manufacturing sectors during the period. They include vegetable and animals oils and fats (20), basic organic chemicals (35), medicine, chemical prophylaxis, and pharmacy (37), plastic and primary synthetic rubber (40), medical equipment, dental, orthopaedics, and rehabilitation (42), special-purpose machinery (46), cars (all kinds) (47), machinery and equipment used for broadcasting, television, and information activities (51), iron and steel (52), textile products (all kinds) (54). For most services sectors, the rankings have remained the same when moving from total to domestic linkage indices, for example,

education and training (82), healthcare and social supporting services (83), cultural services, sports, and entertainment (84), and services of organisations and foundations (85).

The results of my analysis are widely consistent with those found by Alauddin (1986), Mujeri and Alauddin (1994), and Lekuthai (2006, 2007). Under the exclusion of imported intermediate inputs in linkage measurement, nonindustrial and agricultural sectors with less import content, such as paddy (1), sugarcane and tea (4), and pigs (6), are likely to have stronger linkages with the rest of the economy in terms of purchase from others. By contrast, some manufacturing sectors like motor vehicles, motorbikes (44), and special-purpose machinery (46), which depend much on imports for their inputs, fail to be the most important backward-linking sectors when domestic linkages are considered.

There are important implications obtained from my analysis's results. Various nonindustrial and agricultural sectors have provided strong actual production linkages; thus, they need to receive consistent support from the government. Certain sectors, such as motor vehicles, motorbikes (44), special-purpose machinery (46), cars (all kinds) (47), and machinery and equipment used for broadcasting, television, and information activities (51), do depend heavily on imports as their inputs. If we depend too much on the development of these sectors, imports would induce economic expansion only in the exporting countries. For fully utilising these sectors' potential linkages and turning them into good candidates for key sectors, the development of upstream industries and supporting industries is highly required (Lekuthai, 2006, 2007).

Table 6-3 Backward linkages and rankings

	Sectors	2000				2007				2012			
		U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank
1	Paddy (all kinds)	0.71	74	1.07	60	0.75	63	1.07	60	0.79	67	0.90	58
2	Raw rubber	0.66	82	1.02	69	0.68	74	1.02	69	0.61	81	0.76	80
3	Coffee beans	0.77	69	1.22	42	0.92	50	1.22	42	0.82	63	0.88	61
4	Sugarcane and tea	0.66	81	1.12	56	0.82	56	1.12	56	0.86	60	0.98	41
5	Other crops and perennial plants	0.58	86	1.20	46	0.90	52	1.20	46	0.80	65	0.89	60
6	Pigs	0.91	49	2.14	2	1.32	13	2.14	2	1.37	5	1.58	2
7	Buffaloes and cows	0.88	54	1.36	25	0.78	61	1.36	25	0.93	57	1.14	17
8	Poultry	0.77	68	1.93	6	1.18	23	1.93	6	1.38	3	1.50	4
9	Other livestock and poultry	0.79	64	1.90	7	1.16	26	1.90	7	0.96	55	1.16	15
10	Agricultural services and other agricultural products	0.88	56	1.76	11	1.06	37	1.76	11	0.79	66	0.93	51
11	Forestry	0.62	85	1.09	57	0.79	59	1.09	57	0.73	70	0.68	86
12	Fishery	0.99	42	0.91	82	1.10	32	0.91	82	1.16	26	0.94	49
13	Fish farming	0.67	79	2.02	4	1.28	17	2.02	4	1.14	28	1.30	9
14	Coal	0.83	60	1.30	30	1.06	39	1.30	30	1.11	33	1.03	29
15	Exploiting mine and ore	0.97	45	1.67	12	1.15	27	1.67	12	0.66	74	0.82	73
16	Exploiting stone, sand, and gravel	0.97	46	1.02	67	0.81	58	1.02	67	1.02	47	0.93	50
17	Other minerals	0.89	53	1.06	62	0.77	62	1.06	62	0.83	62	0.87	63
18	Exploiting crude oil and natural gas	0.63	84	0.77	86	0.46	86	0.77	86	0.87	59	0.80	78
19	Processed, preserved meat, and by-products	1.10	30	2.41	1	1.44	5	2.41	1	1.37	4	1.70	1
20	Vegetable and animal oils and fats	0.85	59	1.38	23	1.87	1	1.38	23	1.90	1	1.19	12
21	Milk and by-products	1.18	23	1.45	18	1.05	40	1.45	18	1.35	6	1.37	6
22	Cocoa, chocolate and candy, cake products from flour	1.18	22	1.79	9	1.24	20	1.79	9	1.14	29	1.28	11
23	Processed preserved vegetables and fruit	0.94	47	1.89	8	1.25	19	1.89	8	1.08	36	1.17	14

