INWARD FOREIGN DIRECT INVESTMENT AND PRODUCTIVITY: EVIDENCE FROM VIETNAMESE MICRODATA

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DECLARATION

I certify that the work contained in this thesis, or any part of it, has not been accepted in substance for any previous degree awarded to me, and is not concurrently being submitted for any degree other than that of Doctor of Philosophy being studied at the University of Greenwich. I also declare that this work is the result of my own investigations, except where otherwise identified by references and that the contents are not the outcome of any form of research misconduct.

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ABSTRACT

Drawing on a rich dataset of 166,697 firms from 2001-2010, this thesis investigates the direct, indirect and crowding-in/crowding-out effects of inward foreign direct investment (FDI) on firm productivity in Vietnam; and whether the effects are heterogeneous across firm and industry characteristics and geographic regions. Using a Cobb-Douglas production function and a Generalized Method of Moments (GMM) estimator that takes account of firm-specific fixed effects, endogeneity, and simultaneity, we report that, overall, the share of foreign capital in firm equity has a positive but small direct effect on firm productivity. However, the overall effect conceals a high degree of heterogeneity in that the direct effect: (i) diminishes and eventually becomes negative as intra-industry concentration increases; (ii) is larger in R&D-active and small firms relative to the reference categories; and (iii) is smaller in regions that are least successful in attracting FDI. Furthermore, we report that the crowding-out effect dominates at low FDI intensity industries and regions, indicating that domestic firms that operate in such industries and regions experience market-share loss triggered by the foreign presence. However, the effects are reversed in industries and regions with high FDI intensity, implying that domestic firms that withstand competition in such industries and regions benefit from crowding-in effects. Finally, we report that spillover effects are either insignificant or negative and small - with the exception of positive backward spillover-effects on small firms and positive backward and forward spillover-effects on R&D-inactive firms. We conjecture that the absence of spillover effects may be related to imperfect nature of the spillover measures commonly used in the literature and uncertainty about the lag structure of the spillovers. Overall, our findings contribute to existing knowledge by bridging the evidence gap with respect to an under-studied country (Vietnam) and making a strong case for investigating the extent of heterogeneity in the productivity effects of inward FDI. Our findings also have important policy implications in that they point out the need for the region- and industry-specific support policies and counter-measures that would ameliorate the divergence between FDI-poor and FDI-rich regions and industries.

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2SLS	Two Stages Least Square
AES	Annual Enterprise Survey
DEA	Data Envelopment Analysis
FDI	Foreign Direct Investment
FE	Fixed Effects
GFCF	Gross Fixed Capital Formation
GMM	Generalized Method of Moments
GSO	General Statistics Office
HHI	Herfindahl–Hirschman Index
IO	Input-Output
IV	Instrumental Variable
LP	Levinsohn & Petrin
MNE	Multinational Enterprises
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
OP	Olley & Pakes
PPI	Producer Price Index
PSM	Propensity Score Matching
PSO	Provincial Statistical Office
R&D	Research & Development
RE	Random Effects
SFA	Stochastic Frontier Analysis
SOE	State-Owned Enterprise
TFP	Total Factor Productivity
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organization
VSIC	Vietnam Standard Industry Classification
WLS	Weighted Least Square

CHAPTER 1: INTRODUCTION

Foreign direct investment (FDI) has long been seen as a driver that fosters competition and facilitates the transfer of new technologies (Griffith et al., 2004). Many countries have made efforts to attract FDI as part of their industrialization and technological development policies. Moreover, it is well recognized that economic growth depends not only on the use of factors of production such as labour and capital, but also on technical progress and efficiency in resource use. The efficiency-driven productivity gains have captured a great deal of interest and have been used as benchmarks for ranking firms and countries (Biesebroeck, 2003).

When multinational enterprises (MNEs) establish subsidiaries overseas, they encounter certain disadvantages in terms of access to production resources and domestic demand compared to local enterprises, as domestic firms are more experienced in serving their home markets and hold more information on product types, consumer tastes and distributional networks relative to MNEs. With a view to competing successfully with domestic counterparts, MNEs need to possess "superior knowledge" (Cave, 1971) that helps to compensate for those disadvantages. Hymer (1976) defines superior knowledge as a set of "intangible productive assets" such as specialized know-how, superior management and marketing capabilities, export contacts and coordinated, quality-orientated relationships with suppliers and customers, which provide MNEs with a competitive advantage over indigenous firms. Those intangible assets are internalized within the MNEs, which are expected to do "better" than domestically owned firms that lack access to such assets.

The traditional theory of MNEs suggests that they may play an important role in increasing the productivity levels of the host country (Dunning and Lundan, 2008). The entry of MNEs may affect the overall productivity levels of the host country by bringing in new ideas, advanced technology and better managerial skills that may improve the allocation of resources therein (Kindleberger, 1969). Furthermore, to compete with foreign affiliates, indigenous firms are forced to be more competitive; hence, the level of competition is increased in the local market.

Nevertheless, the host country may incur costs associated with the entry of MNEs. The latter may introduce inappropriate or out-of-date technology that works against the interest of the host countries (Lall and Streeten, 1977; Winters, 1991; Moosa, 2002). Moreover, the entry of foreign investors might raise the level of concentration in the host country's local market, as their presence might exert pressure for mergers among domestic firms, or even the exit of indigenous firms from the market (Reuber et al., 1973; Lall and Streeten, 1977; Newfarmer and Mueller, 1975). Besides, MNEs may harm the environment of the host country through overexploiting resources (OECD, 1999).

1.1 Motivations of the Research

We aim to investigate the effects of inward FDI on the productivity of resident firms (firms with and without foreign partnerships) using firm-level data collected by the General Statistical Office (GSO) of Vietnam. The micro-level focus is informed by the increased availability of firm-level data and the scope for augmenting the Cobb–Douglas production function with the measures of inward FDI presence and a range of firm or industry covariates that allow for estimating the effects of the factors that capture deviations from the standard assumptions of perfect competition and continuous optimisation. As the unit of analysis, the resident firm can be either a firm with foreign capital (hereafter, **foreign-owned firm** or **FDI firm**) or a firm without foreign capital (hereafter, **non-FDI firm** or **domestically owned firm**). Also in this thesis, FDI refers to inward FDI from home countries to host countries.

The effects of inward FDI on firm productivity can be either direct or indirect. Direct-effect estimations allow for inference about whether the foreign capital invested (or a proxy thereof) is conducive to higher levels of productivity among all firms (with and without FDI presence) in the recipient country. This is measured as the rate of increase in the productivity of firms in Vietnam when the level of foreign capital invested (or proxies thereof) increases by one unit. As such, it can be interpreted as the direct effect of inward FDI when a firm with an FDI presence increases its FDI intensity by one unit, or when a firm without FDI switches from a purely domestic status to a joint ownership status. On the other hand, the indirect effects provide an indication of the effect of industry-level FDI spillovers on the productivity of firms within the industry and across industries. The intra-industry effect is due to horizontal spillovers (externalities), which occur as a result of skill or technology diffusion from FDI firms to non-FDI firms in the same industry. The inter-industry effects, on the other hand, occur as a result of skill or technology spillovers (externalities) from FDI firms to non-FDI firms that act as suppliers of the FDI firms (i.e., through backward linkages), or as a result of spillovers (externalities) from FDI firms to non-FDI firms that act as users of intermediates produced by FDI firms (i.e., through forward linkages).

Micro-level studies investigate the productivity effects of inward FDI with different research designs, different estimators and at two levels of aggregation: firm and industry. In terms of design, some studies follow a case study approach. Case studies provide detailed firm- or industry-specific information that cannot be captured in regression analysis (see, for example, Ivarsson and Alvstam, 2005). However, findings from case studies are difficult to generalize, as they relate to particular FDI projects, the choice of which may not be random or representative.

On the other hand, industry-level studies may benefit from relatively long dimensions in the industry-level panel datasets and public availability of the latter.[1] The main drawback of industry-level studies is that their findings conceal a high degree of firm heterogeneity within each industry. Firm-level data allows not only for taking account of firm heterogeneity, but also for controlling for industry characteristics such as concentration levels, technological differences or within-industry spillover effects.

Firm-level studies, particularly those using panel data, benefit from higher degrees of freedom and large sample variability. As indicated in Hsiao (1996), these features of panel data allow researchers to obtain more reliable results and test more sophisticated behavioural models with less restrictive assumptions. Moreover, panel datasets allow individual heterogeneity to be controlled; that is, they can allow for industry, firm and time effects that cannot be captured with cross-sectional data. Nevertheless, firm-level panel data may contain measurement errors, and firm entry into and exit from the dataset may reflect some endogenous selection decisions. For example, it is usually difficult to establish whether missing firms in a particular year are missing due to random rotation by statistical agencies (in which case the absence of the firm may not be a source of bias) or due to non-responsive firms or firms that exit as a result of takeovers or bankruptcy. In the latter case, missing firm/year data may be a source of attrition bias. Given that appropriate modelling and estimation methods exist to address some if not all of these potential sources of bias, firm-level panel data seems to be the most appropriate for an analysis of FDI and productivity.

Our study endeavours to analyse the direct and indirect (spillover) effects and crowding-in/crowding-out effects of inward FDI on the productivity of resident firms in Vietnam. Vietnam

[1]It should be noted, however, that early industry-level studies tended to use cross-sectional data (see, for example, Caves, 1974; Globerman, 1979; Blomstrom and Perrson, 1983; Kokko, 1994).

is a developing country that has recorded remarkable success in terms of attracting inward FDI, following the legislative reform in 1987. The Law on Foreign Investment dated 29 December 1987 introduced a new regime under which FDI could enter Vietnam for the first time. Furthermore, the Vietnamese government launched domestic reforms to provide a better investment climate. The reforms concerned the restructuring of state-owned enterprises (SOEs), banking and financial system and tax administration.

With a view to removing the residual obstacles against foreign investors in Vietnam, major amendments were made to the first Law on Foreign Investment in 1992, 1996 and 2000. In 2006, the law was replaced by a Unified Investment Law that regulates both domestic and foreign investment. Those changes and amendments have led to three outcomes: (i) higher levels of tax incentives; (ii) simplification of investment licensing procedures; and (iii) promotion of technology transfer.[2]

FDI inflows into Vietnam have increased substantially over the last 26 years (1988–2014). According to the GSO, the country has attracted 17,500 FDI projects, with registered capital of USD 268.7 billion (see Figure 3.1). The share of FDI enterprises in total employment and exports has been increasing year by year. In 2012, FDI firms employed 24.54% of the total labour force in Vietnam. Although the FDI sector only makes up one-fourth of total employment, it plays a substantial role in the export activities of the whole economy (see Figure 3.2). In the period 2000–2013, the share of the FDI sector in exports increased from 47% to 67%. In 2013, the exports of the FDI sector were twice those of the domestic sector. Those numbers confirm the indispensable contribution of FDI firms to Vietnamese exports (see Figure 3.3).

Given this background, the relationship between inward FDI and the productivity nexus has attracted growing interest from researchers on Vietnam. Nevertheless, and to the best of our knowledge, research that examines both the direct and indirect effects of FDI on the productivity of resident firms in Vietnam is rare, as most papers concentrate only on the indirect or spillover effects of FDI. Moreover, the existing studies do not investigate whether the productivity effects

[2]In addition to adjustments of the law on FDI, the Vietnamese government has endeavored to bring about great changes in other laws such as land law, competition law and bankruptcy law to ensure a good business environment for foreign investment.

of FDI are also associated with crowding-in or crowding-out effects on domestic firms. Finally, the findings from existing studies are heterogeneous and the sources of heterogeneity (for example, measurement issues, differences in model specifications and estimation methods, and industry-specific variations) are not discussed or evaluated systematically. Therefore, it is necessary to investigate the productivity effects of inward FDI in Vietnam as a separate study and in a more systematic manner, paying attention to direct and indirect effects, crowding-in and crowding-out effects, the variation of all FDI effects by industry and ownership types, and the effects of the mediating factors that may influence the outcomes.

This research utilizes firm-level Vietnamese panel data from 2001–2010. The dataset is compiled from the Annual Enterprises Survey (AES) conducted by GSO. The surveys collect comprehensive data on Vietnamese enterprises, including industry and ownership type, output, assets and liabilities, capital stock, investment, employment, location, wages, sales, obligations of firms to the government and so on. Our sample, which consists of all surveyed firms in 28 industries, is an unbalanced panel consisting of 166,697 firms over a period of 10 years from 2001–2010, with a total of 504,642 observations. The firms included are from four main clusters, consisting of manufacturing; utilities; construction, science and technology activities; and computer and related activities. These clusters are selected on the basis of the two-digit Vietnamese Standard Industrial Classification Codes (VSIC) of 1993. Although the dataset lacks data on intermediate inputs, working hours and employee skills, it contains value added, headcount of employment and a wide range of variables needed for conducting productivity analysis.

1.2 Problem Statement

Despite theoretical predictions concerning the beneficial effects of inward FDI on productivity, the evidence from empirical studies is mixed (Gorg and Greenway, 2001). With respect to direct effects, most studies report a positive relationship between FDI and productivity (Aitken and Harrison, 1999; Doms and Jensen, 1998; Okamoto, 1999). However, some researchers also find no evidence or ambiguous results (Globerman et al., 1994; Konings, 2000). Although some studies reflect awareness of heterogenous effects, the sources of heterogeneity examined differ between studies and the range of such sources remain limited.

The crowding-in/crowding-out effects tend to be overlooked in the exitsing literature. A few reserachers (e.g., Aitken and Harrison, 1999) tend to report evidence of the crowding-out effect, whereby FDI intensity at the firm and industry levels is associated with larger market shares for FDI-firms. With respect to intra-industry/horizontal spillovers, a number of studies also report a positive relationship between the presence of foreign firms and the productivity of domestic firms (Caves, 1974; Globerman, 1979; Blomstrom and Perrson, 1983; Haddad and Harrison, 1993; Hale and Long, 2007). However, this is by no means a consensus view, as other studies find a negative or no relationship between FDI spillovers and the productivity of local firms (Aitken and Harrison, 1999; Konings, 2001; Djankov and Hoeckman, 2000; Kathuria, 2000; Smarzynska, 2002; Javorcik, 2004; Bwalya, 2006; Murakami, 2007; Javorcik and Spatareanu, 2008).

Similarly, the empirical evidence on inter-industry/vertical spillover is also mixed. Some studies report a negative vertical spillover effect or no effect (Harris and Robinson, 2004; Thangavelu and Pattnayak, 2006; Liu, 2008; Barbosa and Eiris, 2009). Other studies report positive effects (Kugler, 2001; Smarzynska, 2002; Schoors and van de Tol, 2002; Blalock and Gertler, 2003; Javorcik, 2004; Bwalya, 2006; Halpern and Muraközy, 2007; Javorick and Spatareanu, 2008; Lin et al., 2009). Studies on both horizontal and vertical FDI spillover effects reflect similar patterns of heterogeneity in their empirical findings (Le Thanh Thuy, 2005; Pham Xuan Kien, 2008; Nguyen Phi Lan, 2008; Tran Toan Thang, 2011; Anwar and Nguyen, 2014).

Despite evident variations in the findings, policy makers in host countries and international organizations often assume that inward FDI has positive direct and indirect effects on productivity (UNCTAD, 2001). This policy stance, coupled with heterogeneity in the evidence base, increases the need for a careful evaluation of both modelling and estimation techniques, together with a critical assessment of the measurement issues and mediating factors that drive the results in empirical work.

The aim of this study is to contribute to existing knowledge along three dimensions. First, we estimate direct, indirect and crowding-in/crowding-out effects and discuss the extent to which these effects vary across industries, economic regions and firm characteristics. Secondly, we discuss the extent to which effect-size estimates measure what they are supposed to measure in the relevant theoretical framework. Finally, we investigate whether the indirect or spillover effects of inward FDI are contemporaneous or are observed with some lags.

Existing literature on the relationship between FDI and productivity leaves several gaps that need to be bridged. Firstly, most of the studies focus on spillover effects, pay little attention to direct effects and neglect the crowding-in/crowding-out effects. In the specific case of Vietnam, all the literature concerns about spillover effects, research on direct and crowding-in/crowding-out effects has not been investigated. Secondly, current literature is rather limited in the study of sources of heterogeneity in the FDI-productivity link that can affect size and magnitude of the effects. In the literature survey of this thesis, out of 59 papers that provide 158 findings, only 18 papers concern about the heterogeneity sources of spillovers of FDI and productivity relationship. No attention at all has been paid for the heterogeneity in findings of direct effects and crowding-in/crowding-out effects.

1.3 Objectives and Aims of the Research

This research focuses on the direct and indirect effects of inward FDI on the productivity of firms in Vietnam, and on whether inward FDI has a crowding-in/crowding-out effect on both private and publicly owned Vietnamese firms. It utilizes a rich dataset compiled by the Vietnamese GSO from 2001–2010. The dataset provides detailed information on the share of foreign investors in firm equity, firm outputs and inputs, a range of firm-specific variables and provincial/regional codes for 166,697 firms over a period of 10 years from 2001–2010, with a total of 504,642 observations in 28 industries, including manufacturing, utilities (electricity, gas and water supply), construction, science and technology activities, and computer and related activities.

The objectives of this research are:

(i) To estimate and discuss the direct and indirect (horizontal and vertical spillover) effects and crowding-in or crowding-out effects of inward FDI on firms in Vietnam.

(ii) To estimate and discuss the sources of heterogeneity that affect the direct and indirect effects and crowding-in or crowding-out effects of inward FDI on firms in Vietnam.

(iii) To derive conclusions that support evidence-based policy and practice and contribute to the existing knowledge base.

Our main innovations/contributions in this study include: (i) estimation of a wider range of inward FDI effects compared to existing studies on Vietnam and beyond; (ii) use of dynamic panel data methodology, specifically the generalized method of moments (GMM), to control for endogeneity that could be due to simultaneity and mismeasurement; and (iii) providing disaggregated evidence on the effects of inward FDI with attention to the sources of heterogeneity that affect the existence, size and magnitude of these direct, indirect and crowding-in/crowding-out effects.

1.4 Research Questions

To achieve the research objectives, the following five research questions will be addressed:

Research question 1: Does the share of foreign capital have direct effects on the productivity of FDI firms in Vietnam?

Research question 2: Does the share of foreign capital have crowding-in/crowding-out effects in Vietnam?

Research question 3: Does the share of foreign capital have horizontal spillover effects on the productivity of resident firms, domestic firms and foreign-owned firms in Vietnam?

Research question 4: Does the share of foreign capital have vertical spillover effects on the productivity of resident firms, domestic firms and foreign-owned firms in Vietnam?

Research question 5: Do direct, indirect and crowding-in/crowding-out effects vary between industries, firm sizes, ownership types, firm research and development (R&D) status, geographical regions and industry concentration in Vietnam?

1.5 Relevance and Justification of the Research

This research has original contribution to both knowledge base and evidence base on the direct, crowding-in/crowding out and indirect productivity effects of inward FDI in general and in the particular context of Vietnam. The evidence we report is based on a rich dataset and takes account of the potential endogeneity bias that may result from simultaneity (reverse causality) and mismeasurement of the key variables in the production function. Moreover, the research takes the issue of heterogeneity seriously and accounts for a wide range of potential sources of variation in reported estimates, including firm and industry characteristics and regional factors. As such, it has the potential to contribute to evidence-based policy and practice in Vietnam, and to encourage future research to take account of heterogeneity in a more consistent manner.

1.6 Organization of the Thesis

Apart from the Introduction Chapter (Chapter 1) and the Conclusions Chapter (Chapter 7), the thesis comprises of a chapter for literature review (Chapter 2), a chapter for data and methodology (Chapter 3) and three corresponding empirical chapters for direct, crowding-in/crowding-out and spillovers effects (Chapter 4, Chapter 5, Chapter 6). The three empirical chapters are connected closely and consistently in the same theme on how foreign presence affect the productivity of resident firms in a host country. Firstly, when foreign investors enter a host country, their firm specific advantages in terms of superior technology, advanced marketing, and managerial skills may impact the productivity of firms with the foreign partnership (FDI firms), which is investigated in Chapter 4 on direct effects of FDI. Later, the foreign presence may affect the host country's industrial structure and competition level. On the one hand, they may boost competition and reduce the concentration, which enhances domestic firms' competitiveness. On the other hand, they may reduce competition and increase industrial concentration in the host country. In this scenario, foreign firms increase their output at the expense of domestic firms. The issue of whether foreign presence does good or does harm to domestic firms in terms of output is examined in Chapter 5 on crowding-in/crowding-out effects of FDI. Lastly, through interaction with domestic firms in the same industry or in upstream and downstream industries in the value chain of production, the presence of foreign investors may generate knowledge externalities within or between industries that can enhance or hamper the productivity of firms in a host country. This interesting aspect of how foreign presence indirectly affects productivity of firms in a host country is studied in Chapter 6 on spillovers effects of FDI. Hence, three chapters of empirical work are expected to produce an integrated and coherent study of inward FDI and productivity of firms in a host country in general and in specific case of Vietnam in particular.

The thesis is organized as follows.

Chapter 2 reviews the literature on inward FDI and its effects on firm productivity in general and on Vietnam in particular. In this chapter, we first review the theoretical perspectives of the relationship between inward FDI and firm productivity in the host country. This review of the theoretical work enables us to identify the channels through which inward FDI may affect productivity, as well as the extent of complementarities or conflict between the motives that induce

MNEs to engage in FDI and the productivity effects of the latter on firm productivity in the host country. It also enables us to discuss the extent to which direct, crowding-in/crowding-out and spillover effects can be measured accurately and what kind of data is required to obtain accurate/reliable estimates. The largest part of Chapter 2, however, is devoted to a detailed review of empirical work. We review the empirical literature on direct, spillover and crowding-in/crowding-out effects, paying attention to five dimensions of the evidence base: data type, level of data aggregation, productivity measures, measures of foreign presence and econometric methods used. The wider literature and the specific subset on Vietnam is reviewed sequentially, but in both sets we pay attention to mediating factors that affect the reported findings. The chapter concludes with overall findings and discusses the implications for the analysis to follow in the empirical chapters.