	Sectors	2000				2007				2012			
		U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank
24	Alcohol	0.94	48	1.42	21	1.03	44	1.42	21	0.94	56	1.05	23
25	Beer	0.99	43	1.45	17	1.06	36	1.45	17	0.68	73	0.79	79
26	Non-alcohol water and soft drinks	1.17	25	1.42	20	1.03	43	1.42	20	1.04	45	1.07	20
27	Sugar	1.06	38	1.54	15	1.04	41	1.54	15	1.06	41	1.34	8
28	Processed coffee and tea (all kinds), rice, and flour (all kinds)	1.09	34	1.76	10	1.15	28	1.76	10	1.18	22	1.48	5
29	Cigarettes	0.88	55	1.52	16	1.13	29	1.52	16	0.99	49	1.06	22
30	Processed preserved fishery and by-products	1.21	19	2.09	3	1.41	6	2.09	3	1.30	8	1.55	3
31	Glass and by-products	1.12	28	1.00	73	0.87	54	1.00	73	0.97	53	0.94	46
32	Cements and other non-metallic mineral products	1.19	20	1.28	31	0.93	49	1.28	31	0.99	50	1.05	25
33	Paper and by-products	1.21	18	1.39	22	1.17	24	1.39	22	1.18	20	1.18	13
34	Processed wood and by-products	0.99	44	1.33	28	0.94	48	1.33	28	1.13	31	0.96	42
35	Basic organic chemicals	1.03	41	1.19	47	1.29	16	1.19	47	0.97	54	1.05	27
36	Fertiliser and nitrogen compound	1.08	36	1.21	45	1.32	11	1.21	45	1.01	48	0.98	40
37	Medicine, chemical prophylaxis, and pharmacy	1.06	39	1.21	44	1.00	45	1.21	44	0.98	52	0.94	48
38	By-product rubber	1.08	37	0.97	78	0.69	72	0.97	78	1.16	27	0.99	36
39	Other chemical products and man-made fibres	1.17	24	1.31	29	1.21	22	1.31	29	1.21	18	1.02	31
40	Plastic and primary synthetic rubber	1.29	13	1.13	52	1.17	25	1.13	52	1.18	21	0.87	62
41	By-product plastic	1.21	17	1.01	72	0.94	47	1.01	72	1.21	15	0.84	68
42	Medical equipment, dental, orthopaedics, and rehabilitation	1.09	35	0.91	83	0.69	71	0.91	83	1.05	42	0.91	54
43	Bed, cabinet, tables, and chairs	1.24	15	1.26	36	0.86	55	1.26	36	1.10	34	1.01	33
44	Motor vehicles and motor bikes	1.57	1	1.26	34	1.26	18	1.26	34	1.34	7	1.28	10
45	General-purpose machinery	1.29	12	1.13	55	1.04	42	1.13	55	1.17	23	0.91	53
46	Special-purpose machinery	1.34	8	1.26	35	1.48	4	1.26	35	1.43	2	0.84	71
47	Cars (all kinds)	1.12	29	1.25	38	1.31	14	1.25	38	1.07	40	1.01	32
48	Transport means	1.09	32	1.21	43	1.35	9	1.21	43	1.17	25	1.04	28

	Sectors	2000				2007				2012			
		U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank
49	Motor, electric generator, and power transformers	1.31	10	1.00	74	0.72	69	1.00	74	1.25	9	0.99	37
50	Other electronic products	1.43	4	1.36	24	1.09	34	1.36	24	1.25	10	0.99	39
51	Machinery and equipment used for broadcasting, television, and information activities	1.52	3	1.15	49	0.90	51	1.15	49	1.22	12	0.99	38
52	Iron and steel	1.56	2	1.13	54	1.71	2	1.13	54	1.11	32	0.89	59
53	Other metal products	1.42	5	1.22	40	1.51	3	1.22	40	1.22	14	0.96	43
54	Textile products (all kinds)	1.25	14	1.54	14	1.38	8	1.54	14	1.21	16	0.92	52
55	Fibre (all kinds)	1.13	27	1.56	13	1.39	7	1.56	13	1.23	11	0.91	56
56	Costume (all kinds)	1.40	6	1.33	27	1.34	10	1.33	27	1.08	37	0.90	57
57	Leather, preliminary processed fur, suitcase, bags, saddle, and other same kinds	1.19	21	1.27	33	1.23	21	1.27	33	1.05	43	1.05	24
58	Shoes and sandals (all kinds)	1.40	7	1.25	37	0.99	46	1.25	37	1.02	46	1.00	34
59	Animal feed	1.16	26	1.98	5	1.32	12	1.98	5	1.22	13	1.35	7
60	Products of printing activities	1.22	16	1.34	26	1.09	33	1.34	26	1.19	19	1.15	16
61	Other processed industrial products	1.33	9	1.01	71	0.79	60	1.01	71	1.07	39	0.94	47
62	Gasoline, lubricants, and other products extracting from oil and gas	1.10	31	0.90	85	1.30	15	0.90	85	1.21	17	1.11	19
63	Electric and gas production	0.74	72	1.06	61	0.63	80	1.06	61	0.57	82	0.72	84
64	Exploitation, processing, and supply of water	0.65	83	1.01	70	0.63	79	1.01	70	0.76	68	0.84	69
65	Construction	1.29	11	1.28	32	1.10	31	1.28	32	1.09	35	1.05	26
66	Wholesale and retail	0.90	52	0.96	80	0.62	81	0.96	80	0.64	76	0.82	74
67	Repairing cars, motorbikes, and accessories and auxiliary parts of motorbikes and cars	1.04	40	0.99	76	0.67	77	0.99	76	0.81	64	0.87	64
68	Residential services	0.82	61	1.04	64	0.59	83	1.04	64	0.70	72	0.86	66
69	Food services	0.87	57	1.24	39	0.71	70	1.24	39	1.04	44	1.14	18
70	Transport by road	0.75	70	0.90	84	1.06	38	0.90	84	1.07	38	0.94	45
71	Railway transport	0.69	76	0.99	77	0.87	53	0.99	77	0.83	61	0.95	44