Chapter 3 provides an overview of inward FDI flows and stocks in Vietnam, paying attention to sectoral, geographical and temporal patterns. These patterns are discussed in the context of policy reform in Vietnam and in the light of global competition for attracting FDI. This is followed by a detailed discussion of the data and methodology employed in this research. As indicated above, our dataset is compiled from the AES conducted by the GSO. It contains comprehensive data on Vietnamese enterprises, including industry and ownership type, output, assets and liabilities, capital stock, investment, employment, location, wages, sales, obligations of firms to the government and so on. Our sample consists of firms in 28 industries, and constitutes an unbalanced panel consisting of 166,697 firms over a period of 10 years (2001–2010), with a total of 504,642 observations. In this chapter, we provide a range of descriptive statistics on the shares of foreign investors in firm equity, and the distribution of firms with a foreign presence across industry and region and over time. We also discuss the quality and reliability issues associated with the original survey and with the construction of the estimation sample. This is followed by a detailed discussion of the existing estimation methods and the kinds of modelling and methodological innovations that we introduce.

In Chapter 4, we estimate the direct effect of inward FDI in Vietnam, captured through foreign capital shares. In this chapter, we discuss the measurement and estimation issues in detail. We also investigate whether FDI intensity and the productivity of FDI firms are linear or non-linear. Moreover, we examine how firm sizes, firm ownership types, firm R&D status, industry concentration and economic regions affect the size and magnitude of the effects. We observe that the share of foreign capital in firm equity has a positive and significant effect on the productivity of firms in Vietnam. Also, we report an inverted U-shaped relationship between FDI intensity and the productivity of FDI firms. Firm and industry characteristics, along with regional disparity, are found to influence the existence and degree of the direct effects.

Chapter 5 presents empirical results and discusses the findings on the crowding-in/crowding-out effects of inward FDI on the turnover of Vietnamese firms in 28 industries in Vietnam from 2001–2010. In this chapter, we pay attention to similarities and differences between the findings, depending on the characteristics of firms, industries and economic regions. Overall, we detect evidence of the crowding-out effects of FDI on the turnover of firms in Vietnam. Additionally, the effects are dependent on the characteristics of the firm, industry and region.

Chapter 6 presents empirical evidence and discussion on the indirect or spillover effects of the foreign presence and productivity of firms in 28 industries in Vietnam from 2001–2010. In this chapter, we address the measurement and estimation issues while modelling horizontal and vertical spillovers, and pay attention to the extent to which these effects vary across firm heterogeneity, industries and economic regions. Generally, we find no significant evidence of FDI spillovers on average firms and foreign firms in Vietnam from 2001–2010, except the positive backward spillover-effects on small firms and positive backward and forward spillover-effects on R&D-inactive firms. We suggest that the attributes of firm, industry and economic region are the heterogeneous sources of the findings.

Chapter 7 summarizes and concludes the analyses and findings of the thesis. The findings are synthesized in accordance with the main research questions stated at the beginning of the thesis. The findings shed light on the issue of FDI and productivity in Vietnam, and contribute to existing knowledge through new evidence that takes account of heterogeneity and endogeneity problems encountered in the estimation of production functions.

On the whole, this thesis contributes to the knowledge base and evidence base on the relationship between inward FDI and the productivity of firms in the host country in three aspects: direct, crowding-in/crowding-out and indirect effects. The two estimation issues of endogeneity and heterogeneity are systematically dealt with in the research. Intrinsically, this thesis is expected to produce both comprehensive and robust evidence on the direct, crowding-in/crowding-out and spillover effects of FDI on the productivity of firms in Vietnam.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter first discusses the theoretical perspectives that identify the channels through which inward FDI may affect productivity directly and indirectly; and how the effect may vary depending on mediating factors such as absorption capacity, domestic firms' characteristics and FDI characteristics. The second, and more substantial, part of the chapter is devoted to a comprehensive review of the empirical literature on inward FDI and productivity. The empirical literature is reviewed both in general and with respect to Vietnam. The review focuses on direct, indirect and crowding-in/crowding-out effects, and on other dimensions of the research field such as data type, level of data aggregation, productivity measures, measures of foreign presence and econometric methods used. The chapter concludes with a synthesis of the overall findings, demonstrating how our research is informed by the existing literature and what it aims to contribute to the extant body of knowledge on the relationship between inward FDI and productivity in the host country.

2.2 Theoretical Underpinnings of the FDI–Productivity Relationship

Conventional wisdom suggests that inward FDI can increase host countries' productivity, both directly by introducing new technologies and indirectly through technology spillover. The concepts of direct and indirect effects share some similarities and differences. Both seek to explain why a causal relationship may exist between FDI and firm performance in the host country. The difference between the two lies in the way in which inward FDI and the technology associated with it affect the firm under investigation. The direct effect captures the change in firm productivity when the firm-level FDI measure increases by one unit. As such, it can be interpreted as the direct effect of inward FDI when a firm with an FDI presence increases its FDI intensity by one unit, or when a firm without FDI switches from a purely domestic status to a joint ownership status. That is why it is often referred to as the own-firm effect.

In contrast, the indirect effect relates to the influence of industry-level FDI intensity on the productivity of the representative firm. The effect occurs as a result of technology spillover, which enables all firms in a given industry of the host country to benefit from the technology associated with the inward FDI presence in their industry. Nevertheless, the existing literature limits the spillover effect to the externality enjoyed by domestically owned firms only, on the grounds that the superior technology associated with inward FDI will be imitated only to some extent by domestic firms. Following this line of argument, the interpretation is that industry-level FDI has spillover effects on domestic firms only. Yet, we think that the technology associated with FDI presence in an industry may have spillover effects on both domestic firms and firms with foreign ownership. That is why we review the literature with an eye to establishing whether such distinctions are made. We also make the case for investigating spillover effects on different firm types, including domestic firms only, foreign firms only and both domestic and foreign firms taken together.

Direct and indirect effects have been studied widely and over a long period (Caves, 1974; Globerman, 1979; Aitken and Harrison, 1999; Vahter, 2004; Benfratello and Sembenelli, 2006; Taymaz and Yilmaz, 2008; Batool et al., 2009). The approach remains fairly similar to the contributions by pioneering studies (Caves, 1974; Aitken and Harrison, 1999; Javorcik, 2004). It involves relating foreign ownership at firm level (in the case of direct effects) or spillover pool at sector level (in the case of indirect effects) to the productivity of two firm types: FDI firms and domestically owned firms. A positive (negative) coefficient on FDI intensity (or FDI capital) is interpreted as evidence of positive (negative) direct effects on productivity. The direct effect captures the change in firm output that can be accounted for by FDI presence, after controlling for the effects of conventional inputs. The firm in question is either an FDI firm or a domestically owned firm that switches status from a domestically owned to an FDI firm. On the other hand, a positive (negative) coefficient on FDI concentration in the industry/sector indicates positive (negative) spillover effects on the typical firm. The latter can be either a domestically owned firm if the estimation sample consists of non-FDI firms, or both FDI and non-FDI firms if the sample consists of all firms.

2.2.1 FDI and Direct Effects on Productivity

In the conventional approach, FDI influences productivity in an industry directly by bringing in new capital and by improving the average skill level and efficiency of the industry. FDI can also bring in “relatively” advanced technology, which may not be imported directly due to market imperfections and high transaction costs (Buckley and Casson, 1976; Caves, 1996; Teece, 1981).

Finally, MNEs have to compete in foreign markets, where local firms have better knowledge of local markets, consumer preferences and business practices. Given this constellation of factors, MNEs draw on their mostly intangible advantages, which are internalized through expansion abroad rather than through market mechanisms (Buckley and Casson, 1976). This theory of internalization suggests that MNEs' foreign subsidiaries can be expected to enjoy higher productivity or profitability levels compared to local firms.

However, Hymer (1960) also draws attention to the dual nature of FDI. On the one hand, he agrees with the conventional argument that MNEs investing abroad have to compete with domestic firms that have advantages in terms of culture, language, legal system and consumer preferences. These costs of doing business abroad initially conceptualized by Hymer were named the "liability of foreignness" – a well-known concept in international business also used by other recent scholars, such as Zaheer (1995), Eden and Miller (2004) and Gaur, Kumar and Sarathy (2011). The core of the "liability of foreignness" is that firms face social and economic costs when they operate in foreign markets. Eden and Miller (2004) stated that some of these costs, such as becoming familiar with the language and economic systems of the host country, can be overcome over time. However, the other costs, such as unfamiliarity and relational and discriminatory hazards, persist longer and often put MNEs in a disadvantageous position compared to domestic firms. MNEs offset their disadvantages of liability of foreignness by exploiting their market power and firm-specific advantages. Stated differently, MNE subsidiaries may have higher levels of productivity compared to domestically owned firms, as the former draw on their intangible advantages to compete against the latter, who benefit from better knowledge of the local market. The intangible advantages of the MNEs and their subsidiaries consist of patent-protected superior technology, brand names, marketing and managerial skills, economies of scale and cheaper sources of finance.

On the other hand, Hymer (1960, 1970) also draws attention to the potentially adverse effects of FDI in terms of own-firm productivity and/or development of the host countries by distinguishing between exogenous and endogenous policy environments and the implications of the latter for productivity (Dunning and Rugman, 1985, p. 230). Caves (1996) and Rugman and Verbeke (1998) concur with Hymer that MNEs' strategic perspective on government policy reflects the extent to which they view the policy as exogenous or endogenous. If government policy is viewed as exogenous, MNEs will work within the rules and deploy their intangible advantages to compete within the host-country market. However, if the policy environment is considered as endogenous, MNEs have the option of securing market positions by engaging in strategic actions aimed at influencing or changing the policy environment in their favour.

The differential productivity effects of exogenous and endogenous policy environments can be placed in sharp relief by focusing on two sources of productivity: efficiency gains and gains due to technological change (Fare et al., 1994). The productivity effects under different combinations of policy environment types and sources of productivity gains are summarized in Table 2.1.

Table 2.1: The policy environment and productivity effects of FDI

	Sources of productivity change		
Type of policy environment	***Efficiency change***	***Technological change***	***Total change***
Exogenous	+	+	+
Endogenous	+/-	+/-	+/-
Total change	+/-	+/-	+/-

When the policy environment is exogenous, MNEs deploy higher levels of technology and know-how to survive in the foreign market. In this case, FDI firms are more likely to be more productive than domestic firms for two reasons: increased efficiency and a higher level of technology. Stated differently, under the condition of exogenous policy environment, FDI firms are likely to be more productive than domestic firms – that is, the direct effect of FDI on subsidiaries' productivity is positive. By the same logic, the indirect (spillover effects on the domestically owned or typical firm are also expected to be positive.

However, the outcomes are less certain when the policy environment is endogenous – that is, when the policy environment is a product of interactions between the MNEs and the host-country government. Under this scenario, MNEs compete within the host country not only by drawing on their intangible and tangible asset advantages, but also by deploying their asymmetric bargaining powers with a view to securing concessions or preferential treatment with respect to tax/subsidy regimes, environmental or labour protection obligations or reduced cost of access to land and infrastructure. In this scenario, the returns on FDI investment may be sufficient for MNEs to invest in the host country, but the profitability reflects a mixture of both real productivity gains and rents associated with the endogenous nature of the MNEs' market power. Hence, the direct or indirect productivity gains can be either positive or negative. This is the case whether the productivity gains are due to efficiency improvements or higher levels of technology. The implications of the processes summarized above can be followed in the last column and row of Table 2.1, which indicates that the partial and overall productivity effects may be uncertain. The magnitude and sign of productivity effects depend on the extent to which MNEs deploy their market powers to extract rents as opposed to introducing better technologies.

2.2.2 FDI and Crowding-in and Crowding-out Effects

Theoretically, the impact of a foreign presence on the host country's industrial structure and competition is controversial. On the one hand, when MNEs enter existing foreign markets, they may boost competition and reduce the concentration, which enhances domestic firms' competitiveness. This is usually referred to as the spillover effects of FDI on the productivity of host-country firms. MNEs possess some sort of firm-specific assets or efficiency advantages that enables them to operate abroad successfully (Hymer, 1960; Buckley and Casson, 1976). The inflows of those tangible and intangible assets into a host country can benefit host-country indigenous firms, raising their productivity and reducing their costs of production, and thus increasing their probability of survival (Markusen, 2002; Helpman et al., 2004; Gorg and Strobl, 2003).

On the other hand, multinationals may reduce competition and increase industrial concentration. The foreign presence of MNEs on factor and product markets for production may have negative effects on the survival of indigenous firms' plants. More efficient MNEs that produce at lower marginal costs than domestic firms tend to increase their output at the expense of their rival indigenous firms. If the domestic firms face fixed costs of production, their average costs will increase, reducing the probability of their plants' survival. A larger presence of foreign competitors may also drive up factor costs, for example, leading to higher wages in the factor market, which in turn may bring about an increased probability of shutdowns and exiting the market among indigenous firms (Görg and Strobl, 2003). However, as emphasized by Dunning and Lundan (2008), whether a foreign presence is beneficial or detrimental to the host country's industrial structure and competition may depend on several factors, particularly the mode of establishment chosen by the multinational enterprise (greenfield investment or acquisitions) and industry- or country-specific circumstances.

The competition effects of MNEs on domestic firms are discussed in a prominent work by Aitken and Harrison (1999). The authors argue that when MNEs enter a host-country market, their advanced technologies and know-how may attract demand away from domestic enterprises, particularly in the short run. This is called the “market-stealing effect” or “crowding-out effect.” Conversely, a “crowding-in effect” may occur when the foreign presence increases the demand for the products and services of domestic firms. In summary, firm-specific FDI intensity and FDI concentration at the industry level may be associated with lower (higher) market shares for domestic firms relative to FDI firms.

In the presence of crowding-out effects, domestically owned firms have lower levels of productivity, as their fixed costs are spread over a smaller scale of production. Stated differently, the crowding-out effect is the reallocation of market share from less productive (domestic) firms to more productive (foreign) firms, as depicted in Figure 2.1.

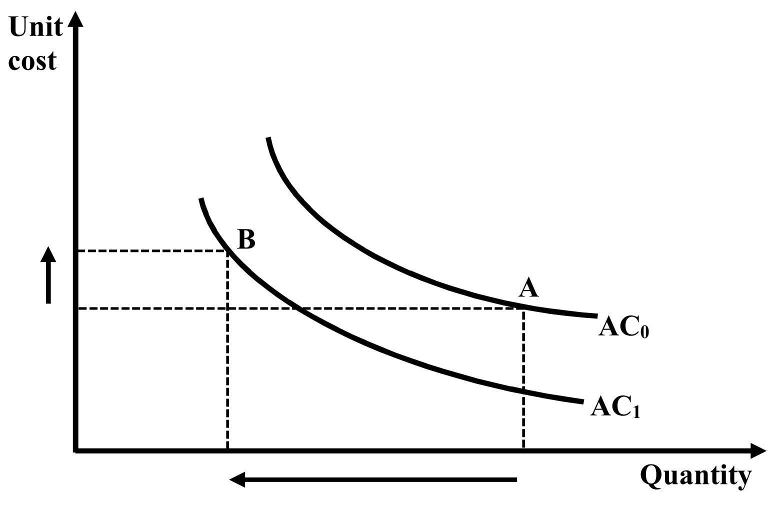

Figure 2.1: Output response of domestic firms to foreign entrants

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Initially, a domestically owned firm operates along the average cost curve depicted at AC_0. The entry of foreign-owned firms generates positive spillover effects on domestic firms, leading to a downward shift in the latter's average cost curve from AC_0 to AC_1. However, foreign firms enter the market with firm-specific advantages in terms of tangible and intangible assets, and may be operating at lower marginal costs compared to domestic firms. To the extent that this is the case, and if the existing market is only imperfectly competitive, the foreign firm with lower marginal costs will increase production at the expense of its domestically owned competitor. As the latter spreads its fixed costs over a smaller market, it moves up along the new average cost curve (AC_1), with the consequence of lower market share (or smaller turnover).

Caves (1996) and Blomstrom, Kokko and Zejen (2000) argue that MNEs are more likely to crowd out local firms in developing rather than developed countries. This is because of a wider technology gap between indigenous firms and foreign affiliates in the latter. From a policy perspective, these arguments raise concerns about the costs and benefits of attracting FDI – especially in developing or transitional countries, where FDI becomes a substitute for domestic investment due to a shortage of savings or other structural deficiencies. In such cases, FDI may perpetuate structural deficiencies rather than encouraging structural reforms. That is why Cordonnier (2002) argues that FDI has actually complicated the restructuring process in the Russian banking sector. A similar concern has been noted by Dawar and Frost (1999), who argue that a foreign presence may represent a "death sentence" for local firms, with little or no overall gains in host-country productivity.

2.2.3 FDI Externalities: Marshallian or Jacobian?

The theoretical framework for indirect or spillover effects on productivity originates from the neoclassical theories of knowledge production (Arrow, 1962) and endogenous growth models (Romer, 1986). Marshall (1890), Arrow (1962), Romer (1986) and Jacobs (1969) have contributed to theories of "dynamic externalities" (as formalized by Glaeser et al., 1992, p.1130), with a view to explaining knowledge spillovers and how they affect growth. As Glaeser et al. (1992) indicate, both theories deal with technological externalities, whereby innovations and improvements occurring in one firm can increase the productivity of other firms without full compensation by the latter. However, the theories differ along two dimensions. The first dimension is whether knowledge spillovers come from within an industry or between industries. The second dimension is how local competition affects the impact of these knowledge spillovers on growth. As a consequence, two types of knowledge spillovers are thought to be important for innovation and growth: Marshall–Arrow–Romer (MAR) spillovers and Jacobian spillovers.

MAR theory focuses on spillovers within an industry. In MAR theory, the concentration of firms in the same industry helps knowledge to diffuse among firms and enhance innovation and growth. These intra-industry spillovers are known as localization or "specialization" externalities. One implication of the MAR theory is that a local monopoly is better for growth than local competition. This is because the local monopoly can restrict the flows of ideas to others, so that externalities are internalized by the innovator. When externalities are internalized, the rates of innovation and growth are higher.

Marshall (1890) proposes that the concentration of production in a particular location (agglomeration) generates external benefits for firms in that location. He argues that "the mysteries of the trade become no mystery, but are, as it was, in the air" (Marshall, 1890, p.156), implying that knowledge spillovers may occur when firms locate near one another to learn and to speed up their rate of innovation. Marshall also asserts that the second reason for firms to agglomerate is to take advantage of the scale economies associated with a large labour pool. Agglomeration occurs because workers are able to move across firms and industries. Notably, this agglomeration can only occur if the industries use the same type of workers; that is, only firms operating in the same stage of production can benefit. Lastly, firms choose to locate near one another to reduce the costs of obtaining inputs from upstream suppliers or shipping goods to downstream customers. In essence, through his work, Marshall suggests the externalities (so-called Marshallian externalities) between firms located near other firms in the same industry, which are usually referred as to intra-industry spillovers.

Marshall's work was later extended by the work of many authors, including Arrow (1962) and Romer (1986). Arrow (1962) asserts that growth is driven by the accumulation of knowledge, which includes learning by doing in the same industry. Romer (1986), the pioneering work in endogenous growth theory, builds on Marshall (1890) and Arrow (1962) and focuses on the investment–growth nexus. Unlike the Solow neoclassical growth model, the Romer endogenous growth model explains technological change as an endogenous outcome of public and private investment in human capital and knowledge-intensive industries. The endogenous growth model begins by assuming that growth processes derive from the firm or industry level and specifies technological progress as a function of the stock of research and development. Romer focuses on the possibility of external effects as R&D efforts by one firm spill over and affect the stock of knowledge available to all firms in the industry. In his model, knowledge is assumed to be an input to production that has increasing marginal productivity, and investment in knowledge is supposed to generate natural externalities. He states: "The creation of new knowledge by one firm is assumed to have a positive external effect on the production possibilities of other firms because knowledge cannot be perfectly patented or kept secret" (Romer, 1986, p. 1003). In the model, each industry individually produces with constant returns to scale, so his model is consistent with perfect competition, and up to this point it matches the assumptions of the Solow neoclassical growth model. However, Romer departs from Solow when he proposes that the economy-wide capital stock positively affects output at the industry level. Hence, there may be increasing returns to scale at the economy-wide level. In sum, the Romer endogenous growth model highlights the roles of human capital accumulation and technological externalities.

Contrary to MAR theory, which focuses on spillovers within an industry, the Jacobian spillovers theory concentrates on spillovers between industries. Jacobs (1969) argues that knowledge may spill over between complementary rather than similar industries, as ideas developed by one industry can be applied in other industries. The exchange of complementary knowledge across diverse firms and economic agents facilitates search and experimentation in innovation. Therefore, a diversified local production structure leads to increasing returns and gives rise to urbanization or "diversification" externalities. Jacobs also challenges MAR theory when she stresses that local competition, rather than a local monopoly, speeds up the adoption of technology and promotes innovation and growth.

However, the theoretical case for spillovers is not as straightforward as these two theories would suggest. Drawing on Hymer (1960) and other related work by Caves (1996) and Rugman and Verbeke (1998), the effect of FDI spillovers on the productivity of domestic firms may not be necessarily positive. This uncertainty is evident in the evolutionary perspective, where knowledge generated by active R&D firms cannot be absorbed by other firms unless the latter invest in R&D in the first place (Cohen and Levinthal, 1989). Stated differently, FDI spillovers may depend on the technology gap between foreign and domestic firms, and the benefits of positive spillovers may accrue only if domestic firms enhance their absorptive capacity through prior technology investment.

Koizumi and Kopecky (1977) were the first to model FDI and technology transfer explicitly. The two scholars use a partial equilibrium framework to analyse technology transfer from a parent firm to its subsidiary. Technology transfer is assumed to be an increasing function of the country's capital stock owned by foreign residents. The transmission of foreign technology is viewed as "automatic" and technology is treated as a public good. Findlay (1978) and Das (1987) support Koizumi and Kopecky (1977) by proposing that superior technology possessed by foreign firms is a "public good" in nature, and can be transferred automatically. The common theme of these models is that they analyse the direct transfer of technology. Another strand of models examines the issue of FDI and technology transfer indirectly using a growth theory framework. Walz (1997) incorporates FDI into an endogenous growth framework where MNEs play a significant role in growth and specialization patterns. Walz extends the idea of trade-related international knowledge spillovers used in Grossman and Helpman (1991) and applies them to FDI. It is noticeable that most existing literature on FDI spillover effects and productivity employs an endogenous framework to quantify the relationship and the effect sizes.

As profit maximizers, there is no incentive for MNEs to create knowledge transfer without receiving an appropriate return for it. Besides, MNEs may be selective in the transfer of technology to their subsidiaries, as they face the risk of knowledge spillover that may erode their firm-specific advantages and hence worsen their market power (Balsvik, 2006). MNEs then have incentives to protect their intangible asset advantages and minimize spillovers in several ways. First, MNEs can pay higher wages to their employees to reduce labour mobility from MNEs to local firms in the future, as analysed in Fosfuri et al. (2001) and Glass and Saggi (2002). Secondly, MNEs can invest in protecting intellectual property rights such as patents and secrecy (Nadiri, 1993), or send their own managers and engineers from the home country rather than hiring locals in order to prevent leaks of technology to local firms (Sawada, 2010). Thirdly, through switching from FDI to export to other countries, MNEs can protect their intangible assets (Balsvik, 2006). Nevertheless, the incentive to limit spillovers may be limited to horizontal spillovers. As argued by Javorcik (2004), MNEs or their subsidiaries may not try to minimize vertical spillovers since they benefit from more productive local suppliers/buyers.

Gachino (2007) adopts a critical view and identifies three main weaknesses in the existing framework. First, a foreign presence may not be the only factor in determining the magnitude of spillovers and their effects on productivity. Moreover, the effects of a foreign presence on productivity are usually thought to occur automatically. Because of the assumption of automaticity, the actual mechanism through which spillovers take place and the process of endogenous technological change in terms of skills, knowledge and learning acquired are ignored. Finally, the theoretical background builds only a narrow conceptualization of the spillover phenomenon. The background stresses the role of MNEs, but pays little attention to the role and efforts of local firms, as well as other supportive factors within the local systems of innovation in host countries.

The measurement of spillovers is another issue to be addressed. Spillovers are difficult to measure directly, because data on the actual flow of knowledge, capital and labour across firms is unavailable. Hence, proxies are employed to quantify spillovers and to estimate their effects on firm productivity in the host country. Unfortunately, proxies bring with them uncertainty about the extent to which they represent the variables of interest. Gorg and Strobl (2001) propose that the use of proxies for spillover pool in an industry, whether foreign output, employment, capital, equity, asset or sales/revenue/turnover shares, might lead to over- or underestimated productivity effects. The second measurement issue is whether the relationship between spillovers and productivity is contemporaneous or occurs with lags. Javorcik (2004) and Liu (2008) argue that spillovers take time to manifest themselves; however, the time lag is still an open question. Finally, there is the issue of how to distinguish spillovers from unobserved firm characteristics. If there are firm-, industry-, time- and region-specific factors unknown to the econometrician but known to the firm, the correlation between firm productivity and foreign presence is confounded. Hence, productivity effect estimates could be biased even if spillovers could be measured correctly. It is true that researchers can eliminate firm-specific effects by using time-differenced data or within estimators. However, such estimators yield consistent estimates only if the firm-specific effect is fixed over time.

Noticeably, in the existing literature, several empirical studies take advantages of firms' panel data and match them with firms' survey data on employer-employee or employer-innovation relationship, particularly for detecting the effects of FDI on productivity and the interaction between FDI and R&D or FDI and spillovers. For instance, the works of John Van Reenen and Eve Caroli (2001); Rachel Griffith, Rupert Harrison and John Van Reenen (2006); Ralf Martin and Chiara Criscuolo (2009); Bronwyn Hall and Jacques Mairesse (1995);…should be seen as motivations for the next step of future research, when the firm-level panel data in this research could be matched with other firm-survey data on employment and/or R&D to quantify comprehensively the effects of FDI on firm productivity and/or firm R&D.

The discussions in parts 2.2.1-2.2.3 above indicate that the assumptions and implications of spillover and internalization theories should be placed under a critical spotlight. On the one hand, MNE subsidiaries can be expected to enjoy higher productivity or profitability levels compared to local firms. However, and as Hymer (1960, 1970) has demonstrated, the productivity differential and the underlying technological gap between FDI firms and domestic firms depend on the MNEs' market power and whether market imperfections are exogenous or endogenous. As such, the direct effect of FDI on the productivity of FDI firms may be small in magnitude and may vary between different industries and/or between different motivations for FDI.

A similar cautious assessment is also called for when indirect productivity effects are the focus of analysis. On the one hand, the MAR and Jacobian perspectives demonstrate why the interaction between FDI firms and other firms in the same or different industries/locations/countries can generate spillovers that boost innovation and growth. However, the spillover effects become uncertain when market imperfections are endogenous (Hymer, 1960; Caves, 1996; Rugman and Verbeke, 1998) or when large technology gaps between foreign FDI firms and domestic firms constrain the ability of the latter to benefit from knowledge spillovers (Cohen and Levinthal, 1989).

Moreover, the argument on the crowding-out effect of FDI on the domestic market presented in part 2.2.2 of this section highlights the issue of whether the effects of FDI on the productivity of foreign-owned firms may be obtained at the expense of domestically-owned firms in terms of their market shares. From a policy perspective, these arguments raise concerns about the costs and benefits of attracting FDI – especially in developing or transitional countries.

2.2.4 Externalities, Spillovers and Productivity

Meyer (2004) argues that spillovers are generated by non-market transactions involving foreign MNEs' resources, particularly when knowledge is spread to local counterparts without a contractual relationship. Spillover effects from FDI on firms in the host country are also defined as "an increase in the productivity" of resident firms "as a consequence of the presence of foreign firms" in the host economy (OECD, 2008b, p.7). While the first definition implies that FDI spillovers affect the productivity of domestically owned firms, the second extends the spillover effect to all resident firms, which includes firms with an FDI presence. In this thesis, we adopt the OECD (2008b) definition and investigate the spillover effects on all resident firms. However, we also investigate whether the spillover effects differ between domestically owned and FDI firms.

Caves (1974, pp.176–177) points to three potential spillover benefits from FDI: (i) allocative efficiency; (ii) higher level of technical or X-efficiency; and (iii) diffusion of technology and knowledge to local firms. FDI may improve allocative and technical efficiency through competitive pressure. Foreign entrants break down entry barriers, compete for factor inputs and customers, and reduce the market power of domestic firms. These changes make marginal firms exit or become more productive. Furthermore, Caves also articulated that FDI might improve host-country productivity through technology transfer. Technology transfer can occur when there is economic contact between foreign and local firms. Caves asserted that FDI affiliates would enjoy more benefits from technology transfer than purely domestic firms, because FDI affiliates were direct and immediate recipients of technology from foreign firms. Other potential positive effects of FDI emphasized by various studies on the productivity of domestic firms are via competitive pressures that eventually force the domestic firms to become more efficient; learning by doing; and the diffusion of knowledge through demonstration effects or labour turnover (e.g., Globerman, 1979; Blomstrom and Wolf, 1994; Djankov and Hoekman, 2000).

FDI spillovers can be split into two broad categories: intra-industry or horizontal spillovers; and inter-industry or vertical spillovers. Horizontal spillovers refer to the "increase in the productivity" of resident firms "resulting from the presence of foreign firms in the same industry" (OECD, 2008b, p.7). In the same manner, vertical spillovers present the increase in the productivity of resident firms in the host country resulting from the presence of foreign firms in upstream and downstream industries. More concretely, vertical spillovers can be broken into forward spillovers (indigenous firms act as downstream local buyers of intermediate inputs produced by foreign firms) and backward spillovers (indigenous firms establish themselves as upstream local suppliers of foreign affiliates; OECD, 2008b, p.8). These classifications can be visualized as in Figure 2.2.

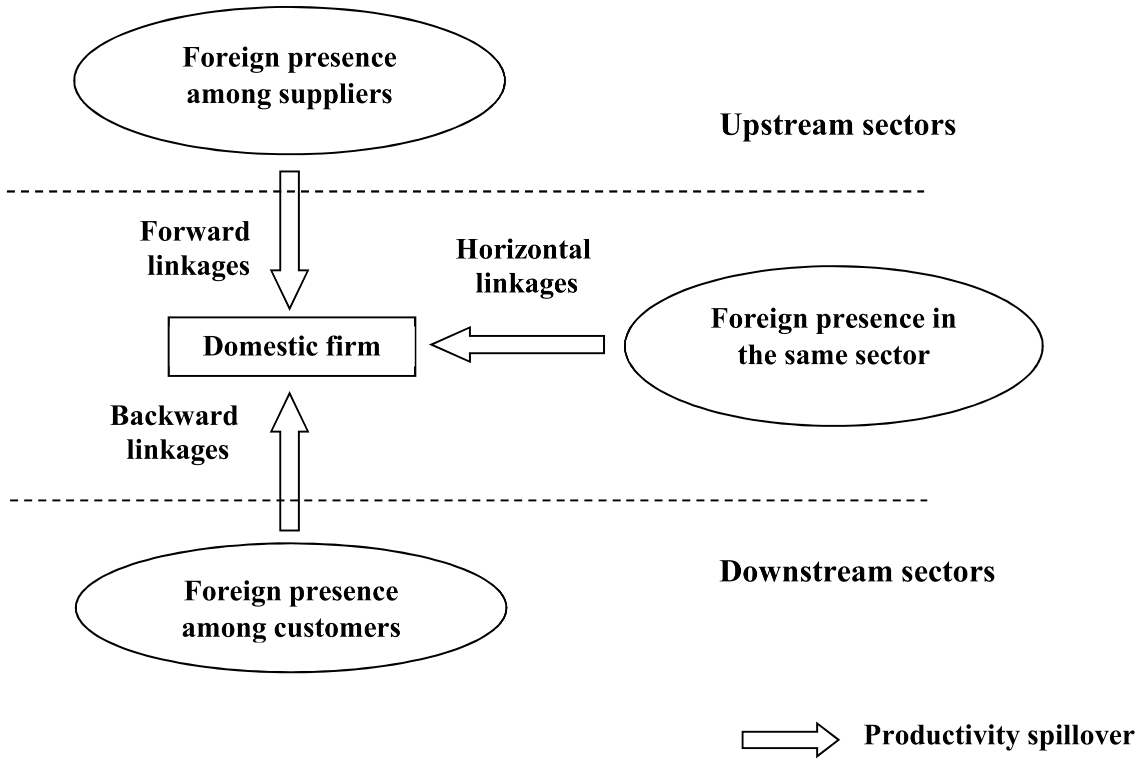

Figure 2.2: Linkages of FDI spillovers

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Figure 2.2 illustrates the three linkages of FDI spillovers indicated above. The interaction between foreign firms and resident firms in the same industry of the host country is referred to as horizontal linkages. The interaction between foreign firms and their local suppliers is referred as to backward linkages. The interaction between foreign firms and their local customers is referred as to forward linkages.

Horizontal Spillovers and Productivity

Horizontal spillovers arise from three channels: competition effect, labour mobility effect and demonstration effect. Firstly, the presence of inward investors might introduce severer competition in the domestic market, forcing local firms to make the most of their resources and technology in more efficient ways to stay competitive, therefore enhancing the productivity of local counterparts (Wang and Blomstrom, 1992; Kokko, 1994). This is usually referred to as competition effects. Secondly, the superior knowledge of MNEs may overflow to domestic firms through labour mobility; that is, when employees trained by MNEs move to work for local firms or establish their own businesses, bringing with them knowledge and intangible assets that they had accumulated before while working in foreign affiliates (Fosfuri, Motta and Ronde, 2001). Thirdly, foreign firms may generate de-onstration effects in the domestic market. A demonstration effect occurs when domestic firms observe, imitate and apply the actions, skills or techniques, new technologies, advanced marketing and managerial practices introduced by MNEs to the host country (Wang and Blomstrom, 1992).

Among those three channels of horizontal spillovers, competition effects may lead to either positive or negative outcomes. Aitken and Harrison (1999) argue that, in the short run, the existence of foreign firms with their advanced technologies and know-how may attract demand away from domestic enterprises. As domestic firms reduce production, they may experience a higher average cost, since fixed costs are spread over a smaller amount of output, therefore resulting in less productivity for domestic firms (the "market-stealing effect" or "crowding-out effect"). However, in the long run, when all costs are treated as variable costs, domestic firms may reduce their costs by reallocating their resources more efficiently and/or imitating skills and techniques from foreign counterparts (Wang and Blomstrom, 1992). If the efficiency effect is larger than the competition effect, there could be positive spillovers. Besides, the presence of foreign investors may also boost the labour costs of domestic firms as foreign investors often offer higher wages, which might raise wages for all firms in competitive labour markets (Aitken, Harrison and Lipsey, 1996).

Vertical Spillovers and Productivity

Buckley and Casson (1976) indicate that it may be difficult for firms to transfer technology to other unrelated firms because of high transaction costs. In this situation, the firm may choose internalization through backward and forward integration. As foreign firms build vertical production networks, they include domestic firms in their production chain and interact with those local affiliates upstream or downstream in this chain. It has been argued that positive vertical spillovers tend to be more pronounced than horizontal spillovers, as MNEs have an inducement to enhance the productivity of their buyers and suppliers rather than their competitors (Blalock and Gertler, 2003; Lin and Saggi, 2005). Blalock and Gertler (2003) argue that technology diffusion from FDI is more visible inter-industry (in upstream and downstream sectors) than intra-industry; that is, the diffusion is more likely to be directed to local suppliers or buyers between industries than to local competitors in the same industry. In this case, a cost-reduction incentive encourages MNEs to transfer technology to their suppliers/buyers in their value chain, because such transfer grants private benefits to MNEs. Moreover, Blalock and Gertler propose that market imperfection causes MNEs to transfer their technology widely through demonstration and labour mobility effects that can benefit the whole economy. As a result, the social benefit from technology transfer is greater than the private benefit, and spillover then occurs. Technology from MNEs, in this case, is a public good in nature, its diffusion causing a positive externality to the host country.

Backward linkages are relationships that domestic firms establish as upstream local suppliers of foreign affiliates, while forward linkages are relationships in which indigenous firms act as downstream local buyers of intermediate inputs produced by foreign firms. More concretely, backward spillovers state the technology transfer from foreign affiliates to domestic counterparts through supply chains, and forward spillovers are present when indigenous firms have access to new or less costly intermediate inputs for production thanks to a foreign presence in upstream industries.

Clearly, if inbound investors are able to prevent leakages of their firms' intangible assets to domestic competitors in the same industries, there would be no scope for horizontal spillover effects. However, there is a possibility that foreign affiliates may improve the productivity of domestic firms through backward and forward linkages. Giroud (2003) stresses the importance of backward linkages for developing host countries, as the linkages offer a direct channel for knowledge dissipation from foreign affiliates to local suppliers. Lall (1980) and Javorcik (2004) assert that backward linkages may induce technology spillovers through various channels. First, foreign firms may transfer technology directly to their local suppliers by training or technical assistance, in order to increase the quality of supplier products. Moreover, close linkages between foreign firms and local counterparts may induce workers in foreign firms to turn to work in local suppliers, thereby diffusing technology from foreign to local firms. Last but not least, higher requirements for product quality and on-time delivery set by foreign firms may provide incentives to local suppliers to improve their production process or technology. Blalock and Gertler (2003) explain the incentives for foreign firms to produce backward linkages, since the full benefit of foreign investment can only be achieved when the quality of inputs in the host country is close enough to that in the home country, but at a lower cost.

There are several factors that can affect the decisions of foreign investors in backward linkages. Rodriguez-Clare (1996) emphasizes that if a foreign firm can easily gain access to the international market and import intermediate goods from overseas, it will decide between sources locally and abroad and might do harm to the host country when it imports goods from the overseas market. In addition, even if foreign investors buy intermediate goods from local suppliers, those local affiliates still stand a chance of learning and absorbing the transferred technology from foreign counterparts unsuccessfully if the locals lag far behind foreign affiliates in productivity level (Smarzynska, 2002). Moreover, Lin and Saggi (2007) postulate that the presence of foreign firms can impede the vertical spillover effect on domestic firms in particular, and hurt the domestic economy in general if they require their domestic suppliers to cease supplying other downstream firms as a condition of transferring their technology.

Regarding forward linkages, Aitken and Harrison (1999) stress the significance of linkages in many industries and assert that generally, the downstream effects of FDI are of more benefit than the upstream effects. However, researchers have not paid much attention to these forward spillovers. Meyer (2003) confirms that the linkages can take place in two ways. Firstly, domestic firms may benefit from having foreign suppliers of intermediate goods and machinery with better-quality products and lower costs. Secondly, as marketing outlets for foreign firms, domestic firms may receive support in the form of training in sales techniques and supply of sales equipment, therefore generating more technology externalities. In other words, forward linkages occur as the foreign presence supports domestic firms by supplying those firms with better inputs and techniques, enhancing the productivity of all downstream local firms. Nevertheless, in some cases the inputs might be more expensive and less suitable to local requirements; therefore, they mainly benefit domestic firms that can handle the better but more expensive inputs.

This overview suggests that spillover effects are neither guaranteed nor automatic. FDI may have detrimental effects on the productivity of indigenous firms in at least two dimensions. Firstly, there is a possibility of a market-stealing effect or crowding out in the short run, as analysed in Aitken and Harrison (1999), when more productive foreign firms take demand away from less efficient domestic firms, forcing the indigenous firms to increase average costs, hence lowering their productivity. Secondly, it is possible that FDI may be undertaken to source the technology of the host country. This is known as reverse spillovers, as discussed in Driffield and Love (2005).

2.3 Mediating Factors and Sources of Heterogeneity

Most of the existing literature investigating the productivity effects of FDI tends to overlook the fact that local firms in competition with foreign affiliates in the same sector or in cooperation with upstream and downstream foreign affiliates are not homogeneous in terms of size, absorptive capacity, productivity or technology levels (Damijan et al. 2013). Besides, firms operate in different geographic regions with different levels of FDI intensity, education or infrastructure quality that lead to heterogeneous FDI effects on firm productivity. Some recent studies on FDI spillovers have investigated the potential sources of heterogeneity. In these studies, the potential sources of heterogeneity are discussed under three headings: technology gap between foreign and domestic firms and absorptive capacity of domestic firms; domestic firm characteristics; and FDI characteristics. The relevant work will be reviewed below.

However, most studies on direct and crowding-in/crowding-out effects do not consider the issue of heterogegenity in any systematic manner. This lack of attention to sources of heterogeneity in studies on the direct and corwding-in/crowding-out effects of FDI constitutes an evidence gap that this reseach aims to bridge. Bridging the evidence gap will enable us to verify how the average effect varies by firm, industry and regional characteristics that have been found to influence the spillover-effect estimates.

In what follows, we review the literature that mainly focuses on sources of heterogeneity in the estimates of the FDI spillover effects.

Technology gap and absorptive capacity

In studies on spillover effects, technolo./ .ap and a,sorptive capacit/ have been investigated widely. Narula and Marin (2003) define this as follows: "absorptive capacity includes the ability to internalize knowledge created by the others and modifying it to fit their own specific applications, process and routines" (p.23). Findlay (1978) and Kokko (1994) suggest that spillovers from FDI will increase together with the technological gap, which is measured as the difference between the domestic firm's labour productivity and the average labour productivity in foreign firms.

Views diverge on the role of the technology gap in FDI spillovers. Some studies find that a large technology gap is beneficial for local firms, since their catching-up potential increases (Findlay, 1978; Wang and Blomström, 1992; Smeets, 2008). Other studies, such as those by Lapan and Bardhan (1973), Perez (1997) and Kinoshita (2001), argue that domestic firms, in order to benefit from higher technology related to foreign firms, must have a "moderate" technology gap with foreign partners, since the gap will increase the possibility of domestic firms acquiring an upper level of efficiency via the imitation of foreign technology. If the gap is too large, domestic firms cannot fully receive the benefits from the advantages of the MNEs' technology, as technology diffusion is not an automatic procedure from senders to recipients – it also requires recipients to have enough capacity to absorb and adopt such technology. However, the gap should not be too narrow, as domestic firms only gain a slight benefit from the modern technology of foreign investors in this case.

A handful of studies emphasize the importance of the domestic firm's absorptive capacity in the technology transfer process. Absorptive capacity demonstrates the ability of firms to efficiently absorb and internalize knowledge from outside through the adaptation and application of external knowledge sources (Cohen and Levinthal, 1989, 1990). According to Rogers (2004), absorptive capability has three major elements: accessibility to overseas technology; learning ability; and incentives to implement technologies. Cantwell (1993) and Perez (1997) confirm that the existing technological capability of an indigenous firm will decide the ability of the firm to follow and adapt the technology development introduced by foreign firms. Kokko (1996) reaffirms that the more local firms invest in learning to enhance the level of technological competence, the more knowledge they can absorb from the foreign affiliate. Cohen and Levinthal (1989) and Griffith, Redding and Reenen (2003) illustrate that the absorptive capacity of domestic firms can be obtained by their spending level in R&D. Wang (2010) confirms the measurement of absorptive capacity by the technology gap between foreign and domestic firms, human capital and the financial development of domestic firms.

However, technology gap and firm absorptive capacity are of importance not only in spillover linkages but also in direct and crowding-in/crowding-out effects. Generally, firms with high absorptive capacity can utilize external knowledge and technology to improve productivity, as is well documented in the industrial organisation literature by Pavitt (1984), Cohen and Levinthal (1990) and Teece and Pisano (1998). In this perspective, firm absorptive capacity represents the ability of firms to internalize knowledge created by the others, regardless of firm types. In other words, firm absorptive capacity can influence the existence, sign and magnitude of the direct effects on FDI firms and of the crowding-in/crowding-out effects in the case of FDI-firms and domestic firms. A similar observation can be made with respect technology gap between firms and the latter's effect on direct productivity and crowding-in/crowding-out effects.