	Sectors	2000				2007				2012			
		U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank	U_j	Rank	$\bar{U}_j$	Rank
72	Waterway transport	0.91	50	0.93	81	1.08	35	0.93	81	1.17	24	1.03	30
73	Airline services	1.09	33	1.22	41	1.11	30	1.22	41	1.13	30	1.00	35
74	Postal and delivery; telecommunication services	0.70	75	1.19	48	0.72	68	1.19	48	0.99	51	1.07	21
75	Travel agency services, tour business; supporting services of promoting and organising tour	0.80	63	1.00	75	0.73	66	1.00	75	0.64	78	0.83	72
76	Financial services (except insurance)	0.67	80	1.07	58	0.62	82	1.07	58	0.63	79	0.86	67
77	Lottery, bet, and gamble	0.67	78	1.43	19	0.73	65	1.43	19	0.63	80	0.86	65
78	Insurance	0.81	62	1.13	51	0.75	64	1.13	51	0.54	84	0.76	81
79	Research and technology	0.91	51	1.03	66	0.68	75	1.03	66	0.70	71	0.81	75
80	Real estate business services and other consulting services	0.74	71	0.97	79	0.55	85	0.97	79	0.52	85	0.72	83
81	Services of communist party activities, political and social organisation, state management, defence and compulsory social security	0.86	58	1.05	63	0.64	78	1.05	63	0.56	83	0.74	82
82	Education and training	0.72	73	1.02	68	0.59	84	1.02	68	0.50	86	0.69	85
83	Healthcare and social supporting services	0.78	65	1.07	59	0.81	57	1.07	59	0.89	58	0.84	70
84	Cultural services, sports, and entertainment	0.78	66	1.13	53	0.69	73	1.13	53	0.66	75	0.81	77
85	Services of organisations and foundations	0.77	67	1.15	50	0.73	67	1.15	50	0.64	77	0.81	76
86	Other services	0.69	77	1.03	65	0.68	76	1.03	65	0.76	69	0.91	55

Source: Author’s compilation from 2000, 2007, and 2012 IO tables

Turning to forward linkages, wholesale and retail (66) has been consistently the most important forward-linking sector across the years under both total and domestic indices (Table 6-4). Other vital sectors playing the role of input providers in the economy consist of resource-based sectors, such as exploiting crude oil and natural gas (18), iron and steel (52), animal feed (59), and gasoline, lubricants, and other products extracting from oil and gas (62). From observation, the changes in sectoral rankings by total and domestic linkages are less significant in forward-linking sectors than backward-linking sectors.

Table 6-4 Forward linkages and rankings

	Sectors	2000				2007				2012			
		U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank
1	Paddy (all kinds)	1.10	19	1.71	5	1.34	19	3.15	6	1.03	25	1.52	12
2	Raw rubber	0.50	68	0.75	65	0.48	55	0.93	67	0.47	60	0.67	65
3	Coffee beans	0.42	81	0.66	80	0.86	25	1.90	19	1.23	22	1.07	26
4	Sugarcane and tea	0.69	38	1.09	19	0.57	44	1.35	34	0.77	33	1.18	21
5	Other crops and perennial plants	1.13	18	1.65	7	1.99	5	3.68	3	2.23	8	2.46	4
6	Pigs	0.55	59	0.87	40	0.58	42	1.44	29	0.86	31	1.36	17
7	Buffaloes and cows	0.49	69	0.76	64	0.38	72	0.97	61	0.51	53	0.80	42
8	Poultry	0.54	61	0.85	44	0.47	60	1.17	47	0.49	57	0.78	45
9	Other livestock and poultry	0.60	50	0.93	35	0.38	74	0.94	64	0.43	68	0.69	60
10	Agricultural services and other agricultural products	0.64	45	1.01	29	0.84	28	2.02	16	0.73	34	0.99	30
11	Forestry	0.99	25	1.31	12	0.78	32	1.43	31	1.52	17	0.78	46
12	Fishery	0.66	43	1.04	23	0.47	59	1.18	46	0.46	63	0.73	53
13	Fish farming	0.54	63	0.84	45	0.50	51	1.24	38	0.67	37	1.05	29
14	Coal	0.70	36	0.96	32	1.52	14	2.29	9	0.57	46	0.77	49
15	Exploiting mine and ore	0.71	34	1.02	27	0.34	86	0.84	86	0.44	66	0.68	62
16	Exploiting stone, sand, and gravel	0.61	48	0.81	51	0.58	43	1.23	39	0.41	70	0.65	67
17	Other minerals	0.62	46	0.74	66	0.60	40	1.02	55	1.06	24	0.74	51
18	Exploiting crude oil and natural gas	1.15	17	1.05	21	1.74	7	1.02	56	3.81	4	2.47	3
19	Processed, preserved meat, and by-products	0.51	67	0.78	58	0.64	38	1.52	25	0.46	62	0.71	57
20	Vegetable and animal oils and fats	0.45	71	0.68	76	1.54	13	1.45	28	1.66	16	1.11	24
21	Milk and by-products	0.59	51	0.83	49	0.49	53	1.13	49	0.72	36	0.93	33
22	Cocoa, chocolate and candy, cake products from flour	0.42	79	0.67	79	0.34	83	0.86	82	0.37	74	0.60	73
23	Processed preserved vegetables and fruit	0.48	70	0.74	67	0.60	41	1.47	27	0.41	71	0.63	69