Domestic firm characteristics

Another factor that may have an impact on the presence of spillovers effects is the size of domestic firms, since it relates to the capacity of firms to reap the benefits from inward investment. Aitken and Harrison (1999) point out that small firms (in terms of employment or output) may have less competitiveness compared with large firms; therefore, they might suffer more significant losses. In addition, such firms may have the inability to produce at a large enough production scale to imitate the technology brought in by MNEs. For those reasons, larger firms are supposed to benefit more from the existence of spillover pool. On the same theme, Zhang, Li and Zhou (2010) allege that large domestic firms with more internal capabilities and a stronger capacity than small ones can benefit more from FDI spillovers. Conversely, as Dimelis and Louri (2004) point out in their research, large indigenous firms are usually competitive and do not have many differences in technology level in comparison with foreign affiliates; therefore, little technical knowledge transfers from MNEs to them, while small domestic firms may perform at suboptimal efficiency, differing from foreign firms in terms of technology level, hence they are more influenced by the foreign presence and receive larger spillover effects.

Discussion by Li, Liu and Parker (2001) and Sinani and Meyer (2004) proposes that the o1nership t/pe of indi.enous fir-s may also have impacts on spillovers, especially in transitional economies. They found that FDI in those economies has diverse effects on privately owned and state-owned local firms.

The debate on domestic firm size and spillovers can be extended to the case of crowding-in/crowding-out effects too. Shepherd (1972), Scherer (1973), Caves and Porter (1977) Amato and Amato (2004) argue that firm size is an an explanatory factor in the study of firm performance in general. Large firms usually have advantages in terms of resources and competitiveness while small firms commonly have lower level of resources and competitive advantages. Therefore, small firms may be more vulnerable than large firms under the competition pressure from foreign counterparts. Hence, size of firms may well be a mediating factor in the analysis of crowding-in/crowding-out effects.

FDI characteristics

The question of whether FDI from different countries creates similar spillovers to domestic firms has captured a great deal of attention from researchers. The distance between home and host countries, the degree of foreign ownership, the entry mode of FDI and the size of foreign firms are among the key factors that are expected to influence spillovers.

Regarding the distance ,et1een the ho-e and host countries of 2D3, Rodriguez-Clare (1996) asserts that backward linkages depend directly on transport costs; that is, on the distance between the home and host countries of FDI. High transport costs will generate incentives for foreign firms to source locally, and hence enhance the evidence of backward linkages. Moreover, Rodriguez-Clare puts forward that legal, cultural and social differences also lead to various results in obtaining spillovers.

The de.ree of forei.n o1nership in investment projects has been seen as a significant factor in determining the magnitude of spillovers (Blomstrom and Sjoholm, 1999; Dimelis and Louri, 2002; Javorcik and Spatareanu, 2003). There is a considerable amount of debate on the influence of foreign ownership structures on spillovers. According to Ramachandra (1993), minority foreign ownership limits the incentives for the parent firm to transfer more advanced technology to its domestic counterpart due to its lower control over its management, resulting in a high risk of firm-specific knowledge leakages. In the same way, total or majority foreign ownership brings foreign investors the chance to control their affiliates tightly so that they can prevent leakage of the firm's intangible assets. In other words, a wider degree of foreign ownership increases the possibility of spillovers taking place. Those ideas are in harmony with the analyses of Mansfield and Romeo (1980) and Desai, Foley and Hines (2004). In contrast, Nakamura and Xie (1998) and Barbosa and Louri (2002) propose that spillovers may be limited if foreign affiliates are fully or majority owned, as there is weak interaction with local agents. Along the same lines, Javorcik (2004) argues that local participation with MNEs may lead to a higher level of spillovers, as partial foreign ownership firms tend to source locally.

Moreover, foreign firm size may affect the sign and magnitude of spillover effects. However, empirical evidence seems to produce mixed results. Using a sample of 3,742 manufacturing firms operating in Greece in 1997, Dimelis and Louri (2004) propose that small foreign firm size is found to generate more FDI productivity than large foreign firm size. Through employing a firm-level panel dataset for Romanian firms from 1996–2005, Lenaerts and Merleved (2015) assert that only medium-sized foreign firms generate spillover effects, while micro, small and, more surprisingly, large foreign firms do not.

Similarly, in studies for direct effects, foreign firm size can be a control factor that impact on the sign and magnitude of the effects. One the one hand, large firms are expected to be more efficient in production as they could use more specialized inputs and better coordinate their resources (Farole and Winkler, 2012). On the other hand, small firms could be more efficient because they have flexible, non-hierarchical structures (Tybout, 2000 and Dhawan, 2001). Hence, the argument between foreign firm size and direct effects is controversial and need to be empirically examined.

In sum, section 2.3 has recapitulated three group of factors that can cause heterogeneity in the findings on FDI and productivity or FDI and crowding-in/crowding-out effects: the technology gap between foreign and domestic firms; the characteristic of indigenous firms, and the characteristics of FDI. As these factors are neglected in recent studies on direct and crowding-in/crowding-out effects, we aim to bridge the evidence gap by investigating the extent to which the FDI effects on firm performance differ by firm, industry and regional characteristics. To achieve this aim, in the empirical chapters of this thesis, we first investigate the sign and magnitude of the effects of interest. Then, we examine whether firm, industry and regional characteristics affect the direct, crowding-in/crowding-out and spillover effects of FDI on Vietnamese firms.

2.4 Empirical Evidence on FDI and Productivity: An Overview

To review the empirical evidence on FDI's productivity effects, we have collected a large number of papers on the topic, including published papers, working papers, reports and discussion papers from databases such as JSTOR, ScienceDirect, NBER, SSRN, RePec and Depocen. The review is organized in three parts. The first part covers the growing empirical evidence on the direct effects of FDI on the productivity of resident firms, while the second part reports the empirical evidence of crowding-in/crowding-out effects. The third part investigates the empirical evidence on the spillover effects of FDI on resident firms' productivity. In each part, we start with a brief review of the measurement issues. After that, we synthesize the primary study evidence with respect to four main features: data type and level of aggregation; productivity measurement; foreign presence measurement; and econometric methods applied. This approach is expected to provide a comprehensive synthesis of evidence on the relationship between FDI presence and productivity and the sources of variation/heterogeneity in the evidence base.

Concerning the direct and indirect effects and crowding-in/crowding-out effects of FDI, we have reviewed 5& papers, which provide 15+ findin.s on the topic. The summary of empirical findings is given in Table 2.2 with respect to five different effect types: direct effects, horizontal effects, vertical forward spillovers, vertical backward spillovers and crowding-in/crowding-out effects. For each effect type, we first provide a summary of the findings in terms of sign and significance (row 1). Then we provide a breakdown of the findings under four headings: (i) data type; (ii) estimation method; (iii) publication dates; and (iv) whether the findings control for mediating factors. We will refer to this information in the reviews of the literature on direct, indirect and crowding-in/crowding-out effects in sections 2.5 and 2.6.

Table 2.2: Summary of empirical findings on direct, indirect and crowding-in/crowding-out effects of FDI

Summary of findings	Direct productivity effect	Horizontal spillover effect	Forward spillover effect	Backward spillover effect	Crowding-in/out effect
Number of findings, of which	**20**	**79**	**20**	**36**	**3**
✓ ***Positive effect***	*14*	*34*	*5*	*19*	*3*
✓ ***Insignificant effect***	*5*	*16*	*6*	*4*	*n.a.*
✓ ***Negative effect***	*1*	*20*	*5*	*9*	*n.a.*
✓ ***Mixed effects***	*n.a.*	*9*	*4*	*4*	*n.a.*
Broken down as follows:					
Data type					
Cross-section/industry: 5 findings (all about horizontal effects) Positive: 5/5	n.a.	(+): 5/5	n.a.	n.a.	n.a.
Cross-section/firm: 14 findings Positive: 6/14	(+): 1/2 (n.s.): 1/2	(+): 5/8 (n.s.): 3/8	(n.s.): 2/2	(n.s.): 2/2	
Panel/industry: 10 findings Positive: 7/10	n.a.	(+): 4/7 (mixed): 2/7 (n.s.): 1/7	(+): 2/2	(+): 1/1	
Panel/firm: 127 findings Positive: 55/127	(+): 13/18 (-): 1/18 (n.s.): 4/18	(+): 20/59 (-): 20/59 (mixed): 7/59 (n.s.): 12/59	(+): 3/16 (-): 5/16 (mixed): 4/16 (n.s.): 4/16	(+): 16/31 (-): 9/31 (mixed): 4/31 (n.s.): 2/31	(+): 3/3 (crowding-out effect)
Survey/case study: 2 findings				(+): 2/2	

Estimation method					
Ordinary least squares estimator: 57 findings <u>Positive: 31/57</u>	(+): 6/9 (-): 1/9 (n.s.): 2/9	(+): 15/31 (-): 9/31 (mixed): 3/31 (n.s.): 4/31	(+): 2/5 (-): 1/5 (mixed): 1/5 (n.s.): 1/5	(+): 5/9 (-): 2/9 (mixed): 1/9 (n.s.): 1/9	(+): 3/3 (crowding-out effect)
Fixed effects, random effects estimators: 25 findings <u>Positive: 12/25</u>	(+): 4/4	(+): 8/15 (-): 2/15 (mixed): 4/15 (n.s.): 1/15	(mixed): 2/2	(-): 2/4 (mixed): 2/4	
Other estimators (two stages least squares; first difference; long difference; GMM; Levinsohn–Petrin; Olley–Pakes; quantile regression; propensity score matching; stochastic frontier analysis; Translog; treatment effects; weighted least squares): 74 findings <u>Positive: 29/74</u>	(+):4/7 (n.s.): 3/7	(+): 11/33 (-): 9/33 (mixed): 2/33 (n.s.):11/33	(+): 2/13 (-): 5/13 (mixed):1/13 (n.s.): 5/13	(+): 12/21 (-): 5/21 (mixed): 1/21 (n.s.): 3/21	
Publication dates					
Decades of publication 1970–1999: 13 findings <u>Positive: 9/13</u>	(+):2/4 (-): 1/4 (n.s.): 1/4	(+): 6/8 (-): 1/8 (n.s.):1/8			(+): 1/3 (crowding-out effect)
Decades of publication 2000–2009: 124 findings <u>Positive: 55/124</u>	(+):12/16 (n.s.): 4/16	(+): 24/61 (-): 14/61 (mixed): 9/61 (n.s.):14/61	(+): 4/16 (-): 2/16 (mixed): 4/16 (n.s.): 6/16	(+): 13/29 (-): 8/29 (mixed): 4/29 (n.s.): 4/29	(+): 2/3 (crowding-out effect)
Decades of publication 2010 onward: 21 findings <u>Positive: 12/21</u>		(+): 4/10 (-): 5/10 (n.s.): 1/10	(+): 1/4 (-): 3/4	(+): 7/7	
Control for mediating factors	n.a.	18/59 papers			n.a.

4ote: The literature survey includes 59 papers that provide 158 findings; (n.s.): not significant; n.a.: not available.

More information on the studies reviewed can be found in Tables A2.1, A2.2 and A2.3 in the Appendix, where we present summary information on author(s), country studied, period studied, data type, level of data aggregation, sample size, measure(s) of productivity, measure(s) of foreign presence, econometric method used and main results obtained for direct, crowding-in/crowding-out and spillover effects. In the following sections below, we summarize the findings and discuss the extent of similarity/variation, with the view of taking stock of the existing evidence and informing the estimations that will be conducted in Chapters 4, 5 and 6.

2.5 Review of Empirical Studies on Direct Productivity and Crowding-in / Crowding-out Effects

The direct effect of FDI is estimated by regressing a measure of productivity on a variable that depicts foreign ownership (FO) in a given firm. The general model used for estimation can be stated as follows:

$$\boldsymbol{7}_1 = \beta_{10} + \beta_{11}\boldsymbol{6} + \beta_{12}\boldsymbol{5} + \beta_{13}\boldsymbol{2)} + \varepsilon \qquad (2.1)^{3}$$

The dependent variable $(\boldsymbol{7}_1$ in Equation 2.1 is usually measured by output, sales or value added in levels or as ratios per employee, or as the total factor productivity (TFP) of all firms. The variable $\boldsymbol{2)}$ is either a dummy variable that captures partly or fully foreign-owned firms or a ratio that measures FDI intensity in terms of equity share, sales share or asset share of FDI firms. If $\boldsymbol{2)}$ is the dummy variable, it takes the value 1 if the company is foreign-owned in partly or fully and 0 if purely domestically-owned. A positive and significant β_{13} would indicate positive productivity effects due to FDI presence. The effect is either relative to domestic firms (when $\boldsymbol{2)}$ is a dummy variable) or represents the level of increase in productivity when FDI intensity increases by one unit. In other words, the positive and significant β_{13} implies that foreign ownership has positive direct effects on productivity of foreign invested firms. Conversely, a negative and significant β_{13} would indicate negative direct effects due to FDI presence.

Compared to studies on the indirect effects, there is only a small number of studies on the direct effects of FDI. Most papers on the topic employ firm-level panel data (18 out of 20 findings in this

[3] Firm and time subscripts are omitted for simplicity.

literature review). The pattern of the empirical evidence on direct effects seems to be clear: most findings (14 out of 20) indicate a positive effect of foreign ownership on productivity, while only 6 out of 20 findings indicate insignificant or negative effects.

Of the studies that report a positive direct effect, Aitken and Harrison (1999) estimate the direct effect of FDI in Venezuela by employing a large firm-level panel dataset of more than 43,000 firms from 1976–1989. After controlling for differences in the labour force, materials, capital and industries, the scholars found a 10.5% productivity advantage of foreign-owned plants over domestic plants. Konings (2001) investigates the direct effect of FDI on firms in Poland, Bulgaria and Romania. Using panel data on 2,321 Bulgarian firms, 3,844 Romanian firms and 262 Polish firms from 1993–1997, the author reports no statistically significant effect of foreign ownership on productivity in Bulgaria and Romania, whereas the results for Poland confirm that foreign-invested firms perform better than firms without foreign participation. Konings explains the difference by indicating that Poland was more advanced on the path of transition at that time. Sgard (2001) utilizes firm-level data in Hungary with more than 33,000 observations, reporting that productivity is higher in foreign-owned firms compared to firms in the rest of the economy. Vahter (2004) utilizes sales per employee as a measure of productivity in Estonia (1996–2001) and Slovenia (1994–2000). His main finding indicates that foreign-invested firms in both Estonia and Slovenia are more productive than domestic firms in both countries. More recently, Taymaz and Yilmaz (2008) and Batool et al. (2009) have reported similar findings to those summarized above with data from Turkey and Pakistan. Using the propensity score matching (PSM) method, Arnold and Jarvocik (2009) confirm the positive effect of foreign ownership on the productivity of acquired firms in Romania during the 1983–2001 period.

Aitken and Harrison (1999) suggest two important reasons why economists usually assume that FDI firms outperform non-FDI ones. The first reason is that superior (and possibly newer) production equipment can be transferred from the parent company in the home country to its FDI affiliate in the host country. The second is that the foreign affiliate may also receive an inflow of non-tangible assets from its parent, in the form of technological know-how, management and marketing capabilities, trade contracts, a coordinated network of relationships with suppliers and customers abroad and so on. Assuming that the local affiliate has sufficient absorptive capabilities to use the production equipment and follow this know-how, they can possess significant competitive advantages over non-FDI enterprises.

However, there are some papers that cast doubt on the positive relationship between foreign ownership and the productivity of FDI firms. Globerman et al. (1994) examined the relative economic performance of foreign affiliates in 21 Canadian industries and domestic counterparts. The authors found that having controlled for the capital intensity and size of foreign partners, there is no significant difference in labour productivity (measured by value added per worker) between foreign-owned firms and domestic firms. Using Moroccan firm-level panel data from 1985–1989, Haddad and Harrison (1993) conclude that foreign firms lag behind domestic firms in productivity growth in protected markets. Using a sample of 2,026 Italian firms from 1992–1999, Benfratello and Sembenelli (2006) apply a system GMM estimator to quantify the direct effect of FDI on productivity. After controlling for unobserved heterogeneity, input simultaneity and measurement errors, foreign ownership is found to have an insignificant effect on productivity.

Doms and Jensen (1998) propose that the nature and type of activity undertaken by FDI firms may induce insignificant or even negative FDI effects on productivity. If FDI firms focus only on low value-added operations with outdated technology and low-skilled workers, FDI presence may be associated with lower productivity in their host-country operations. Besides, Gomes and Ramaswamy (1999) argue that cost disadvantages may lead FDI firms to have a lower productivity level when foreign investors engage in production overseas. The cost disadvantages may be due to costs of coordination and control, or administrative costs to manage cultural differences and diverse human resources, which increase significantly as the MNE expands into overseas markets.

To summarize, a positive relationship between foreign ownership and the productivity of FDI firms is documented in the majority of the empirical studies on the topic. The two possible reasons that support this positive relationship are superior (and possibly newer) production equipment and non-tangible assets such as technological know-how, management and marketing capabilities, trade contracts and a coordinated network of relationships with suppliers and customers abroad. However, there are some papers that provide negative or no evidence of the direct effect of FDI on the productivity of FDI firms. The nature and type of activity and cost disadvantages are suggested as the likely causes of negative or insignificant relationships between the foreign presence and FDI firm productivity.

To test for crowding-out/crowding-in effects, researchers estimate a turnover (or sales) equation that omits the input factors of production, as suggested by Aitken and Harrison (1999). The input factors are excluded with a view to examining the effect of the foreign presence on the production scale of domestic firms, rather than their productivity.

Only a few empirical studies investigate the crowding-out effects of FDI. The seminal study by Aitken and Harrison (1999) reports contemporaneous crowding-out effects that are reversed only in the long run as a result of spillover effects. Following Aitken and Harrison (1999), Hu and Jefferson (2002) confirm the crowding-out effect in the Chinese textile industry in the five-year period from 1995–1999. A similar finding is reported by Hsieh (2006), who utilizes firm-level data from the Chinese Annual Survey of Industries conducted by China's National Bureau of Statistics from 1998–2004, and reports that a 10% increase in foreign ownership share decreases the output of domestic firms by 3.5%, suggesting that the foreign presence forces domestic firms to contract. Using 1994–2001 firm-level Czech data, Kosova (2010) reinforces the finding of a crowding-out effect from FDI to domestic firms in the country. Moreover, the author also analyses whether the crowding-out effect is permanent or temporary. His findings indicate that the crowding-out effect appears only in the short term and after an initial entry shakeout. Then growing FDI firm sales induce domestic demand effects and lead to higher domestic firm growth and survival.

Given the small number of studies on the crowding-in/crowding-out effects of FDI, our research is motivated to explore the issue to bridge this evidence gap. This is particularly relevant for Vietnam, where much effort has been made to attract FDI but the latter's effect on market-shares of domestic firms remain unexplored.

2.6 Empirical Studies on FDI Spillovers: Review of Measurement, Estimation and Findings

This section is structured as follows: we first review the measurement of productivity and FDI spillovers used in the literature. Then in the next two parts, we review the empirical literature on the productivity effects of horizontal and vertical FDI spillovers. Detailed information on the studies included can be seen in Table A2.3 in the Appendix with respect to author(s); country studied; period studied; data type; level of data aggregation; sample size; measure of productivity; measure of FDI spillovers; econometric method used; and main findings on productivity effects of horizontal, backward or forward spillovers.

2.6.1 Measurement Issues

The common method used in the research papers to estimate the productivity effects of FDI spillovers is to augment the productivity model in Equation 2.1 with a measure of FDI spillovers in the firm's own industry or in other industries with which the firm interacts. The general model used can be stated as follows:

$$\boldsymbol{7}_2 = \beta_{20} + \beta_{21}\boldsymbol{6} + \beta_{22}\boldsymbol{5} + \beta_{23}\boldsymbol{2)} + \beta_{24}\boldsymbol{!8} + \delta \qquad (2.2)$$ [4]

The intra-industry or inter-industry spillover pool (***!8***) can be a weighted or unweigted level of FDI intensity and corresponds to the three spillover types in this thesis: horizontal, vertical forward and vertical backward. A positive and significant coefficient on the spillover variable (β_{24}) indicates that the level of intra-industry or inter-industry FDI is associated with higher levels of firm productivity within the industry (positive horizontal spillover effect) or in other industries (positive vertical spillover effect). The spillover effect can be estimated either for domestic firms only (by restricting the sample to domestic firms) or for all resident firms (if the sample includes both domestic and FDI firms).

The dependent variable $\boldsymbol{7}_2$ in Equation 2.2 – productivity – is generally measured in five ways in empirical studies. Firstly, it can be calculated as sector .ross output, as is the case in Aitken and Harrison (1999), Smarzynska (2002), Harris and Robinson (2004), Javorcik (2004), Haskel et al. (2007) and Barbosa and Eiris (2009). Secondly, productivity can be measured through estimating ***928***, as in Chuang and Lin (1999), Kugler (2001), Halpern and Muraközy (2007), Liu (2008), Javorick and Spatareanu (2008) and Tran Toan Thang (2011). Thirdly, la,our productivit/ is sometimes employed to compute productivity, as in Blomstrom and Pearson (1983), Haddad and Harrison (1993), Kokko (1994), Blomstrom and Sjoholm (1999), Aslanoglu (2000), Baldwin and Gu (2005) and Le and Pomfret (2011). Fourthly, value added can be used as a measure of

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[4] Firm and time subscripts are omitted for simplicity.

productivity, as is the case in Caves (1974), Globerman (1979), Liu et al. (2000), Kathuria (2000), Nguyen Thi Tue Anh et al. (2006), Hale and Long (2007), Wang and Zhao (2008), Gorg et al. (2009) and Hoang Van Thanh and Pham Thien Hoang (2010). Fifthly, sales or turnover is occasionally used to measure productivity, for example in Djankov and Hoeckman (2000), Schoors and van de Tol (2002) and Dimelis and Louri (2004).