	Sectors	2000				2007				2012			
		U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank
24	Alcohol	0.44	75	0.68	75	0.35	82	0.87	78	0.37	75	0.59	74
25	Beer	0.43	77	0.67	77	0.34	84	0.86	81	0.34	83	0.56	83
26	Non-alcohol water and soft drinks	0.43	76	0.68	74	0.35	79	0.88	76	0.35	79	0.57	78
27	Sugar	0.67	41	1.04	22	0.48	56	1.11	51	0.52	51	0.81	41
28	Processed coffee and tea (all kinds), rice, and flour (all kinds)	0.88	29	1.35	11	1.15	21	2.59	7	0.98	26	1.39	16
29	Cigarettes	0.56	57	0.81	54	0.38	71	0.95	63	0.34	86	0.55	86
30	Processed preserved fishery and by-products	0.56	54	0.87	39	0.55	46	1.33	35	0.48	58	0.73	52
31	Glass and by-products	0.67	42	0.91	36	0.53	49	1.00	59	0.56	49	0.71	55
32	Cements and other non-metallic mineral products	1.51	12	1.67	6	0.85	26	1.65	21	0.58	44	0.85	37
33	Paper and by-products	1.57	11	1.44	9	1.71	8	2.23	11	1.67	15	1.70	9
34	Processed wood and by-products	0.75	32	1.03	24	0.78	31	1.57	23	0.88	29	1.20	20
35	Basic organic chemicals	1.69	10	0.86	41	1.55	12	1.16	48	2.41	6	1.12	23
36	Fertiliser and nitrogen compound	1.17	16	1.03	25	2.47	4	2.03	15	1.47	19	1.41	15
37	Medicine, chemical prophylaxis, and pharmacy	0.71	35	0.81	52	0.81	30	1.19	44	0.87	30	0.86	35
38	By-product rubber	1.01	24	1.08	20	0.71	35	1.27	36	0.97	27	1.11	25
39	Other chemical products and man-made fibres	1.21	15	1.14	15	1.57	11	1.77	20	1.83	10	1.32	18
40	Plastic and primary synthetic rubber	2.84	4	0.88	37	1.15	22	1.00	58	2.43	5	0.70	59
41	By-product plastic	1.30	14	1.18	14	1.49	16	2.08	14	1.68	14	1.50	13
42	Medical equipment’s, dental, orthopaedics, and rehabilitation	0.55	60	0.69	69	0.38	73	0.86	80	0.47	59	0.63	71
43	Bed, cabinet, tables, and chairs	0.62	47	0.82	50	0.36	77	0.89	73	0.53	50	0.79	44
44	Motor vehicles and motor bikes	2.84	5	1.37	10	0.40	70	0.92	68	0.51	55	0.81	39
45	General-purpose machinery	0.76	31	0.69	71	0.42	65	0.98	60	0.42	69	0.58	77
46	Special-purpose machinery	1.04	23	0.78	57	0.46	62	0.85	84	1.78	11	0.71	56

	Sectors	2000				2007				2012			
		U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank
47	Cars (all kinds)	1.10	20	0.93	34	0.48	58	0.85	83	0.34	85	0.55	85
48	Transport means	0.70	37	0.87	38	0.47	61	0.94	65	0.58	43	0.83	38
49	Motor, electric generator, and power transformers	0.42	80	0.66	81	0.48	54	1.12	50	0.50	56	0.65	68
50	Other electronic products	0.98	26	0.98	30	1.34	18	2.18	12	2.07	9	1.48	14
51	Machinery and equipment used for broadcasting, television, and information activities	2.78	6	1.09	18	0.46	63	0.93	66	0.57	47	0.77	48
52	Iron and steel	4.42	3	2.14	4	6.85	2	2.39	8	4.44	2	1.54	11
53	Other metal products	1.40	13	1.11	17	1.50	15	2.23	10	4.25	3	2.27	5
54	Textile products (all kinds)	1.05	22	1.02	26	0.92	24	1.21	42	0.60	40	0.73	54
55	Fibre (all kinds)	0.92	27	0.85	43	1.28	20	2.18	13	1.51	18	1.15	22
56	Costume (all kinds)	0.52	65	0.78	60	0.43	64	1.02	54	0.44	67	0.67	64
57	Leather, preliminary processed fur, suitcase, bags, saddle, and other same kinds	0.65	44	0.78	61	0.85	27	1.35	33	0.72	35	0.99	31
58	Shoes and sandals (all kinds)	0.56	56	0.86	42	0.41	66	1.01	57	0.36	77	0.58	75
59	Animal feed	0.74	33	1.14	16	1.71	9	4.07	2	1.46	21	1.87	7
60	Products of printing activities	0.67	40	0.97	31	0.51	50	1.21	43	0.59	42	0.88	34
61	Other processed industrial products	2.30	7	1.50	8	1.40	17	1.98	18	1.19	23	1.07	27
62	Gasoline, lubricants, and other products extracting from oil and gas	4.95	2	0.73	68	11.34	1	0.97	62	5.39	1	2.84	1
63	Electric and gas production	2.16	8	2.31	2	1.98	6	3.29	4	1.46	20	1.59	10
64	Exploitation, processing, and supply of water	0.53	64	0.79	55	0.48	57	1.11	52	0.51	54	0.75	50
65	Construction	0.41	83	0.65	83	0.54	47	1.24	37	0.64	39	0.95	32
66	Wholesale and retail	6.47	1	4.60	1	3.32	3	5.56	1	2.31	7	2.61	2
67	Repairing cars, motorbikes, and accessories and auxiliary parts of motorbikes and cars	0.57	53	0.81	53	0.69	36	1.49	26	0.44	65	0.67	63
68	Residential services	0.55	58	0.78	59	0.61	39	1.23	40	0.47	61	0.68	61