As discussed in Hall et al. (2010), .ross output is the value of the real output produced through the utilization of two primary inputs (labour and capital) plus the intermediate inputs. :alue added is the output obtained from the combined use of labour and capital and can be defined as gross output less purchased inputs such as materials. Nickell (1996) and Griffith et al. (2006) suggest direct ways to formalize value added as the sum of total employment cost, operating profits, depreciation costs and interest payments. 5a,our productivit/ is usually calculated based on value added (value added per worker) or gross output (gross output per worker; OECD, 2001, p.14–15). !ales or turnover is used as a proxy for output, which is gross output minus the increase in inventories of finished goods (Hall et al., 2010). Comin (2006, p.1) defines TFP as "the portion of output not explained by the amount of inputs used in production. As such, its level is determined by how efficiently and intensely the inputs are utilized in production." In estimation, TFP is determined as the difference between actual and predicted outputs.

Each productivity measure has its own advantages and disadvantages. Hall et al. (2010) justify the use of .ross output and value added in measuring productivity. Theoretically, gross output is a better measurement of productivity than value added, as it allows for substitution between materials and other two inputs (labour and capital). However, when data at firm level is employed, value added is preferred over gross output because of two main reasons. Firstly, the material–output ratio can vary substantially across firms because of their different degrees of vertical integration. Secondly, proper modelling of the demand for intermediate inputs would probably require modelling adjustment costs related to the stocking of material, which is often not available. The merit of the la,our productivit/ measure lies in its readability and ease of calculation; however, the demerit arises from the fact that labour productivity is only a partial measure of productivity, with neglecting capital as another input that constitutes productivity. One of the advantages of the 928 measure is that it helps disentangle the contribution of technology from labour, capital and intermediate inputs. However, all other non-technological factors such as adjustment costs, scale and cyclical effects, pure changes in efficiency and measurement error are also captured in TFP. Therefore, ***928*** is used with caution when estimating the technological spillover effects on productivity.

The horizontal or vertical spillover pool is assumed to measure the extent to which a firm can benefit from the positive externalities associated with arguably superior technology, know-how and tacit knowledge that FDI firms possess. Because such qualities of FDI firms are usually unobservable or not measured in the existing data, researchers employ proxies for the potential spillover pools. Hence, the relevant coefficient in Equation 2.2 – β_{23} – has been estimated by using different measures of FDI presence within the industry (for horizontal spillovers) or in the downstream or upstream industries (for vertical spillovers). The measures of FDI presence usually consist of FDI firm shares in industr/ output (Blomstrom and Sjohom, 1999; Kokko et al., 2001; Damijan et al., 2003; Javorick and Spatareanu, 2008; Anwar and Nguyen, 2014); industr/ e-plo/-ent (Caves, 1974; Blomstrom and Pearson, 1983; Kokko, 1994; Aslanoglu, 2000; Girma and Gorg, 2005; Balsvik and Haller, 2006; Haskel et al., 2007; Hoang Van Thanh and Pham Thien Hoang, 2010); industr/ capital or equit/ (Kugler, 2001; Harris and Robinson, 2004; Dimelis and Louri, 2004; Wang and Zhao, 2008; Tran Toan Thang, 2011; Aitken and Harrison, 1999; Smarzynska, 2002; Javorcik, 2004; Thangavelu and Pattnayak, 2006; Liu, 2008; Barbosa and Eiris, 2009); industr/ value added (Globerman, 1979, Aslanoglu, 2000); industr/ total assets (Haddad and Harrison, 1993; Djankov and Hoeckman, 2000); and industr/ sales;revenue;turnover (Kathuria, 2000; Barrios and Strobl, 2002; Schoors and van de Tol, 2002; Halpern and Muraközy, 2007; Pham Xuan Kien, 2008; Gorg et al., 2009).

The adequacy and relevance of these spillover proxies are still debated in the literature. Gorg and Strobl (2001) argue that the use of different proxies for FDI spillovers might lead to upward or downward bias in estimating the productivity effects of FDI spillovers. Kathuria (2000) lends support to this argument by reporting that local Indian firms do not benefit at all from a foreign presence if FDI spillovers are measured by the share of FDI firms in sales, but they do benefit if the FDI firms' share in capital is used. Sinani and Meyer (2004) utilize different measures and report that the largest spillover effects are observed when FDI spillovers are proxied by the share of employment, followed by share of sales. The share of foreign firms in total equity produces the smallest magnitude of spillovers. Aslanoglu (2000) also uses various proxies for FDI spillovers.

These consist of the share of FDI firms in industry employment, industry total assets, total sales and total value added. He argues that the share of FDI firms in total value added is the best measure, as value added is a good indicator of productive capacity.

From a theoretical perspective, Haskel et al. (2007) suggest that the share of FDI firms in industry employment is the best measure, as spillover theories emphasize the role of interpersonal contacts. In contrast, Kohpaiboon (2005) asserts that the output share of foreign firms in total output should be preferred, because the employment share tends to underestimate the actual presence of FDI firms, which are known to be more capital intensive than domestic firms. Aitken and Harrison (1999) point out that the share of FDI firms in industry capital can be distorted by the presence of foreign ownership restrictions. Therefore, they introduce a proxy that combines the share of capital with FDI firm employment.

Given the lack of consensus about the best measure of FDI spillovers, and the additional issues related to the lag structure of the relationship between FDI spillovers and productivity to be discussed below, the empirical evidence on the productivity effects of FDI spillovers should be interpreted with caution. This applies to the findings to be reported in this thesis too, where we use a measure similar to that of Aitken and Harrison (1999) – namely, the foreign equity share of FDI firms weighted by their shares in industry value added. This weighted measure enables us to balance the downward bias associated with the equity share with the relatively upward bias associated with sales and output.

2.6.2 Evidence on Horizontal Spillover Effects

In this section, we review the empirical evidence on the productivity effects of horizontal FDI spillovers with respect to (i) data type and data aggregation; (ii) productivity measurement; (iii) spillover pool measurement; and (iv) estimation methods.

There has been a large body of empirical studies on the horizontal spillover effects of FDI in host countries using industry- as well as firm-level data. The studies cover both developing and developed countries and employ both cross-sectional and panel data. Given the plurality of spillover measures, it is not surprising that the evidence is varied. The variation in the evidence base is exacerbated by other study-specific factors such as data type, data aggregation level and estimation methods.

In general, out of 79 findings on horizontal spillovers, 43% indicate a positive relationship, while only 25% witness a negative effect of FDI on firm productivity in the same industry. Another 20% of the findings report no significant evidence, and the rest find ambiguous estimation results on horizontal spillovers of FDI.

*vidence variation ,/ data t/pe: Researchers employ both cross-sectional and panel data to examine the relationship between FDI spillovers and the productivity of incumbent firms. More concretely, out of 59 papers on spillover effects that have been surveyed in the literature, one-fifth use cross-sectional data to quantify the relationship, while the remainder utilize the panel data. Most of the cross-sectional data papers produce positive results, while the results of panel data papers are far from consistent.

When cross-sectional data is used, a majority of the findings (five out of eight) find evidence of horizontal spillovers on the local productivity of incumbent firms. Caves first implemented an econometric test for the effects of FDI on the labour productivity of Australian domestic industries. Using cross-sectional Australian manufacturing data between 1962 and 1966, Caves (1974) finds that MNEs have a positive effect on labour productivity in the corresponding industries. Globerman (1979) examines such effects in Canadian manufacturing industries in 1972, finding that the presence of foreign firms is positively correlated with the labour productivity of domestic plants. Blomstrom and Perrson (1983) and Kokko (1994), both exploring Mexican manufacturing industry in 1970, are in congruence with Caves (1974) and Globerman (1979) about the positive relationship between the productivity of domestic firms and the entry of foreign firms. Blomstrom and Sjohom (1999) suggest a direct relationship between the productivity of Indonesian domestic firms and a foreign presence in 1991; and Kokko et al. (2001) produce evidence of positive horizontal spillovers on 763 locally owned firms in Uruguayan manufacturing industry in 1988. Dimelis and Louri (2004) prove that the entrance of foreign affiliates boosts the productivity of local Greek firms in 1997.

Only three findings from cross-sectional data confirm insignificant results. Using Moroccan domestic firms' data for the 1985–1989 period, Haddad and Harrison (1993) report an insignificant relationship between a foreign presence in the industry and the productivity growth of domestic firms. Other researchers, including Aslanoglu (2000) on Turkish indigenous firms in 1993 and Hale and Long (2007) on Chinese domestic firms in 2000, also report insignificant effects due to horizontal spillovers.

When panel data is used, a large proportion (64%) of the findings indicate negative or insignificant productivity effects due to horizontal spillovers. Aitken and Harrison (1999) report the findings of negatively significant effects of horizontal spillovers when investigating more than 4,000 plants in Venezuela from 1976–1989. The authors affirm a negative relationship between foreign ownership and the productivity of domestic plants. Aitken and Harrison describe these negative spillovers as a "market-stealing effect," when the entrance of foreign firms forces domestic firms to reduce production. Additionally, some empirical studies on the spillover effects of FDI in transition economies also show negative or insignificant results. Konings (2001), relying on unbalanced panel data of 2,321 Bulgarian firms in 1993 and 1997, 3,844 Romanian firms from 1994–1997 and 262 Polish firms over the same period as in Bulgaria, asserts the importance of FDI as a conduit of technology diffusion from a foreign firm to its affiliate. However, the researcher provides negative evidence of spillovers to domestic firms in Romania and Bulgaria, as well as no evidence of spillovers in Poland. Konings justifies his findings by judging the differences among stages of transition in the countries studied. More precisely, Bulgaria and Romania are in the early stage of transition in the period studied, hence it is likely that inefficient firms will be moved out by the foreign presence. In other words, the competition effects may outweigh the technology spillovers, resulting in negative spillovers on productivity. Conversely, Poland is in a later transitional phase, hence Polish domestic firms have more capability to compete with foreign firms, impeding competition effects. Employing firm-level data for the Czech Republic from 1992–1996, Djankov and Hoeckman (2000) also detect evidence of negative effects of spillovers on local enterprises' productivity growth. Similarly, Kathuria (2000) postulates a negative impact of foreign firms on productivity spillovers in 368 Indian manufacturing firms in the period 1975–1989. The findings of Bwalya (2006) for 125 Zambian domestic firms in 1993–1995 and Javorcik and Spatareanu (2008) for 13,129 indigenous Romanian firms in 1998–2003 corroborate the findings of Aitken and Harrison (1999), Djankov and Hoeckman (2000) and Konings (2001) on the detrimental effects of FDI on host-country domestic firms' productivity. In the same manner, some researchers fail to find significant evidence of the effects of a foreign presence on domestic firms' productivity. Harris and Robinson (2004) investigate 5,324 UK manufacturing firms in 20 industries from 1974–1995 and conclude that there is no clear evidence of horizontal spillovers overall. More specifically, there is insignificant evidence of spillovers in the same industry in one-third of 20 industries covered in the research; and another 7 industries represent negative inter-industry spillovers, as competition effects prevail over the positive impacts of FDI on productivity, leading to negative effects overall. Murakami (2007) devotes an effort to examining the technology spillover from foreign-owned firms in Japanese manufacturing industry from 1994–1998, and propose that the foreign presence decreases the TFP of domestic firms in the short run (after one year of a foreign presence), but in the long run (after four years of a foreign presence) there is a positive relationship between the productivity growth of domestic firms and foreign affiliates. Liu (2008) is consistent with Murakami (2007) in stating that the increase in foreign presence decreases the short-term productivity of Chinese domestic manufacturing firms, but encourages the long-run productivity of indigenous firms in the same industry. Gorg et al. (2009) explore Hungarian firm-level panel data on 41,986 firms for the period 1992–2003, and conclude that there is no evidence of positive horizontal productivity spillovers from foreign affiliates to domestic firms. Moreover, the authors postulate that the characteristics of the industry may affect the size of horizontal linkages: FDI is not likely to generate spillovers in a labour-intensive sector, but the magnitude of within-industry spillovers increases in capital-intensive industries. In addition, the researchers provide convincing evidence that the extent of spillovers diverges from the early stage and later stage of transition in Hungary. More concretely, strong positive technology diffusion from foreign firms to local affiliates could be seen in the first period, while a competition effect became more prominent in the second stage that outweighed the positive effects, leading to negative effects on the productivity of domestic rooms. Other researchers, including Smarzynska (2002), Javorcik (2004), Halpern and Muraközy (2007), Lin et al. (2009), Barbosa and Eiris (2009) and Jude (2013), advocate the same findings of no evidence of horizontal spillovers.

However, some other researchers, by using panel data, report significantly positive horizontal spillovers from FDI on domestic productivity. Those positive findings account for 36% of the total findings in this literature survey. Liu et al. (2000) are successful in investigating the positive relationship between a foreign presence and domestic productivity through employing industry-level data in the period 1991–1995. Baldwin and Gu (2005) employ data on 1,403 Canadian manufacturing firms and witness a 10% increase in the share of foreign-controlled plants expanding the labour productivity of domestic plants by 0.3%. Other studies that also confirm positive spillovers are Kugler (2001) for Colombian domestic firms in 1974–1998; Barrios and Strobl (2002) for Spanish indigenous firms in the nine-year period from 1990–1998; Damijan et al′ (2003) for domestic firms in four transition countries (Czech Republic, Poland, Romania and Slovakia) in 1994–1999; Schoors and van de Tol (2002) for Hungarian domestic enterprises in 1997–1998; Girma and Gorg (2005) for UK incumbent firms in a long period of 13 years from 1980–1992; Haskel et al. (2007) for UK domestic firms in 1973–1992; Thangavelu and Pattnayak (2006) for pharmaceutical firms in India for 1989–2000; Wang and Zhao (2008) for Chinese domestic firms in 2000–2002; and Jude (2012) for Romanian domestic firms in 2000–2008.

From these analyses, there is a tendency for older studies to use more cross-sectional datasets, while more recent studies prefer panel datasets. Employing cross-sectional data may lead to biased estimation results, as time-variant differences between industries or firms are impossible to take into account in this type of data. As cross-sectional data tends to produce larger and more significant findings, utilizing a panel dataset, which allows for controlling time-variant factors, seems to be more appropriate in this circumstance (Gorg and Strobl, 2001).

*vidence variation ,/ level of anal/sis: Horizontal spillover effects are estimated at industry and firm levels. Older studies tend to use industry-level data, while more recent studies utilize firm-level data. Industry-level studies include Caves (1974) for Australia; Globerman (1979) for Canada; Blomstrom and Perrson (1983) and Kokko (1994) for Mexico; Liu et al. (2000) for China; Kugler (2001) for Colombia; and Lin et al. (2009) for China. These studies report a positive relationship between FDI spillovers and industry productivity in the host countries. Out of seven studies that employ industry-level data, only one (Lin et al., 2009) reports insignificant effects. In view of the fact that most researchers in this group use cross-sectional data (Caves, 1974; Globerman, 1979; Blomstrom and Perrson, 1983; Kokko, 1994) that is unable to take into consideration industry and time effects, it is therefore difficult to differentiate whether FDI actually enhances the productivity of domestic firms, or whether foreign affiliates merely invest in the high-productivity industries of the host countries.

Most studies on horizontal spillovers are based on firm-level panel data. It should be stressed that one of the benefits of employing panel data in analysing spillovers is that it can control for foreign investors' selection bias. However, the results of the horizontal effects of inward-invested firms on domestic firms by investigating firm-level data are inconclusive. On the one hand, Blomstrom and Sjohom (1999), Kokko et al. (2001), Schoors and van de Tol (2002), Barrios and Strobl (2002), Dimelis and Louri (2004), Girma and Gorg (2005), Baldwin and Gu (2005), Thangavelu and Pattnayak (2006), Haskel et al. (2007) and Wang and Zhao (2008) are those who represent positive findings. On the other hand, Aitken and Harrison (1999), Djankov and Hoeckman (2000), Kathuria (2000), Konings (2001), Bwalya (2006) and Javorick and Spatareanu (2008) evidence the opposite result of negative findings. Moreover, Haddad and Harrison (1993), Aslanoglu (2000), Smarzynska (2002), Damijan et al. (2003), Javorcik (2004), Halpern and Muraközy (2007), Hale and Long (2007), Gorg et al. (2009), Barbosa and Eiris (2009) and Jude (2013) produce no evidence of significant effects of FDI on the productivity of domestic firms.

Evidence variation in spillovers and productivity measurement

There are five ways of quantifying in empirical studies: through output, labour productivity, value added, TFP and sales/turnover**.** In this literature survey, TFP is the most popular, accounting for 34.5% of the total number of studies (Kugler, 2001; Smarzynska, 2002; Barrios and Strobl, 2002; Javorcik, 2004; Girma and Gorg, 2005; Murakami, 2007; Halpern and Murakozy, 2007; Liu, 2008; Jude, 2013), followed by output with 29.5% (Haddad and Harrison, 1993; Aitken and Harrison, 1999; Konings, 2001; Damijan et al., 2003; Harris and Robinson, 2004; Haskel et al., 2007; Barbosa and Eiris, 2009). Labour productivity (which is defined as value added per worker, depicted in Caves, 1974; Globerman, 1979; Blomstrom and Pearson, 1983; Kokko, 1994; Blomstrom and Sjohom, 1999; Aslanoglu, 2000; Liu et al., 2000; Kokko et al., 2001; Baldwin and Gu, 2005) constitutes 18% of all studies examined, value added comprises 10% and sales/turnover forms 8% of the total.

With regard to spillover pool measurement, empirically researchers employ six varying proxies for spillover pool in domestic firms and industries: output share, employment share, equity share, capital share, asset share and sales/turnover share. Those proxies for spillover pool are still in debate in the FDI spillover literature. Some studies use the employment share of foreign firms in the total employment of a sector as a proxy, since they emphasize labour turnover as an important channel for spillovers. Others use capital share or revenue share, as they relate spillovers to demonstration and competition effects. As this literature survey found, in 61 findings of horizontal spillovers, employment share is the most popular (28%) proxy for spillover pool (Caves, 1974; Blomstrom and Pearson, 1983; Kokko, 1994; Aslanoglu, 2000; Liu et al., 2000; Girma and Gorg, 2005; Balsvik and Haller, 2006; Hale and Long, 2007; Haskel et al., 2007). The second most popular proxy for spillover pool is output share, which occurs in 23% of all findings on the topic of horizontal productivity spillovers (Blomstrom and Sjohom, 1999; Kokko et al., 2001; Konings, 2001; Damijan et al., 2003; Javorick and Spatareanu, 2008). Equity share, which constitutes 18% of total findings, is the third most common tool to measure spillover pool (Smarzynska, 2002; Javorcik, 2004; Thangavelu and Pattnayak, 2006; Liu, 2008; Barbosa and Eiris, 2009; Lin et al., 2009). Sales/turnover share accounts for 14% of total findings (Kathuria, 2000; Barrios and Strobl, 2002; Schoors and van de Tol, 2002; Halpern and Murakozy, 2007; Liu, 2008; Gorg et al., 2009) and capital share comprises 12% (Kugler, 2001; Dimelis and Louri, 2004; Wang and Zhao, 2008; Jude, 2013), while asset share is the least popular proxy to quantify spillover pool, at 5% of all findings (Haddad and Harrison, 1993; Djankov and Hoeckman, 2000).

*vidence variation ,/ esti-ation -ethod: On the one hand, a large number of studies follow a standard approach by estimating an augmented production function with proxies for foreign presence to examine horizontal spillovers (Caves, 1974; Globerman, 1979; Haddad and Harrison, 1993; Kokko, 1994; Blomstrom and Sjohom, 1999; Aitken and Harrison, 1999; Liu et al., 2000; Damijan et al., 2003; Harris and Robinson, 2004; Dimelis and Louri, 2004; Bwalya, 2006; Hale and Long, 2007; Haskel et al., 2007; Wang and Zhao, 2008; Barbosa and Eiris, 2009). On the other hand, studies that use the alternative approach through estimating TFP are popular. This approach is processed in two steps: firstly, the sector-specific production functions are estimated to obtain measurements of TFP, in which the residuals not explained by input factors such as labour and capital are used as a proxy for TFP; secondly, TFP is regressed on the proxies of foreign presence. Examples of papers in this group are Barrios and Strobl (2002), Smarzynska (2002), Javorcik (2004), Girma and Gorg (2005), Thangavelu and Pattnayak (2006), Murakami (2007), Halpern and Murakozy (2007), Liu (2008) and Jude (2013).

From our literature survey, for the standard Cobb–Douglas production function approach to estimating productivity, the order of the common econometric methods that are used to quantify the effects of a foreign presence on the productivity of firms in the host countries is first ordinary least squares (OLS), followed by fixed effects (FE) and random effects (RE) and other methods such as GMM, weighted least squares (WLS), two stages least squares (2SLS), Translog, treatment effects, quantile regression and PSM. The literature survey reveals that OLS tends to produce positive results, while other methods generate mixed findings. For example, relying on OLS, Caves (1974), Blomstrom and Perrson (1983), Blomstrom and Sjohom (1999), Kokko (1994), Liu et al. (2000), Kugler (2001), Schoors and van de Tol (2002), Dimelis and Louri (2004) and Baldwin and Gu (2005) are consistent in finding positive results, but Djankov and Hoeckman (2000), Konnings (2001) and Bwalya (2006) affirm negative results. For a two-step approach, Olley–Pakes (OP), Levinsohn–Petrin (LP) and OLS are the common investigation instruments (Kugler, 2001; Barrios and Strobl, 2002; Smarzynska, 2002; Javorcik, 2004; Murakami, 2007; Halpern and Muraközy, 2007; Liu, 2008; Gorg et al., 2009; Lin et al., 2009; Jude, 2013).

There are several explanations for the lack of evidence indicating positive productivity effects due to horizontal spillovers. First and foremost, when MNEs set foot in the domestic market, they might try their best to protect their firm-specific advantages and prevent any leak to indigenous firms as much as possible. Therefore, the only chance that domestic firms can improve their productivity is mainly through competitive pressure brought by the foreign presence that forces them to be more efficient and competitive. However, as pointed out by Aitken and Harrion (1999), such competition may result in negative spillover productivity in the short run because of the "market-stealing effect" or "crowding-out effect." Hence, the positive productivity effects arising from competition pressure or any technology spillovers may be overwhelmed, leading to no clear evidence for research on the topic.