	Sectors	2000				2007				2012			
		U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank	U_i	Rank	$\bar{U}_i$	Rank
69	Food services	0.61	49	0.83	48	0.54	48	1.19	45	0.56	48	0.81	40
70	Transport by road	0.83	30	0.94	33	1.12	23	1.99	17	0.82	32	1.06	28
71	Railway transport	0.45	73	0.69	72	0.41	67	0.89	74	0.36	78	0.57	79
72	Waterway transport	0.56	55	0.77	62	0.66	37	1.23	41	0.57	45	0.79	43
73	Airline services	0.69	39	0.84	46	0.40	69	0.90	71	0.52	52	0.71	58
74	Postal and delivery; telecommunication services	0.90	28	1.19	13	0.72	34	1.55	24	0.60	41	0.86	36
75	Travel agency services, tour business; supporting services of promoting and organising tour	0.41	85	0.65	85	0.35	81	0.84	85	0.35	81	0.56	82
76	Financial services (except insurance)	1.10	21	1.01	28	0.81	29	1.39	32	1.68	13	1.74	8
77	Lottery, bet, and gamble	0.41	86	0.65	86	0.56	45	1.43	30	0.39	73	0.63	70
78	Insurance	0.45	72	0.68	73	0.50	52	1.03	53	0.65	38	0.77	47
79	Research and technology	0.58	52	0.83	47	0.41	68	0.92	69	0.46	64	0.66	66
80	Real estate business services and other consulting services	2.09	9	2.16	3	0.76	33	1.64	22	0.92	28	1.25	19
81	Services of communist party activities, political and social organisation, state management, defence and compulsory social security	0.41	82	0.65	82	0.34	85	0.86	79	0.35	82	0.56	81
82	Education and training	0.52	66	0.76	63	0.37	75	0.89	72	0.40	72	0.60	72
83	Healthcare and social supporting services	0.44	74	0.69	70	0.35	78	0.87	77	0.35	80	0.56	80
84	Cultural services, sports, and entertainment	0.54	62	0.78	56	0.36	76	0.90	70	0.37	76	0.58	76
85	Services of organisations and foundations	0.42	78	0.67	78	0.35	80	0.89	75	0.34	84	0.56	84
86	Other services	0.41	84	0.65	84	1.68	10	3.21	5	1.71	12	2.08	6

Source: Author's compilation from 2000, 2007, and 2012 IO tables

To obtain a clearer idea of how significant changes are in sectoral rankings by the two types of linkages, the Spearman rank correlation coefficients have been computed:

Table 6-5 Spearman rank correlation coefficients between total and domestic linkages

Year	r_s between U_j and $\overline{U}_j$	r_s between U_i and $\overline{U}_i$
2000	0.665	0.847
2007	0.628	0.857
2012	0.683	0.902

Table 6-5 shows the Spearman rank correlation coefficients for all 3 years of 2000, 2007, and 2012. While the r_s between U_j and $\overline{U}_j$ are consistently around the figure 0.6 (i.e. medium-strong correlation), the r_s between U_i and $\overline{U}_i$ are considered to be very strong (r_s > 0.7). This implies that, in general, the import requirements of the backward-linking sectors are relatively higher than those of the forward-linking sectors for each respective year.

One explanation for Vietnam's case is that most of the backward-linking sectors, including motor vehicles and motor bikes (44), special-purpose machinery (46), and machinery and equipment used for broadcasting, television, and information activities (51) are highly engaged in modern technology and depend much on high-quality intermediate imports. By contrast, most of the forward-linking sectors are relatively resource-based, for example exploiting crude oil and natural gas (18), gasoline, lubricants, and other products extracting from oil and gas (62), and electric and gas production (63). These sectors generally depend less on intermediate imports.

6.6 Conclusions

This chapter has provided insight into intersectoral linkages in the context of an open developing country and developed a measurement procedure of domestic linkages for the

case of Vietnam. The chapter shows that conceptual issues were surrounding the analysis of linkages in the context of an open developing country. As most developing countries exhibit a determined dependence on imported intermediate goods, where the linkage effects are concerned, imports would induce economic expansion only in the exporting countries. Thus, instead of total linkages, domestic linkages should be used for ranking sectors in these economies.

The chapter follows the National Research Council (2006) to develop a procedure for the measurement of domestic linkages. By constructing the non-competitive IO tables relying on a similarity assumption, which assumes that imports are distributed over the whole range of industries in the same proportion as the gross domestic output of the corresponding sector, the chapter introduces a comparison between the total and domestic linkages.

The chapter finds a significant difference between total and domestic linkages in the case of Vietnam. In terms of total linkages, key sectors include those from the manufacturing and other sectors within the services and construction groups of economic activity. However, in terms of domestic linkages, nonindustrial and some agricultural sectors tend to emerge as key sectors. The results imply that import plays a significant role in the intersectoral linkages in the Vietnamese economy. The strength of some sectors' linkages is due to the import utilisation effects, but not domestic sectors' real own ability to create linkages.

The results suggest some important policy implications. Nonindustrial and some agricultural sectors need to receive consistent government support as they have provided actual production linkages. Manufacturing industries such as machinery and motor vehicles, which have received strong support from the government through various incentives, induced high import for their production. To fully utilise its potential linkages to the economy, Vietnam needs to develop upstream industries and supporting industries.