The second argument for not obtaining any evidence of a positive relationship between a foreign presence and domestic firms is that positive spillovers might benefit a group of firms or an industry only in a specific period of study, not all firms in all industries at all time periods. For example, by examining the relationship between the presence of foreign-invested firms and the productivity of local firms in Uruguay, Kokko et al. (2001) assert that the nature and extent of spillovers depend on the trade regime in the host country. These scholars found evidence of positive spillovers during the import-substituting trade regime, while there was no evidence in the export-promoting regime. The reason for those findings is that when foreign affiliates enter a host country that has an import-substituting trade regime, they face heavy competition from domestic firms, and the foreign firms need to bring in intangible assets that may spill over to domestic firms. In contrast, if foreign firms locate themselves in an export-promoting host country, they interact less with domestic firms, as in this case foreign firms tend to make use of their international marketing skills and export contacts rather than production technology; thus, there is less chance for spillovers to take place. Another clear example is found in Girma et al. (2001), when the researchers obtained no evidence for spillovers for the whole of UK manufacturing industry, but positive spillovers for domestic firms with a low technology gap of 10% or less from the foreign affiliates. More interestingly, domestic firms with a higher technology gap with MNEs not only benefit nothing from the foreign presence, but also endure a decrease in productivity.

There are also other explanations for why some researchers cannot find any evidence of productivity spillovers. To start with, it takes domestic firms time to learn from multinationals, with no immediate effects in the short run. Therefore, if the study only concentrates on a short time period, it is likely to overestimate the effects of FDI on productivity (Gorg, 2007).

2.6.3 Evidence on Vertical Spillover Effects

Vertical spillovers are evaluated by proxies that are responsible for foreign presence in upstream and downstream sectors. The importance of vertical spillovers has been acknowledged and documented in early studies about R&D and productivity by Romeo (1975) and Scherer (1982). More strongly, Glaeser et al. (1992) assert ample evidence that knowledge spillovers occur between rather than within industries. However, there had been only a limited number of empirical studies that investigate vertical spillovers before that by Javorcik (2004). Javorcik redirects the concentration of researchers from horizontal to vertical spillovers by proving that spillovers are more likely to occur through vertical linkages rather than horizontal, contradicting the previous predominant view in the literature about spillovers. As analysed in the theoretical framework for vertical linkages, foreign firms may enhance the productivity of their local suppliers by providing technical support or setting a higher quality standard in the production process of intermediate products, which introduces incentives for indigenous firms to improve their technology (backward linkages). In the same manner, foreign affiliates may provide domestic buyers with guidelines or assistance in an active or passive way, allowing domestic firms to make use of the products supplied (forward linkages).

Following the theme of presenting the findings of the literature survey on horizontal spillovers, vertical spillovers are synthesized and analysed in terms of four main features: (i) data type and data aggregation; (ii) productivity measurement; (iii) spillover pool measurement; and (iv) estimation characteristics and econometric methods. Detailed information on the literature survey on vertical spillovers can be found in Table A2.3 in the Appendix.

<u>*vidence variation ,/ data t/pe and level of anal/sis</u>: Most studies on vertical spillovers employ firm-level panel data (47 out of 54 findings in this literature survey), with the exception of seven findings from three papers by Kugler (2001) and Lin et al. (2009), which employ panel data at industry level, and Hale and Long (2007), which uses cross-sectional firm-level data for analysis. More interestingly, the case study is also a tool for examining the vertical relationship between foreign affiliates and indigenous firms.

A large number (40%) of the findings on vertical spillovers obtain positive results on effects of foreign presence inter-industry. The pioneering study is by Kugler (2001), and examines 10 manufacturing sectors in Colombia by using industry-level panel data in the period from 1974–1998. One of the advantages of the estimation model that Kugler used is that it enabled him to differentiate between horizontal and vertical linkages. He found strong positive evidence for vertical spillovers, but horizontal linkages were only present in the machinery equipment sector. However, the research is limited by failing to distinguish between forward and backward linkages in vertical spillovers. Smarzynska (2002) employed firm-level panel data on 2,636 manufacturing firms in Lithuania from 1996–2000 and uncovered evidence of spillovers through backward linkages. The empirical results suggest that a 10% increase in the foreign presence in downstream sectors is related to a 0.38% growth in output of domestic firms in the upstream industry. Schoors and van de Tol (2002) investigated the productivity effect of foreign ownership on 1,084 domestic manufacturing firms in Hungary in a two-year period, 1997–1998, and confirmed positive forward linkages but negative backward linkages of FDI on the productivity of domestic firms. More interestingly, the authors asserted that vertical spillovers are relatively more pronounced than horizontal spillovers in enhancing indigenous labour productivity. By utilizing Indonesian firm-level panel data, Blalock and Gertler (2003) are also in line with Smarzynska when finding positive backward linkages but no evidence for horizontal spillovers. They justify their findings by stressing the deliberate technology transfer of foreign affiliates to indigenous suppliers, with a view to enhancing competition and lowering prices in the upstream market. Examining the UK manufacturing sector in the period from 1984–1992, Driffield, Munday and Roberts (2002) accumulate evidence for significant forward linkages but insignificant backward spillovers. Javorcik (2004) employed firm-level panel data for 4,000 Lithuanian firms from 1996–2000 and produced three major contributions to the existing literature. Firstly, she asserted that the foreign presence was related to the higher productivity of domestic supplying firms but not domestic buying firms; that is, positive backward linkages but no forward linkages. Secondly, partially foreign-owned firms benefit more from spillovers than wholly foreign-owned firms. Last but not least, Javorcik (2004) found no evidence of horizontal spillovers, which is consistent with many previous studies. With the investigation of 125 Zambian manufacturing firms, Bwalya (2006) proposed a result of positive backward spillovers that corresponds to those of Schoors and van der Tol (2002), Blalock and Gertler (2003), Damijan et al. (2003) and Javorcik (2004). Javorcik and Spatareanu (2008), using data on 13,129 firms in 48 Romanian industries for the 1998–2003 period, confirm significant positive backward spillover linkages, but negative intra-industry spillovers. Halpern and Muraközy (2007) utilize a sample of 2,987 Hungarian firms in 1996–2003 and suggest positive inter-industry effects of FDI on productivity. Wang and Zhao (2008) allege strong evidence of positive spillovers both within and between industries, and argue that vertical effects play a more important part in enhancing the productivity of Chinese domestic firms than horizontal spillovers over the period 2000–2002. By deeply exploring channels of FDI spillovers on productivity using firm-level data on Chinese manufacturing, Liu et al. (2009) confirmed inter-industry spillovers at both national and regional levels, whereas they found only limited horizontal linkages at the regional level. They used panel data on Chinese domestic firms from 1998–2005 and produced extensive evidence of strong backward and forward linkages of a foreign presence on Chinese domestic firms.

However, a larger number (60%) of the total literature surveyed comes up with negative effects or no evidence of vertical spillovers on host-country productivity. Harris and Robinson (2004) focus on panel data on 20 UK manufacturing-sector firms from 1974–1995, and assert the dominance of vertical linkages over horizontal ones and evidence of negative vertical spillovers in some sectors. Thangavelu and Pattnayak (2006), using panel data consisting of nearly 200 firms in the Indian pharmaceutical industry and employing semi-parametric estimation methods suggested by Olley and Pakes (1996) and Levinsohn and Petrin (2003), propose negative spillovers from backward linkages due to the large technology gap between local and foreign affiliates. Barbosa and Eiris (2009) exploit unbalanced panel data comprising 1,970 Portuguese manufacturing firms in 21 industries over a six-year period, from 1994–1999. The researchers indicate no evidence of intra-industry and inter-industry spillovers by employing the GMM approach. Liu (2008) analysed a large sample of 17,675 Chinese manufacturing firms over a period of five years, from 1995–1999, and stressed the most important role of backward linkages in conveying spillovers among other channels. However, Liu (2008) demonstrated negative backward and forward linkages of a foreign presence on upstream and downstream industries.

Case studies are also used to identify vertical spillover effects. Ivarsson and Alvstam (2005) analysed in depth how foreign affiliates associate in technology transfer to local suppliers by conducting a survey on Volvo, a Swedish premium automobile manufacturer, and its 389 local affiliates, including 153 in Brazil, 73 in China, 64 in India and 99 in Mexico. With a view to improving the sourcing of parts and components for production, Volvo applied several measurements. First, the company frequently issues a Supplier Evaluation Manual, which is produced and improved by Volvo personnel. The manual is sent to each individual local supplier. There are many key areas that are used to assess suppliers, such as global ability, quality system, management structure, logistics, product and process competence and so on. Through the manual, every local supplier is also offered suggestions that can be used to upgrade their internal operations. Secondly, at the same time, Volvo provides local affiliates with technical assistance in particular areas if they require. In addition, it offers technical consultancy on new machinery operations and advice on production organization and quality assurance. The researchers found that Volvo appears to give its local suppliers product technology assistance rather than process technology support. More importantly, a substantial number of indigenous suppliers, with the exception of Mexico, dramatically raised their technological capability and other performance thanks to the foreign presence of Volvo.

*vidence variation ,/ spillovers and productivit/ -easure-ent: Four tools to calculate productivity are employed in the studies: output, TFP, turnover and value added. Of these, TFP is the most popular measure, at 55% of total findings (Kugler, 2001; Smarzynska, 2002; Javorcik, 2004; Thangavelu and Pattnayak, 2006; Halpern and Murakozy, 2007; Javorcik and Spatareanu, 2008; Lin et al., 2009; Jude, 2013), followed by output at 22.5% (Damijan et al., 2003; Harris and Robinson, 2004; Bwalya, 2006; Barbosa and Eiris, 2009), value added accounting for 16% (Hale and Long, 2007; Wang and Zhao, 2008) and turnover (Schoors and van de Tol, 2002) constituting 6.5% of the total.

As regards measurement of spillover pool, five types of shares are used to quantify spillover pool: capital share, employment share, equity share, output share and sales/turnover share. Of all the findings on vertical spillovers, equity share (35.5%) is the most popular measurement method (Javorcik, 2004; Thangavelu and Pattnayak, 2006; Lin et al., 2009; Barbosa and Eiris, 2009), followed by capital share, present in 19.5% of all findings (Kugler, 2001; Harris and Robinson, 2004; Wang and Zhao, 2008; Jude, 2013), employment share (Bwalya, 2006; Hale and Long, 2007) and output share (Damijan et al., 2003; Javorick and Spatareanu, 2008) taking up 16% each, and sales/turnover share (Schoors and van de Tol, 2002; Halpern and Murakozy, 2007) accounting for 13% of total findings.

*vidence variation ,/ esti-ation -ethod: In our literature survey, to examine vertical spillovers a large number of studies employ a standard approach when estimating an augmented production function with proxies for spillover pool, such as Damijan et al. (2003), Harris and Robinson (2004), Bwalya (2006), Wang and Zhao (2008) and Barbosa and Eiris (2009). In addition, a growing number of studies use the alternative approach through TFP, such as Smarzynska (2002), Javorcik (2004), Halpern and Muraközy (2007), Liu (2008) and Jude (2013).

Among those studies that follow the standard approach, GMM and OLS are the popular statistical tools for analysis. However, the two-step approach utilizes OP, LP and OLS as the predominant instruments in investigation. Statistically, in this literature survey, out of 17 papers examined, 9 papers employ two-step estimation and the remaining 8 papers apply the standard approach of an augmented Cobb–Douglas production function.

2.6.4 Evidence on Mediating Factors and Heterogeneity in Spillover-Effect Studies

There is a growing body of empirical evidence on the mediating factors that affect the sign and magnitude of the FDI spillovers on productivity. We review and synthesize these factors under three headings: technology gap and absorptive capacity of domestic firms; domestic firm characteristics; and FDI characteristics.

9echnolo./.ap and a,sorptive capacit/

Not surprisingly, technology gap and absorptive capacity are a significant focus of scholars researching productivity spillovers, as they are of great influence on the magnitude of spillovers. The argument that the size of spillovers is affected by the technology gap between the home and host countries was first raised by Cantwell (1989). This researcher inspected the reaction of European firms to the entrance of US foreign affiliates into the European market over 20 years from 1955–1975, and points out that the responses differ across countries and industries. Cantwell's findings imply that the absorptive capacity of domestic firms is the crucial determinant for the magnitude of spillovers. Using R&D investment of Czech Republic domestic firms as a proxy for absorptive capacity, Kinoshita (2001) asserts that only domestic firms that perform R&D actively can absorb advanced technology and know-how from foreign investors. In the same manner, Keller and Yeaple (2003), through investigating American domestic firms, stress that only firms operating in high-technology sectors can reap the benefit from FDI spillovers. Narula and Marin (2003) capture the absorptive capacity of domestic firms as the investment in new equipment oriented to product/process innovation or training activities. The researchers confirm that those firms with absorptive capacity benefit from spillovers, while the others gain nothing. Focusing on electrical manufacturing firms in Japan, Murakami (2007) measures absorptive capacity as the firm's R&D intensity, which is calculated as R&D costs divided by sales, and finds that firms with a high R&D intensity obtain a positive effect on productivity growth from a foreign presence. Moreover, the absorptive capacity of a domestic firm might also be positively related to its share of s#illed la,our. Blalock and Gertler (2009), for example, confirm that the larger the proportion of employees with college degrees, the more domestic firms' productivity gains from FDI in Indonesian manufacturing.

Do-estic fir- characteristics

In terms of examining do-estic fir- si0e and its effect on the extent of spillovers, the empirical evidence is inconclusive. Aitken and Harrison (1999) differentiate between firms with more than and fewer than 50 workers, and find that only small firms receive productivity externalities from a foreign presence. In contrast, Dimelis and Louri (2001) affirm that only small domestic firms with fewer than 50 employees obtain productivity spillovers. Moreover, Girma and Wakelin (2001) consider the interaction between the size and absorptive capacity of domestic firms, and point out that small indigenous firms with a high proportion of skilled employees reap the largest benefit from productivity spillovers, while large domestic firms with highly skilled labourers gain no profit. They defend their findings by saying that the large firms are the nearest to foreign affiliates regarding technology and market share, and they may already operate at the "technological frontier," hence they do not benefit from a foreign presence. The reverse applies for small firms. Sinani and Meyer (2004) corroborate those findings when they state that FDI productivity spillovers bring positive effects on small and medium-sized firms, not large firms in Estonia, and the small benefit more than the medium-sized.

As for the effects of o1nership t/pe of do-estic fir-s on FDI productivity spillovers, by using data from the Study of Competitiveness, Technology and Firm Linkages conducted by the World Bank in 2001 for China, Hale and Long (2006) demonstrate that the presence of foreign investors has strong positive effects on the productivity performance of private firms, but no or a negative impact on the performance of state-owned enterprises. More concretely, when foreign investors enter the country, they help to increase the productivity of skilled Chinese workers in private firms, but not state-owned firms. Moreover, a foreign presence has no effects on sales to foreign firms and foreign consumers of state-owned enterprises, but a positive impact on private firms' sales. More interestingly, the entry of foreign affiliates tends to reduce the market share and TFP of state-owned firms, while private firms are not influenced. The findings of Hale and Long (2006) corroborate the empirical evidence of Hu and Jefferson (2002) and Sinani and Meyer (2004) for better private ownership than state ownership performance under the presence of foreign investors in China in the period 1995–1999 and Estonia from 1994–1999, respectively.

2D3 characteristics

9he distance ,et1een the ho-e and host countries of 2D3 is expected to have effects on the magnitude of FDI spillovers. Banga (2003) searched for productivity spillover differences between Japanese and US foreign presence on 153 Indian domestic firms across 25 industries. The researcher shows that local firms pick up more productivity spillovers from Japanese rather than US counterparts. Javorcik and Spatareanu (2008) start with a large sample of 59,535 manufacturing firms from 1998–2003 in Romania to detect evidence of a positive relationship between the productivity of Romanian firms in the supplying industries and the foreign presence of US partners in downstream sectors, whereas no significant proof of a connection with European Union (EU) counterparts was found. The authors emphasize that US investors have more incentives to source inputs from Romania than EU counterparts because of the Association Agreement between the EU and Romania, implying lower tariff barriers for EU investors. Therefore, the presence of US firms can produce greater backward spillovers compared to those from the EU.

Regarding the effects of the de.ree of forei.n o1nership on the direction and magnitude of productivity spillovers, the empirical evidence seems to be in agreement. Dimelis and Louri (2002) use three alternative proxies to measure foreign presence, including sales, capital and employment, and employ quantile regressions to uncover the fact that minority foreign ownership is most visibly related to the higher productivity of domestic firms. More concretely, majority foreign ownership only affects the 25% more efficient indigenous firms, but the minority positively correlate at any efficiency level of domestic firms. Using a firm-level panel data of 74,177 Romanian firms in the period 1998–2003, Javorcik and Spatareanu (2008) corroborate the findings of Dimelis and Louri (2002). Javorcik and Spatareanu (2008) affirm that joint ventures between domestic and foreign firms are positively correlated with the productivity of upstream sectors, but find no such effect in examining the productivity of indigenous firms and wholly owned foreign firms. The finding is justified on the grounds that more vertical linkages as well as stronger technology leakages are transmitted from partially owned rather than wholly owned foreign firms to domestic counterparts.

Empirical studies also illustrate other factors that have an influence on the magnitude of FDI productivity spillovers, such as entry mode of FDI and size of foreign firms. Examining the entr/

-ode of 2D3, Braconier, Ekholm and Midelfart-Knarvik (2001) conclude that when MNEs enter the host country through greenfield investment, technology transfer happens immediately as greenfields set up new businesses, hence they have a direct relationship with the employment and value added of the domestic markets. In contrast, when FDI takes place via merger or acquisition, technology is transmitted gradually, restricting or at least delaying spillovers.

!i0e of forei.n fir-s is also a factor that can affect the magnitude of spillovers. According to Dimelis and Louri (2004), relying on a sample of 3,742 Greek manufacturing firms in 1997, small foreign firms are more likely to source locally and interact more intensively with local firms, hence leading to higher spillovers, whereas the reverse logic is true for the larger firms.

Moreover, forei.n fir- location is shown to have an important role for the extent of productivity spillovers. Barrios, Luisito and Strobl (2006) produce evidence that foreign firms collocating (agglomerating) in the same sector and region significantly increase the productivity and employment of local manufacturing firms in Ireland.

To summarize, a voluminous literature has concentrated on the impact of a foreign presence on the productivity of indigenous firms in both developed and developing countries. Findings for direct effects seem to be conclusive on the positive relationship between foreign ownership and the productivity level of domestic firms. Scant but strong empirical evidence demonstrates the crowding-out effect, especially in transitional or developing countries.

However, the main pattern for horizontal or inter-industry effects seems to be unclear. Initially, by using cross-sectional data, most researchers assert positive horizontal effects. Unfortunately, cross-sectional data is claimed to lead to a failure to control for selection bias and heterogeneity between firms and industries. Panel data is then employed to detect the weakness of cross-sectional data in analyses and evaluate the spillover effects. Interestingly, a large number of researchers find negative or no evidence of intra-industry effects, while a large number of vertical spillover studies confirm a positive relationship between foreign presence in upstream or downstream industries and their local buyers or suppliers.

Existing empirical studies also examine factors that influence the direction and size of productivity spillovers. The most evident group of factors are the technology gap between foreign and domestic firms and the absorptive capacity of domestic firms. The main finding of this group is that firms with a high R&D intensity tend to be more capable of obtaining a positive effect on productivity growth from a foreign presence. For the characteristics of the group of domestic firms, research is consistent with the finding that private firms tend to reap more spillover benefits than state-owned firms. However, the impact of the size of domestic firms on FDI spillover productivity remains controversial. A group of FDI characteristics, such as a long distance between the home and host countries of FDI, joint-venture foreign ownership, the greenfield entry mode of FDI, the small size of foreign firms and the agglomeration of foreign firms, are found to have positive impacts on the nature and size of FDI spillovers.

2.7 Review of Empirical Evidence on Vietnam

The number of studies on the effects of FDI on productivity in the Vietnamese context has expanded year by year, especially since the availability of the micro-level data of the Annual Enterprise Survey conducted by the GSO. In this literature survey, studies on Vietnam, like studies on other countries on the same topic, are organized into several main categories: period studied, data type, level of data aggregation, size of sampling, measure of productivity, measure of foreign ownership, econometric method used and main findings obtained for horizontal and/or backward and/or forward linkages. Details of the findings can be found in Table A2.3 in the Appendix.

Tran Ngoc Ca (2002) and Schaumburg-Muller (2003) were the first researchers to report a positive effect of FDI on the labour productivity of Vietnamese domestic firms, even though the effects are weak. Regarding the study of Tran Ngoc Ca (2002), the researcher built a case study of ten foreign companies from five different countries that invested in Vietnam in the 2000s. He affirms that most foreign companies contribute to enhancing the technological capability of domestic firms through extensively training their employees and/or customers (Hewlett-Packard Vietnam, Fujitsu Vietnam and Alcatel Network System Vietnam); training for distribution network staff (Intel); offering assistance with product technology or the production process in order to preserve the quality of products (BP Petco, Mercedes-Benz Vietnam, Sony Vietnam); providing modern technologies to all its factories and distributors; or offering technology learning opportunities for employees, supporting agents and distributors and suppliers (Unilever Vietnam, Honda Vietnam).

Overall, the author justifies positive vertical spillovers in some manufacturing industries in Vietnam.

Giround (2007) conducted a survey on subsidiaries of MNEs in Malaysia and Vietnam, comparing the activities of 49 multinationals in both countries. The research indicates positive evidence of backward spillovers for domestic firms in both countries, but the magnitudes are different. While locally owned suppliers in Malaysia benefit to a large extent from backward spillovers, Vietnamese local suppliers benefit only a little from the presence of foreign affiliates. Limited superior technology and managerial expertise are transmitted from foreign firms to indigenous firms in Vietnam.