Although the chapter has shed some light on linkage analysis of an open developing country, the adopted estimation procedure could be a drawback of this research. The method in which the import coefficient matrices are derived based on certain assumptions regarding the distribution of imports among industries involves the issue of stability of import coefficients, given the fact that various policies and other considerations contribute to determining import activities. This limitation might suggest a significant effort from open economies to remedy the shortcomings in the data, to identify the key sectors.

Appendix 6-1 List of IO sectors

	Industries	2000	2007	2012
1	Paddy (all kinds)	1	1	1
2	Raw rubber	2	4	12
3	Coffee beans	3	5	13
4	Sugarcane and tea	4, 5	2, 6	5, 14
5	Other crops and perennial plants	6	3, 7	2, 3, 4, 6, 7, 8, 9, 10, 11, 15
6	Pigs	7	9	17
7	Buffaloes and cows	8	8	16
8	Poultry	9	10	18
9	Other livestock and poultry, n.e.c	10	11	19
10	Agricultural services and other agricultural products	11, 12	12	20, 21
11	Forestry	13	13, 14	22, 23, 24, 25
12	Fishery	14	15	26
13	Fish farming	15	16	27
14	Coal	16	17	28
15	Exploiting mine and ore	17	22	34
16	Exploiting stone, sand, and gravel	18, 19	20	32
17	Other minerals	20	21	31, 33
18	Exploiting crude oil and natural gas	21	18, 19	29, 30
19	Processed, preserved meat, and by-products	22	23	35
20	Vegetable and animal oils and fats	23	26	38
21	Milk and by-products	24	27	39
22	Cocoa, chocolate and candy, cake products from flour	25	31	42
23	Processed preserved vegetables and fruit	26	25	37
24	Alcohol	27	35	47
25	Beer	28	36	48
26	Non-alcohol water and soft drinks	29	37	49
27	Sugar	30	30	41
28	Processed coffee and tea (all kinds), rice, and flour (all kinds)	31, 32, 35, 36	28, 29, 32, 33	40, 43, 44, 45
29	Cigarettes	33	38	50
30	Processed preserved fishery and by-products	34	24	36
31	Glass and by-products	37, 38	57	70
32	Cements and other non-metallic mineral products	39, 40, 41, 42	58, 59	71, 72, 73
33	Paper and by-products	43	45	57
34	Processed wood and by-products	44	44	56
35	Basic organic chemicals	45, 46	50	62
36	Fertiliser and nitrogen compound	47, 48	51	63
37	Medicine, chemical prophylaxis, and pharmacy	49, 50, 51	54	67

	Industries	2000	2007	2012
38	By-product rubber	52	55	68
39	Other chemical products and man-made fibres	53, 54, 57, 58, 59	53	65, 66
40	Plastic and primary synthetic rubber	55	52	64
41	By-product plastic	56	56	69
42	Medical equipment, dental, orthopaedics, and rehabilitation	60, 61	81	96
43	Bed, cabinet, tables, and chairs	62	79	94
44	Motor vehicles and motor bikes	63, 64	77	92
45	General-purpose machinery	66	72	87
46	Special-purpose machinery	67	73	88
47	Cars (all kinds)	65, 68	74	89
48	Transport means	69	75, 76, 78	90, 91, 93
49	Motor, electric generator, and power transformers	70	66	81
50	Other electronic products	71	62, 64, 65, 67, 68, 69, 70, 71	77, 79, 80, 82, 83, 84, 85, 86
51	Machinery and equipment used for broadcasting, television, and information activities	72	63	78
52	Iron and steel	73	60	74
53	Other metal products	74	61	75, 76
54	Textile products (all kinds)	75, 78, 79	40	52
55	Fibre (all kinds)	76	39	51
56	Costume (all kinds)	77	41	53
57	Leather, preliminary processed fur, suitcase, bags, saddle, and other same kinds	80	42	54
58	Shoes and sandals (all kinds)	81	43	55
59	Animal feed	82	34	46
60	Products of printing activities	83, 84	46	58
61	Other processed industrial products	85	80, 82	95, 97, 98
62	Gasoline, lubricants, and other products extracting from oil and gas	86	47, 48, 49	59, 60, 61
63	Electric and gas production	87	83, 84	99, 100
64	Exploitation, processing, and supply of water	88	85, 86, 87	101, 102, 103, 104, 105
65	Construction	89, 90	88, 89, 90	106, 107, 108, 109, 110, 111
66	Wholesale and retail	91	92	114
67	Repairing cars, motorbikes, and accessories and auxiliary parts of motorbikes and cars	92	91	112, 113
68	Residential services	93	103	125

	Industries	2000	2007	2012
69	Food services	94	104	126
70	Transport by road	95	95, 96	117, 118
71	Railway transport	96	93, 94	115, 116
72	Waterway transport	97	97, 98	119, 120
73	Airline services	98	99, 100	121, 122
74	Postal and delivery; telecommunication services	99	102, 108	124, 130
75	Travel agency services, tour business; supporting services of promoting and organising tour	100	124	147
76	Financial services (except insurance)	101	110	133
77	Lottery, bet, and gamble	102	134	159
78	Insurance	103	111, 112, 113	134, 135, 136
79	Research and technology	104	118, 120	141, 143
80	Real estate business services and other consulting services	105, 106	114, 116	137, 139
81	Services of communist party activities, political and social organisation, state management, defence and compulsory social security	107	128	151
82	Education and training	108	129, 130	152, 153
83	Healthcare and social supporting services	109	131, 132	154, 155, 156
84	Cultural services, sports, and entertainment	110	133, 135	157, 158, 160
85	Services of organisations and foundations	111	136	161
86	Other services	112	101, 105, 106, 107, 109, 115, 117, 119, 121, 122, 123, 125, 126, 127, 137, 138	123, 127, 128, 129, 131, 132, 138, 140, 142, 144, 145, 146, 148, 149, 150, 162, 163, 164

Source: Author's compilation based on IO concordance tables

Chapter 7 Conclusions

7.1 Objectives and key findings

The interrelation between liberalisation reforms and firm productivity has drawn considerable attention from academics. This thesis has contributed to this literature by providing a microeconomic impact assessment of liberalisation reforms in a transitional setting of Vietnam. Following a survey of the process of liberalisation reforms and manufacturing performance, TFP growth of the manufacturing sector is examined using an establishment-level dataset compiled from the Vietnamese Enterprise Surveys from 2006 to 2017. The analysis specifically focuses on the following issues: How has the manufacturing sector performed in terms of TFP? What is the role of ownership structure in determining manufacturing productivity? Has there been significant productivity spillover from FIEs to domestic manufacturing firms?

Vietnam is an ideal setting to answer those research questions. Firstly, Vietnam has implemented extensive liberalisation reforms to transform the country from a centrally planned to market-oriented economy. Secondly, the increasing involvement in GPNs by Vietnam's manufacturing firms makes the country an interesting case to examine the performance of the manufacturing sector and its TFP growth. Thirdly, notable ownership transition with the private sector, particularly, the foreign-invested sector playing an increasing role provides a desirable context to examine the effects of ownership policy reforms on manufacturing productivity. Fourthly, as an investment hotspot, Vietnam is an ideal case to examine the productivity effects of FDI policy reforms.

In general, the thesis provides strong evidence of the positive effects of liberalisation reforms on firms' productivity in the case of Vietnam. Chapter 2 shows that Vietnam has conducted comprehensive reforms that have significant effects on manufacturing development. Key

elements of these liberalisation reforms, including trade liberalisation, policies of FDI promotion, and ownership reforms, have led to significant structural changes in the manufacturing industry. Export-oriented industries have emerged as the primary source of manufacturing dynamism. The private sector, especially the foreign-invested sector, has played an increasingly important role in the sector's development.

Chapter 3 indicates that further liberalisation reforms since 2006 have led to a more efficient manufacturing industry. During 2006–2017, TFP growth of Vietnam's manufacturing showed an upward trend with fully owned foreign firms (FOFs) exhibiting the highest productivity growth and the state-owned enterprises (SOEs) and their joint ventures with foreign firms (JV-SOEs) recording the lowest productivity growth. Private domestic enterprises (PDEs) closely followed the productivity patterns of FOFs and their joint ventures with foreign firms (JV-PDEs). The results at a disaggregated level indicate that PDEs and JV-PDEs had impressive TFP growth rates in many manufacturing industries.

Chapter 4 shows that, when controlled for factors influencing firms' productivity, transformation of the ownership structure has contributed to improvement of Vietnamese manufacturing productivity. Firstly, the results show that FOFs perform better than JV-PDEs. This result implies that relaxing ownership restrictions on FDI has helped improve manufacturing productivity. Secondly, the results indicate that both SOEs and JV-SOEs are at the bottom of the productivity ranking by ownership forms, implying that partial divestiture of SOEs through forming joint ventures is not immune to various productivity-retarding factors affecting SOEs in general. Lastly, the results point out that JV-PDEs perform better than JV-SOEs, suggesting that the choice between state and private entrepreneurs as joint-venture partners is essential in determining the productivity of joint venture operation of FIEs in Vietnam.

Chapter 5 confirms strong evidence of positive productivity spillover from FIEs to local firms through backward and forward channels, implying that domestic firms can benefit from the presence of FIEs along the supply chain. However, there is no evidence of horizontal productivity spillover, indicating that domestic firms are likely to face difficulties competing with FIEs in the same sector. In addition, the chapter shows that foreign firm ownership structure matters for the existence and magnitude of productivity spillover: productivity gains are more significant from JVs than from FOFs. The chapter also points out that local firms operating within GPNs benefit more from foreign presence compared to those involved in the horizontal specialisation.

In short, four main conclusions are made in this thesis. First, liberalisation reforms have had significant effects on manufacturing development and structural changes. Second, during further liberalisation reforms in the second half of 2000s, the manufacturing TFP shows an upward trend with different growth rates among sectors and firms' ownership structures. Third, ownership policy reforms, which resulted in transformation of ownership structure in the economy, have contributed to improving manufacturing productivity. Fourth, FDI promotion policies that culminated in FDI influx into Vietnam have significantly favourable effects on domestic firms' productivity.