Employing industry-level data for two selected periods, 1995–1999 and 2000–2002, Le Thanh Thuy (2005) examines whether FDI creates technological spillovers on labour productivity in 29 sectors from three industrial groups of mining and quarrying, manufacturing, and electricity, gas and water supply in Vietnam. The author finds evidence of positive spillovers from FDI on the labour productivity of domestic industries over the period 1995–1999, but weaker effects in the 2000–2002 period. Moreover, the study also indicates a relationship between the technology gap and intra-industry spillovers: industries with a low technology gap tend to benefit more from a foreign presence than those with a higher gap. The finding is in line with those of Lapan and Bardhan (1973), Perez (1997), Wang and Blomstrom (1992) and Kinoshita (2001). In her research, Le Thanh Thuy also infers the active role of private domestic firms in reaping the benefit from productivity spillovers.

Nguyen Thi Tue Anh et al. (2006) employ cross-sectional data from 2001 to examine whether FDI brings spillover effects on 9,590 Vietnamese domestic firms in the manufacturing sector. The group of researchers indicated the positive intra-industry effects of FDI and clarified that SOEs do not benefit from a foreign presence, but that private firms perform a better job of utilizing the positive effects on labour productivity from FDI.

Pham Xuan Kien (2008) makes use of firm-level data on 441 firms in four sub-industries of food processing, textiles, garments and footwear, electronics and mechanics from 2005 in Vietnam, and finds strong positive effects of FDI on labour productivity. Furthermore, he affirms that productivity spillovers in Vietnam depend on the skills, scale and capital intensity gap between foreign affiliates and indigenous firms. Also, the spillovers are proved to be heterogeneous across four different geographical locations in Vietnam. Moreover, type of FDI is another factor that affects the extent of spillovers. Joint ventures and other types of FDI (build–transfer; build–transfer–operate; build–operate–transfer; agreement), excluding wholly foreign ownership, are found to have a robust impact on labour productivity in Vietnam.

Based on firm-level panel data from 2003–2007, Hoang Van Thanh and Pham Thien Hoang (2010) confirm a positive relationship between a foreign presence and the productivity of Vietnamese domestic firms. Furthermore, with a view to deeply investigating the factors that can influence the magnitude of spillovers, these writers consider the interaction between foreign presence and the technology gap (which is defined as the percentage difference between the domestic firm's labour productivity and that of the average foreign firm in the same industry); foreign presence and capital intensity (which is calculated as the percentage difference of the capital–labour ratio between a domestic firm and that of an average foreign firm in each industry sector); and foreign presence and skill intensity (which is inferred as the difference between the wage of a worker in a domestic firm and the average wage of a worker in a foreign firm in each industry sector). The estimation results indicate a detrimental role of the technology gap in boosting spillovers; that is, the technology gap is a constraint that prevents technology spillovers from foreign firms to Vietnamese domestic firms. Furthermore, the difference in capital intensity between foreign and domestic firms plays a role in enhancing the productivity of the latter. Last but not least, the dissimilarity of skill intensity between the foreign partner and Vietnamese indigenous firms impedes productivity spillovers, raising the importance of developing domestic labour productivity with an eye to harvesting the larger benefit of spillovers.

Nguyen Ngoc Anh et al. (2008), using firm-level panel data from the Annual Enterprise Surveys in the period 2000–2005 conducted by the GSO, carried out empirical research aiming to find evidence of technological spillover effects of a foreign presence on Vietnamese domestic firms in both manufacturing and service sectors. Thanks to the rich dataset, the researchers use two different proxies for spillover pool: by share of output and by share of employment. They assert that these two means will give them a chance to differentiate between labour mobility effects and other effects such as demonstration effects or competition effects. Subsequently, they found positive backward linkages but negative forward spillovers in the manufacturing sector, while these do not seem to exist in the service sector. They also confirmed the result of a positive horizontal spillover effect in the manufacturing sector through the labour mobility channel, and in the service sector through both the output channel (which refers to demonstration and competition effects) and the labour mobility channel.

Nguyen Phi Lan (2008) carried out a study on FDI technology spillover effects on domestic firms' productivity both intra-industry and inter-industry, as well as exploring the degree of variance of FDI across regions of Vietnam in 29 sectors of the manufacturing industry from 2000–2005. The most noticeable finding of the paper is that the whole period 2000–2005 witnessed positive effects of horizontal and backward spillovers of FDI on the productivity of Vietnamese manufacturing firms, while negative impacts are only seen in forward linkages between foreign affiliates in upstream sectors and domestic firms in downstream sectors. The author also discovered the impact of the geographical distribution of FDI on the productivity of indigenous firms and states for the different effects from region to region. With regard to characteristics of domestic firms that can influence the magnitude of spillovers, Nguyen Phi Lan confirms that those domestic firms with a higher human capital stock, lower technology gap and better financial development benefit more from FDI productivity. Furthermore, private firms have strong linkages with foreign partners via technology transfer and technical assistance, and in the meantime the connections between state-owned enterprises and foreign affiliates seem to be weaker.

Le and Pomfret (2011) undertook a thorough study of both horizontal and backward linkages of 7,190 domestic firms and 1,461 foreign firms in 29 sectors of 3 industrial groups in Vietnam over a period of 5 years (from 2000–2006). They found evidence of negative productivity spillovers within industries, but positive effects of FDI spillovers through contacts of local suppliers in upstream industries with foreign buyers in downstream industries. More interestingly, backward linkages are the most important mechanism for technology diffusion from foreign firms to Vietnamese domestic firms. It is noteworthy from the research that the sign and magnitude of spillovers depend on several mediating factors. For example, labour quality of domestic firms, technology gap between domestic and foreign affiliates, and size of indigenous firms are found to influence backward spillovers. Moreover, domestic firms' ownership structures also affect the magnitude of foreign presence: there is no evidence of a relationship between productivity of states and collective firms and foreign presence, but private firms' productivity is negatively related to the presence of foreign firms. Similarly, characteristics of foreign affiliates will partly decide the extent of spillovers. The productivity of domestic firms in Vietnam is negatively correlated with the presence of wholly foreign ownership, while not with the entrance of partly foreign-owned firms.

Tran Toan Thang (2011) used a whole sample of 27,262 domestically owned firms and FDI firms in agriculture, manufacturing and services in Vietnam over a period of 5 years (2001–2005). He confirms the negative horizontal effects of a foreign presence on the TFP of domestic firms and explains the negative results as the consequence of the "market-stealing effect," which has been hypothesized previously in Aitken and Harrison (1999). Regarding vertical spillovers, Tran Toan Thang (2011) suggests the evidence of positive backward and negative forward linkages. In more detail, over the period of 5 years, Vietnamese domestic firms, on average, experienced negative productivity spillovers of -2.1%, of which -1.7% was for intra-industry and -0.4% for inter-industry spillovers. According to the author, the positive backward linkages exist thanks to tougher standard input requirements set by the foreign affiliates to domestic suppliers, and the "learning by doing" or imitation effects by which indigenous firms benefit from a foreign presence. What is more, negative forward linkages are likely to occur because the intermediate inputs produced by foreign firms are of better quality but relatively more expensive than those of domestic firms, hence the domestic firms find those inputs less adaptive. Thus, the domestic firms in downstream industries suffer a detriment from the foreign presence in the upstream industry.

That by Anwar and Nguyen (2014) is the first study that examines deeply the effects of FDI on productivity at regional levels in Vietnam. Focusing on eight geographical regions, the paper produces results of both horizontal and vertical linkages. Firstly, the authors conclude for positive horizontal effects in three out of the eight regions (North East, Central Highland and Mekong River Delta), while positive backward linkages can be found in four regions (Red River Delta, South Central Coast, South East and Mekong River Delta) and only two regions (North West and North Central Coast) exhibit positive forward linkages. Therefore, the researchers suggest that the effects of FDI on the TFP of domestic manufacturing firms in Vietnam depend on their geographical distribution. Also, the authors confirm that backward linkages are the most important channel of technology diffusion, which is consistent with the findings of other researchers such as Smarzynska (2002), Javorcik (2004), Wang and Zhao (2008), Le and Pomfret (2008) and Liu et al. (2009). More interestingly, regions with a better absorptive capacity in terms of better human capital, better technology and a higher level of financial development will benefit more from FDI spillovers.

Utilizing a rich dataset of firms in 22 manufacturing sectors in Vietnam from 2002–2011, Bin Ni et al. (2014) are the first to inspect the relationship of the home-country origin of FDI with the level of horizontal and vertical spillovers of the host country, Vietnam. The researchers categorize foreign investors in Vietnam into three large groups: Asian, European and North America. Then, depending on the status of having or not having a free trade agreement with Vietnam, the authors refer to these as ASEAN and non-ASEAN investors. As East Asian investors are seen to be the biggest investment group, this is tested separately in some models. Regarding horizontal spillovers, ASEAN, East Asian and European investors present negative impacts on the TFP of Vietnamese firms, whereas there is no evidence of intra-industry effects from North American investors. Additionally, European and North American foreign partners show no evidence of backward linkages with domestic firms; however, the presence of Asian investors in downstream industries illustrates a positive relationship with the productivity of Vietnamese domestic firms in upstream industries. Within Asian foreign partners, East Asian investors, excluding Japan, generate a large degree of backward spillovers.

On the whole, FDI productivity effects are examined through horizontal and vertical linkages in the case of Vietnam. Most empirical studies assert positive backward linkages while investigating the relationship between a foreign presence and the productivity of domestic firms. However, the horizontal and forward linkages are found to be ambiguous. Moreover, the degree of technology diffusion and knowledge sharing between foreign and local firms remains small. Nevertheless, the extent of spillovers differs across firms, industries and regions due to their heterogeneous characteristics. In some cases and spheres, spillovers are found to be negative. The divergence in findings could be due to differences in the methods used to estimate, the level of the data, the span of the study period or the data quality.

2.8 Evidence Synthesis, Research Gaps and Implications for Research

2.8.1 Sources of Heterogeneity in FDI and Spillovers Literature: A Synthesis

From these analyses, we can summarize that the differences in variable definition, proxies, data and methodology employed may lead to inconclusive results on the spillover effects of FDI on productivity. We present here some of the factors that are most frequently analysed in empirical studies on the topic of FDI spillovers and productivity.

According to Wooster and Diebel (2010), the disparity in the findings of productivity spillovers may arise from the threshold of forei.n equit/ chosen to define a firm as "foreign-invested." Some studies follow the formal country classification of foreign-invested firms, while others have a seemingly arbitrary rather than clear threshold to track. For instance, in Vietnam the government set a definition of a foreign-invested firm as one with any equity share above 0%, which makes it easy for researchers to differentiate between foreign and domestic firms (Le Thanh Thuy, 2005; Le and Pomfret, 2008). However, in Slovenia and Estonia, firms are considered foreign-invested if they have an equity threshold above 10% and 50%, respectively (Vahter, 2004, p.31), while in India the equity threshold to define a foreign firm is 25% or more (Kathuria, 2000, p.354). The differences may lead to a concern that some studies do not properly control for a direct effect/own-firm effect when modelling FDI spillovers. As an example, firms with a low equity share ranging from above 0–5% are treated as foreign-invested firms in Vietnam and may be affected directly by FDI. However, firms with a foreign equity share above 0–5% in Slovenia and Estonia are treated as domestic firms, and the effect of FDI on that type of firm will be inferred as an indirect effect of FDI.

9he choice of pro</ for spillover pool is also another source of variation in findings concerning spillover effects. Gorg and Strobl (2001) argue that most studies of horizontal effects use the share of employment or share of output for spillover pool, which produces higher magnitudes of horizontal spillover effects than other proxies such as share of capital, share of value added, or share of revenue/sales/turnover for spillover pool.

9echnolo./ .aps ,et1een ho-e and host countries also matter for the differences in findings of spillovers. As Irsova and Havranek (2013) summarize, a large technology gap prevents domestic firms from imitating the technology and adopting the know-how that foreign investors bring in. On the other hand, when the gap is small, indigenous firms are likely to benefit modestly from a foreign presence as they have little to learn from their foreign affiliates.

9he distance ,et1een the ho-e and host countries of 2D3 has positive significant effects on the magnitude of spillovers. In other words, foreign investors from far-off countries have a tendency to generate more beneficial linkages with indigenous firms in upstream and downstream industries. Javorcik and Spatareanu (2011) produce clear evidence when stating that Asian and American investors create greater vertical spillovers than European investors in Romania.

)1nership structure for both indigenous and foreign firms is another mediating factor that has impacts on the magnitude of FDI spillovers. Indigenous firms are expected to receive less benefit from fully foreign-owned firms than from joint-venture firms (Dimelis and Louri, 2002; Javorcik and Spatareanu, 2008). Regarding the ownership structure of domestic firms, empirical evidence confirms a better performance of private ownership than state ownership under the presence of foreign investors (Hu and Jefferson, 2002; Sinani and Meyer, 2004; Hale and Long, 2006).

Moreover, *fir- si0e* may cause the results of spillover effects to differ among studies. Dimelis and Louri (2004) propose that small foreign firm size is found to generate more FDI productivity than large foreign firm size. Lenaerts and Merleved (2015) assert that only medium-sized foreign firms generate spillover effects, while micro, small and, more surprisingly, large foreign firms do not. The impact of domestic firm size on the domestic firm's capacity to absorb FDI spillover is found to be inconsistent with some related studies. Aitken and Harrison (1999) and Zhang, Li and Zhou (2010) allege that large domestic firms with more internal capabilities and stronger capacity than small ones can benefit more from FDI spillovers. In contrast, other studies find that small and medium-sized firms benefit more strongly from FDI spillovers, especially those firms with a higher proportion of skilled labour (Girma and Wakelin, 2007; Sinani and Meyer, 2004).

Additionally, regarding the findings of horizontal spillover effects, the differences originate from two main reasons: the data types and methodology employed.

2or data t/pes, most cross-sectional research papers find a positive relationship between foreign presence and the productivity of domestic firms, while most panel-data studies find mixed or insignificant effects. This observation suggests that the data types used in research are likely to influence the reported estimates.

The advantage of using panel data, especially at firm level rather than industry level, in estimating the size of spillover effects on the productivity of domestic firms are affirmed in the research of Gorg and Strobl (2001). These two scholars argue that panel data studies allow researchers to follow the development of indigenous firms over a longer period of time, not limited to one data point in time as in cross-sectional data. Moreover, by employing panel data, researchers can investigate spillovers in more detail while properly controlling for unobservable factors, which they are not able to do in cross-sectional data. As such, panel data, ideally at firm level, appears to be the most appropriate tool to determine the true magnitude of productivity spillovers. Gorg and Strobl (2001) and Meyer and Sinani (2009) point out in their meta-analysis that studies using cross-sectional data introduce stronger spillover effects than those using panel data. Also, Meyer and Sinani emphasize that employing industry-level data usually leads researchers to obtain a higher result of spillover effects than with firm-level data.

With regard to methodology, all papers that employ cross-sectional data pool OLS to do regression, which does not take account of unobserved simultaneity and heterogeneity of firms or industries, which might be correlated with, but not caused by, the foreign presence, hence they produce biased and inconsistent estimations. For instance, assuming that productivity in sector A is higher than that of sector B, foreign investors may be attracted into the former rather than the latter sector. In a cross-sectional study, a positive significant relationship between foreign presence and the productivity of the domestic sector can be found even though the foreign presence did not cause the higher level of productivity, but rather was attracted by it. Fortunately, in more recent papers, thanks to the availability of panel data and sophisticated techniques to analyse unobservable heterogeneity and simultaneity, these as well as the time-invariant determinant of productivity are controlled. Therefore, the estimation results based on panel data seem to produce more robust evidence.

To summarize, the heterogeneity in finding evidence of spillover effects of FDI on the productivity of domestic firms in the literature stems from various sources: the threshold of foreign equity chosen; the choice of proxy for spillover pool; technology gaps between home and host countries;

the geographical distance between the home and host countries of FDI; foreign and domestic firm size; and ownership structures. Moreover, the differences in findings also originate from the data type and methodology employed. These heterogeneities imply that building a valid model with related mediating factors and employing appropriate and effective econometric methods are indispensable to quantifying the spillover effects of FDI on productivity.

2.8.2 Research Gaps and Implications for Research

From the above analyses and investigation, we have identified a number of limitations in the existing literature.

One limitation concerns the relatively small number of studies on the direct effects of FDI on firm productivity compared to the number of studies on the indirect effects of FDI. Regarding the specific case of Vietnam, to the best of our knowledge research that examines both direct and indirect effects of FDI on the productivity of resident firms in Vietnam is rare, as most papers concentrate on the relationship of indirect or spillover effects of FDI only. Moreover, the existing studies do not investigate if the productivity effects of FDI are also associated with crowding-in or crowding-out effects on domestic firms. Hence, to quantify the effects of FDI on productivity thoroughly, we are the first to examine all direct and spillover effects as well as crowding-in/crowding-out effects in the case of Vietnam.

Another limitation relates to the econometric methods employed in studies on the topic. Primarily, the productivity of a firm is determined by the inputs of production such as labour and capital. However, the procedure of estimating production functions using firm-level data is somehow problematic. The problem arises because a firm determines its output at least to some extent simultaneously with its input use. Putting it another way, productivity is to be correlated with input factors. According to Marschak and Andrews (1944), this simultaneity causes an endogeneity problem, meaning that firm output (the dependent variable) is correlated with the error term in the case of productivity shocks. If there is a positive productivity shock, a profit-maximizing firm will increase both its output and its input demand simultaneously as a reaction. The reverse is true for negative productivity shocks. The main issue is how to solve the endogenous input factor with the existence of unobserved heterogeneity in estimating the production function coefficients (unobserved heterogeneity refers to firm-specific characteristics that are not explicitly accounted for through control variables). Yasar et al. (2008) assert that OLS and RE estimations will lead to biased upward results as they take no account of unobserved productivity shocks. Arnold (2005) suggests a solution by estimating with an FE model. This does, however, require an assumption that unobserved firm-specific productivity is constant throughout the time period studied. However, unobserved firm-specific productivity changes in reaction to FDI presence. More importantly, an FE estimator is likely to produce downward-biased results, as suggested by Nickell (1981). However, this literature survey realizes that OLS, FE and RE are still the most popular tools used on the topic, with about half of the studies utilizing them (see Table 2.2).

There are different methods that account for endogeneity, such as Olley–Pakes and Levinsohn–Petrin, and these have been utilized in the existing literature. Several studies, such as Smarzynska (2002), Javorcik (2004) and Thangavelu and Pattnayak (2006), employ the technique developed by Olley and Pakes (1996). Olley and Pakes use investment as a proxy to control for unobserved firm-specific heterogeneity in productivity. However, the proxy might fail, as investment by firms is not always positive (Levinsohn and Petrin, 2003; Rungi, 2010), challenging the unbiasedness of the Olley–Pakes method. Extending from Olley and Pakes' (1996) approach, Levinsohn and Petrin (2003) use intermediate inputs to control for unobserved firm-specific differences. Unfortunately, this approach has its own drawbacks while relying on the assumption of perfect competition in the input market, which is usually invalid. Besides, data on intermediate inputs is rare and it is usually unavailable in many datasets.

Another possible method is the instrument variable (IV), which aims to achieve consistency of coefficients in the production function by instrumenting the input variables that cause the endogeneity problems. However, Bound et al. (1995) suggest that when the correlation between the instruments and the endogeneous explanatory variable is weak, the IV method can be inconsistent, because of the use of instruments that explain little of the variation in the endogenous explanatory variable. Moreover, estimation results based on this method are biased in the same direction as OLS estimates in finite samples. Blundell and Bond (1999) propose a system GMM estimator using lagged first differences of the variables as instruments in the level equations, and find that this estimator yields more reasonable parameter estimates. Van Biesebroeck (2007) confirms that the system GMM estimator is the most robust technique in the presence of heterogeneity and endogeneity compared to other estimators (OLS, FE, Olley–Pakes, Levinsohn–

Petrin, IV). However, a few studies utilize GMM in the research field to justify the effects of FDI on productivity (Konings, 2001; Damijan et al′, 2003; Harris and Robinson, 2004; Bwalya, 2006; Haskel et al., 2007; Hale and Long, 2007; Barbosa and Eiris, 2009).

Regarding the specific studies on Vietnam, most researchers follow the usual approach of employing OLS, FE and RE in the estimation process (Nguyen Thi Tue Anh et al., 2006; Pham Xuan Kien, 2008; Le and Pomfret, 2011; Le Thanh Thuy, 2005; Nguyen Ngoc Anh et al., 2008; Hoang Van Thanh and Pham Thien Hoang, 2010). Hence it is crucial to employ methods that can perform well in controlling for endogeneity as well as other econometric issues while estimating FDI effects on productivity.

Another limitation regards the issue of under-investigating the mediating factors that affect the direction and magnitude of productivity spillover effects. Many existing papers tend to focus on examining the existence and direction of spillover effects on productivity, without or with only limited attention to the mediating factors of spillovers. In this literature survey, only 18 out of 59 papers consider the issue of mediating factors.

In the case of Vietnam, the same limitation exists, while only a limited number of studies take a closer look at some mediating factors that have effects on the results obtained for productivity spillovers (Javorcik, 2004; Pham Xuan Kien, 2008; Nguyen Phi Lan, 2008; Hoang Van Thanh and Pham Thien Hoang, 2010; Le and Pomfret, 2011). Hence the effects of mediating factors on the direction and extent of the productivity spillover effects of FDI need to be reaffirmed by an adequate focus.

Limitations on the data type (cross-sectional or panel data) and data aggregation (industry or firm level) used in research on the topic raise a concern about the estimation results. As analysed earlier, firm-level panel data seems to be the most appropriate for the analysis of FDI and productivity. However, when firm-level panel data is unavailable, estimations obtained from other types of data might present biased results. In the case of Vietnam, studies on FDI and productivity suffer from several data limitations. Some studies employ aggregate industry-level data, such as Le Thanh Thuy (2005), while some use case studies or survey results of firms in a selected year, which is difficult to generalize (Tran Ngoc Ca, 2002; Giround, 2007), and most researchers make use of data that covers only a short period of study, such as Nguyen Thi Tue Anh et al. (2006) for 2001;

Pham Xuan Kien (2008) for 2005; Nguyen Ngoc Anh et al. (2008) for 2000–2005; Tran Toan Thang (2011) for 2001–2005; and Le and Pomfret (2011) for 2000–2006.