7.2 Policy implications

The findings of this thesis have three main policy implications. Firstly, while SOEs are usually offered a wide range of preferential treatments, they do not perform more efficiently than PDEs. Before and after WTO accession, SOEs are even less productive than the private sector: "Vietnamese SOEs, despite being corporatised and drastically reformed, were […] less productive than private firms" (Baccini et al., 2019, p.79). It is urgent to reform current SOEs and create a level playing field regardless of ownership structure. The Vietnamese government

may consider enhancing the pace of equitising SOEs to improve their performance. The government also may consider fully applying non-discrimination or competitive neutrality principles to reduce inefficiencies in the state sector and ensure a healthy competitive environment. The principles state that, as compared to PDEs, SOEs do not "have preferential rights such as access to land or other resources made available to the state, do not pay below commercial rates for access to capital, and are not exempt from taxes and charges" (OECD, 2020, p.194). Vietnam has made a significant attempt to implement the principles by incorporating them into several laws and regulations. For example, the Law on Competition No. 23/2018/QH14 issued in 2018 prohibits acts that lead to the distortion and restriction of competition in the market. However, the principles have been applied only in several aspects, leaving many exceptions for SOEs (Le, 2021). SOEs have great advantages in many strategic sectors in the economy, such as electricity, petroleum, and telecommunication services. In the short term, some selected components of competitive neutrality principles can be applied prior to the others ('a roadmap approach'). In the long run, a specialised policy framework on competitive neutrality principles should be formulated, containing a mechanism to review, detect, and adjust non-neutral components.

Secondly, it is necessary to foster supplier-buyer relationship between domestic and foreign enterprises in the host country. Indeed, the potential for spillovers from FIEs to domestic firms only becomes perceptible with successfully established linkages or close interactions between them (UNIDO, 2019a). To be considered as FIEs' potential suppliers, domestic enterprises need to reach a minimum capability threshold, which is usually far higher than the actual capacity of domestic enterprises. The large gap between the threshold and firms' capacity has been attributed to various obstacles of domestic firms related to poor ability to obtain certifications and standards, shortage of technical know-how, and difficulty in accessing finance. In order to close the gap, the government may consider funding the costs to reach

certifications and standards. In the short term, this can be done by collecting information about standards from procurement procedures with FIEs and then passing to domestic enterprises. In the longer term, the government may consider developing a consistent standards policy framework that can gradually raise the national standards to align with international standards. In addition, the gap can be closed by initiatives such as Vietnam's Supporting Industry Development Programme – designed to help transfer technology to domestic firms operating in the supporting industry. However, in the longer term, policies should focus on education and training to improve the quality of human capital. The shortage of skilled workers for sophisticated tasks suggests a necessity of strengthening vocational education in the medium term and more advanced skills for conducting R&D in the longer term.

In addition to the above policy recommendations, findings from the thesis also pose many other important issues for policymakers. First, the productivity of the manufacturing sector increases with firm size, implying that the government should provide effective support programs targeting small and medium-sized enterprises (SMEs) to raise their productivity. Some practical policy initiatives to develop SMEs should be enhanced, such as the SME Development Fund and the Credit Guarantee Fund (OECD, 2021). Second, the low performance of firms operating in the outer regions of Vietnam suggests that policies aiming at encouraging investment in the disadvantaged areas have limited results. Third, Vietnam should continue its trade liberalisation reform to benefit from international linkages. Last but not least, reform to promote a competitive environment is needed to improve manufacturing performance.

7.3 Limitations and further research

This thesis has several limitations that should be considered in further research. On the topic of trend and pattern of manufacturing TFP, there are several limitations in terms of data

compilation, TFP measurement approach, and the scope of comparative analysis. Firstly, although significant efforts have been made to clean data, further attempts are needed to remove potential errors and inconsistencies. Secondly, this thesis applies the approach proposed by Ackerberg, Caves, and Frazer (2015) to measure TFP. However, this approach may ignore the role of TFP components. Further research can provide in-depth insights on TFP change by decomposing productivity growth into different components, including technological progress and changes in technical efficiency. Thirdly, further research may consider providing a comparative analysis of the TFP performance among regions, firm size, firm age, or reform phases.

The topic of ownership and productivity nexus suggests two important aspects for further investigation. Firstly, the lower level of productivity in export-oriented FOFs compared to that in other FOFs reflects the lower productivity gains at the formative stage of engagement in simple assembly processes within GPNs. This interesting issue should be considered in further research. Secondly, when considering factors affecting firms' productivity rather than firm ownership, this study does not investigate the role of technology because of data unavailability. Given the importance of this factor in determining the performance of manufacturing firms, further research should be done by taking advantage of the Vietnam Technology and Competitiveness Survey (TCS) conducted jointly by the General Statistics Office (GSO) and the Central Institute for Economic Management (CIEM). These surveys provide information on investment in technology, R&D, or technology usage, which is sufficient to proxy for technology variables.

The analysis of productivity spillover from FIEs to domestic firms can be extended and improved in a number of ways. Firstly, some unique features of the Vietnamese manufacturing sector have not been examined, such as strong export performance, the dualistic policy regime

(inside and outside the export zones), and the source of FDI (investors from different countries behave differently). Studies on these aspects are essential to provide policy implications on further enhancing FDI productivity spillover. Secondly, horizontal productivity spillover can manifest itself, giving sufficient periods for domestic firms to adjust and adapt to a more severe competition environment. An analysis framework should be developed to examine the potential medium- and long-term effects of horizontal spillover. Thirdly, the dummy variable for GPN-concentrated industries is, to some extent, not sufficient to capture the involvement of firms in GPNs. Further research on the same matter can be conducted by employing the Vietnamese Enterprise Surveys (VES) since 2015, which contain the information on whether manufacturing firms supply to FIEs. Last but not least, case studies can complement econometric analysis to provide more insight into whether domestic firms benefit from connecting with FIEs in the host countries.

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