Our work contributes to the growing body of research on FDI and productivity in several ways.

Firstly, unlike previous studies on the topic of FDI and productivity in Vietnam that focus only on indirect effects, this research is the first to examine the direct effects of FDI on productivity and the crowding-in/crowding-out effects of FDI in tandem with the indirect effects of FDI on productivity. This will produce a critical and thorough perception of the actual effects of FDI on the productivity of indigenous Vietnamese firms.

Secondly, this research devotes more effort to taking account of the endogeneity problem in the relationship between factor inputs and the level of productivity by employing a dynamic panel data methodology, specifically the GMM approach proposed by Arellano and Bond (1991) and Blundell and Bond (1998), which is expected to produce robust estimation results. GMM estimation is efficient and provides unbiased estimates in the presence of endogeneity.

Thirdly, the research investigates how firm, industry and regional heterogeneity impacts on the existences, signs and magnitutes of direct, crowding-in/crowding-out and spillovers effects in Vietnam. It goes beyond current literature which focus only on the sources of heterogeneity in spillovers and neglect these sources regarding direct and crowding-in/crowding-out effects.

Finally, the research utilizes a firm-level panel dataset for 10 years from 2001–2010, which has a longer time dimension compared to other earlier studies, to analyse all the associated studied effects of FDI on the productivity of firms in Vietnam.

As such, the research is expected to produce both comprehensive and robust evidence on the direct and spillover effects of FDI on the productivity of firms, as well as the crowding-in/crowding-out effects of FDI in Vietnam.

2.9 Conclusion

This chapter aims to provide a theoretical base and empirical review of the literature on FDI and productivity. The theory of internalization proposes that MNEs' foreign subsidiaries can be expected to enjoy higher productivity or profitability levels compared to local firms, suggesting a positive direct effect of FDI on productivity. However, the dual nature of FDI can cause direct effects of FDI on productivity to be less certain (Hymer, 1976). Neoclassical theories and new growth theories, represented by Marshall (1890), Arrow (1962), Romer (1986) and Jacobs (1969), explain the root of knowledge spillovers and how they affect growth. The theories hypothesize that interaction between firms and other firms in the same or different industries can generate spillovers that boost innovation and growth. In particular, Romer's new growth theory proposes that change in technological progress can enhance economic growth and development. This strand of theories provides a theoretical justification for FDI, with its embodied tangible and intangible assets, as a catalyst for economic growth and development, implying a positive spillover effect of FDI on productivity in the host country. However, the spillover effects become uncertain when the policy environment is endogenous (Hymer, 1960; Caves, 1996; Rugman and Verbeke, 1998), or alternatively when there are large technology gaps between foreign direct-invested firms and domestic firms (Cohen and Levinthal, 1989).

Furthermore, the argument on the crowding-out effect of FDI on the domestic market is also presented in the last part of this section, with the main contribution being Aitken and Harrison's work in 1999. These two authors hypothesize the reallocation of market shares from less productive domestic firms to more productive foreign firms when foreign-invested firms, with their advanced technology and know-how, enter the host country. From a policy perspective, these arguments raise concerns about the costs and benefits of attracting FDI, especially in developing or transitional countries, where FDI becomes a substitute for domestic investment due to the shortage of savings or other structural deficiencies. In such cases, FDI may perpetuate structural deficiencies rather than encouraging structural reforms.

The discussion focuses on 58 empirical papers on the topic in an attempt to record the effects of FDI on the productivity of local firms in both developed and developing countries, based on cross-sectional or panel data at industry or firm level and with various statistical methods employed. The literature review leads to several important empirical findings.

Firstly, in terms of direct effects of FDI on productivity, most papers affirm a positive relationship between foreign presence and FDI firms' productivity. Moreover, scant but strong empirical evidence demonstrates a crowding-out effect, especially in transitional or developing countries.

Secondly, regarding horizontal spillovers of FDI on productivity, most cross-sectional data and/or industry-level papers confirm the positive relationship between the presence of foreign investors and the productivity of domestic firms, while firm-level panel data papers produce ambiguous evidence on the same topic.

Thirdly, focusing on the vertical spillover effects of FDI on productivity, most of the empirical papers employ firm-level panel data, and a large proportion of papers obtain negative or no significant evidence on the effects of foreign presence on domestic firms' productivity.

Fourthly, TFP and output of firms are the most common measures of productivity in those empirical studies. As a result, there are two approaches to estimating productivity spillovers from FDI: a standard augmented production function or two-steps estimation through TFP.

Fifthly, concerning the measure of foreign presence, employment share, output share and equity share are among the most popular proxies for foreign presence in papers on both horizontal and vertical productivity spillovers.

Sixthly, relating to econometric methods that are employed in empirical studies, those studies that follow the standard approach use OLS, FE and RE as the most popular statistical tools for analysis. However, the two-step approach utilizes OP, LP and OLS as the predominant estimators for investigation.

Lastly, mediating factors that have an impact on the direction and magnitude of the corresponding effects of FDI on productivity have been stated clearly in the empirical results: the technology gap between foreign and domestic firms; characteristics of indigenous firms such as absorptive capability, size and ownership type; and characteristics of FDI such as distance between home and host countries, degree of foreign ownership and entry mode.

The gaps for research are identified in four categories and are expected to be bridged in this research in terms of thorough coverage, appropriate and effective econometric methods, a wide range of mediating factors and rich firm-level data.

CHAPTER 3: DATA AND METHODOLOGY

3.1 Introduction

This chapter first provides information on FDI in Vietnam, including FDI inflows by year, distribution of exports and employment by FDI-firms and non-FDI private- and state-owned firms, and distribution of FDI activity by geographical region. In section 3.3, we introduce the Vietnamese firm-level survey and the resulting dataset with respect to questionnaire design, sampling method, survey procedure, and potential strengths and weaknesses of the data in general. Section 3.4 provide detailed information on the samples used for estimating direct, corwding-in/out and spillover effects. Finally, section 3.5 discusses the modeling, econometric specification measurement and estimation issues.

3.2 FDI in Vietnam: Context and Stylized Facts

Vietnam is a developing country that has recorded remarkable success in terms of attracting FDI, following the legislative reform in 1987. The Law on Foreign Investment dated 29 December 1987 introduced a new regime under which FDI could enter Vietnam for the first time. With a view to removing the residual obstacles against foreign investors in Vietnam, major amendments were made to the first Law on Foreign Investment in 1992, 1996 and 2000. In 2006, the law was replaced by a Unified Investment Law, which regulates both domestic and foreign investment. Those changes and amendments have led to three outcomes: (i) higher levels of tax incentives; (ii) simplification of investment licensing procedures; and (iii) promotion of technology transfer.

Furthermore, the Vietnamese government also launched domestic reforms to provide a better investment climate. The reforms concerned the restructuring of state-owned enterprises (SOEs), the banking and financial system and the tax administration. Since 1986, the Vietnamese government has pursued the reform of SOEs with a view to releasing them to have autonomy in production and business activities. SOEs were permitted to perform independent accounting and to use revenues to finance expenditures, with no loss of compensation from the state. Seen as having poor performance and inefficiencies, SOEs were targeted for reform in two key elements: reducing the level of state ownership by "equitization" and divestment; and improving efficiency. Equitization refers to the privatization of a wholly state-owned enterprise by selling part or all of its assets and liabilities to the private sector, thus transforming the SOE into a joint-stock company. Through restructuring SOEs, state ownership of economic assets and production was reduced, which could improve Vietnam's overall growth prospects, as well as offering foreign investors better market access in specific sectors traditionally blocked by SOEs. However, in practice the progress of the reform has been slow, inhibited by factors such as disagreements over the value of assets and the fear of losing preferential credit from the state commercial bank.

The banking and financial system was substantially restructured in the 1990s. The goal of the banking-sector reform was to strengthen the financial position of, and public trust in, the banking system, and bring it closer to international standards. The reform began by separating the central bank (the State Bank of Vietnam, SBV) from commercial banks and allowing private banks to participate in the financial market. The SBV became independent and has been in charge of executing monetary policy and supervising the banking and finance sector. The sector has diversified in terms of participants and activities. New regulations were promulgated to enhance transparency and stabilization in the sector, which allows subsidiaries of foreign-owned banks on an equal basis to local banks. As an example, foreign-owned banks are now permitted to take unlimited local currency deposits from corporate borrowers and to issue credit cards.

The tax system in Vietnam has also undergone reform since the 1990s. The reform aimed to refine the tax system with the introduction of value added tax, company income tax and individual income tax. Moreover, the tax reform was targeted at achieving a gradual reduction of tax rates, more uniform tax ranges and improvements in the tax collection mechanism to meet the requirements of a market economy and the necessary legal conditions for accession to the World Trade Organization (WTO).

Inward FDI inflows into Vietnam have increased substantially over the last 25 years (1988–2013). According to the GSO, the country has attracted 17,500 FDI projects, with registered capital of USD 268.7 billion (see Figure 3.1).

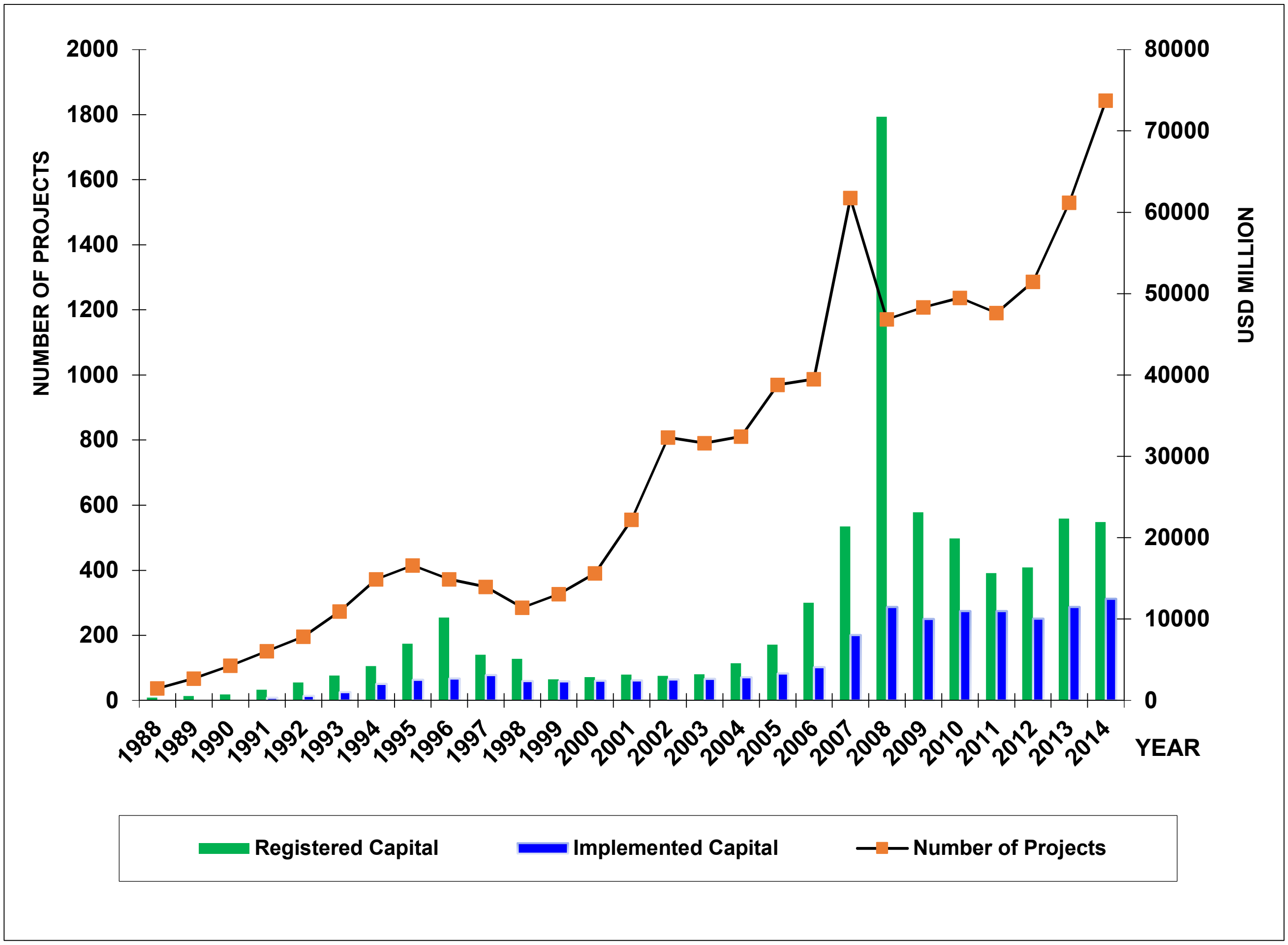

Figure 3.1: Inward FDI in Vietnam (1988–2014)

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Interestingly, there is a spike in the number of projects and in the registered capital in the years 2007 and 2008. The enormously increases of registered capital and number of projects origin from the significant amendments to the law that govern foreign direct investment in Vietnam in 2006. This Unified Investment Law regulates both domestic and foreign investment, creating a level playing field for domestic and foreign investors. The Law increased foreign investors' incentives to invest in Vietnam through three dimensions: higher levels of tax incentives; simplification of investment licensing procedures; and promotion of technology transfer. However, after the peak in 2008, two years after the Unified Investment Law came into enforcement, the global financial crisis started and affected the inward FDI in Vietnam. The crisis hit the number of projects and registered capital down from 2009 to 2011. The gradual recovery in all 3 categories of FDI performance has been made since 2012.

Figure 3.2 depicts the share of employment by economic sector in Vietnam from 2000–2012. It can be clearly seen from the figure that the share of employment and export of FDI enterprises in the total economic sector has increased year by year. In 2000, the share was only just over 11% of the total labour force. However, in 2012, foreign-invested firms employed 24.54% of the total labour force in Vietnam.

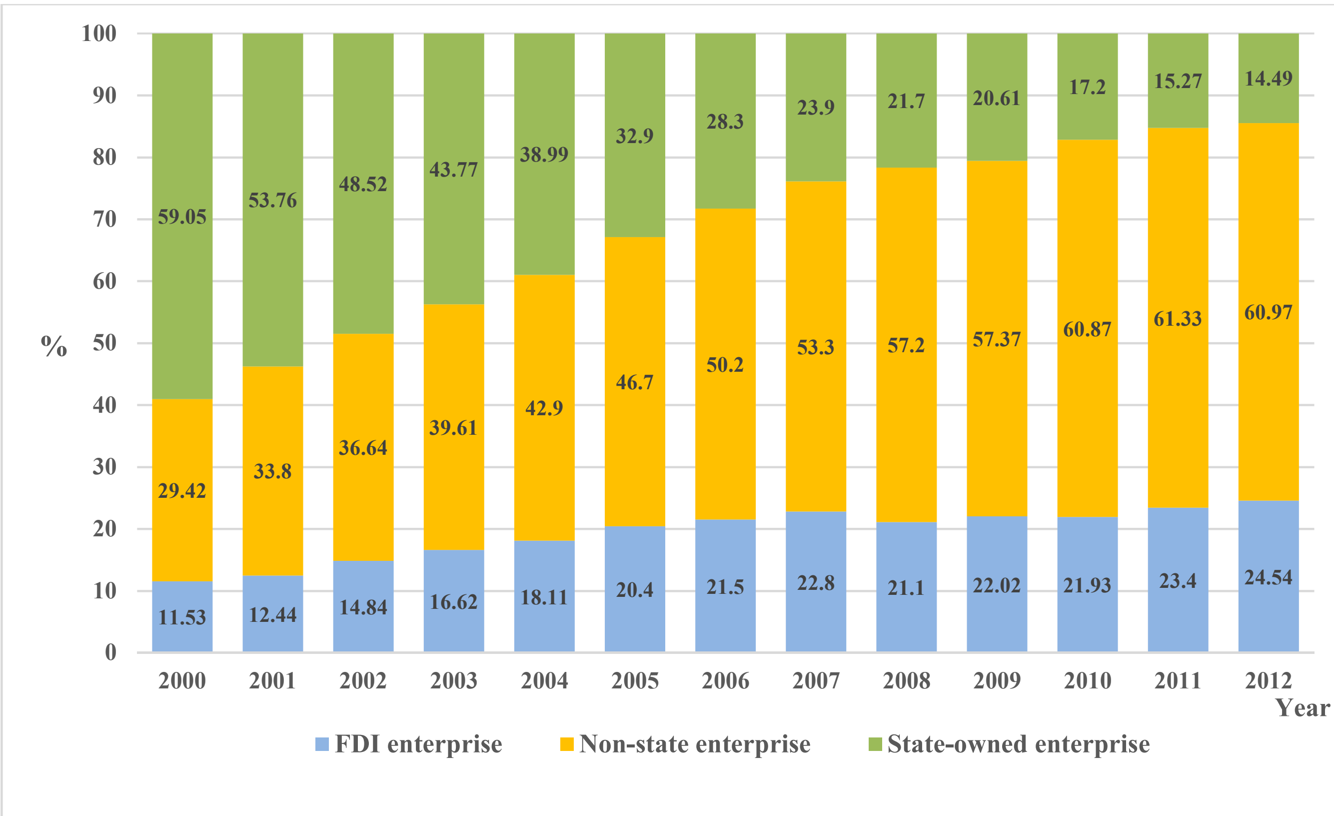

Figure 3.2: Structure of employees in enterprises in Vietnam (2000–2012)

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In terms of exports, the FDI sector has been playing an increasing role in the export performance of the whole economy. In the period 2000–2013, the proportion of exports from the FDI sector increased by 20 percentage points, from 47% to 67%. In 2013, the exports of the FDI sector were double those of the domestic sector. Those numbers confirm the indispensable contribution of FDI to export volumes in Vietnam (see Figure 3.3).

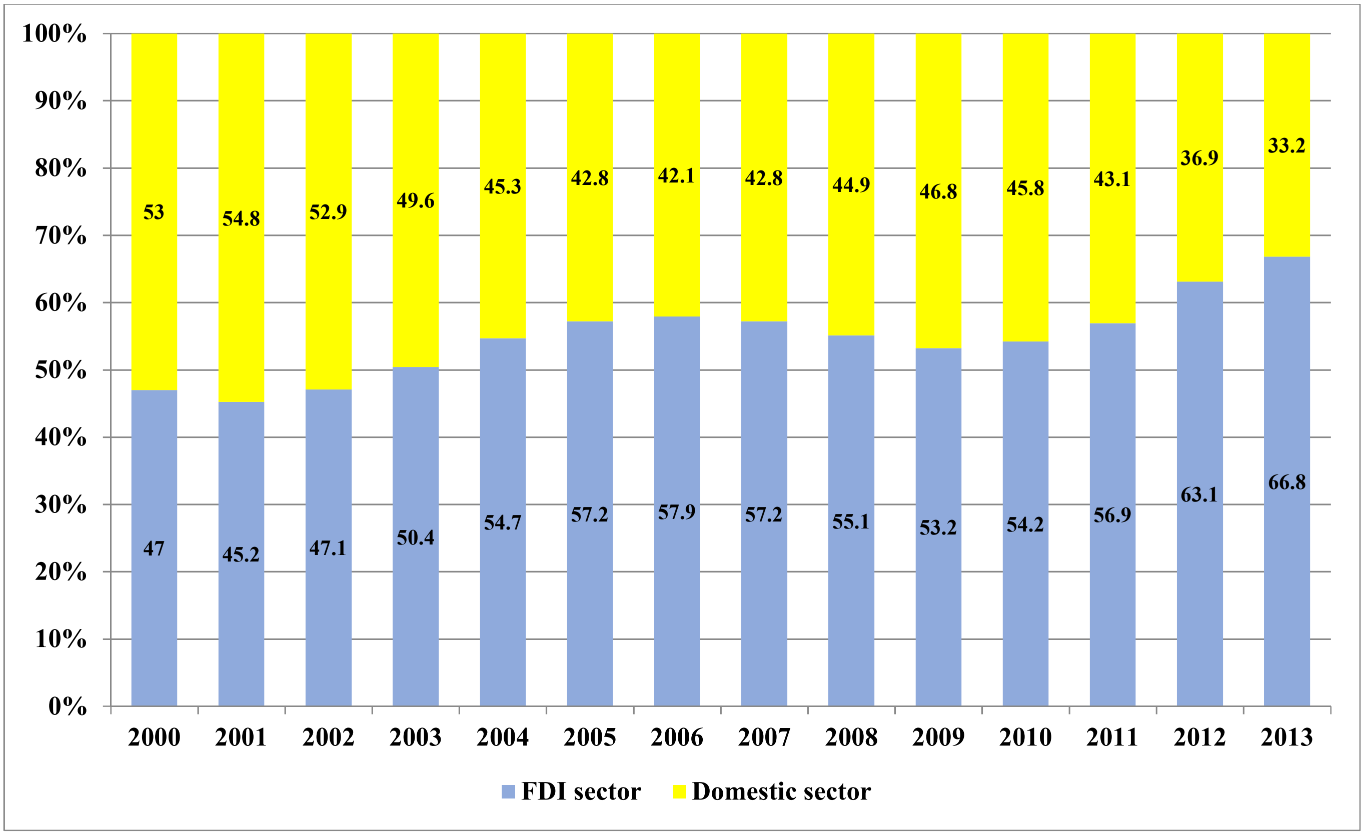

Figure 3.3: Exports of goods by inward FDI and domestic sector in Vietnam (2000–2013)

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The geographical distribution of FDI in Vietnam is apparently uneven. Foreign investors predominantly concentrate their investments in key economic areas where they can take advantage of more developed infrastructure and better labour-related factors (availability, costs, quality of workforce). Vietnam consists of 64 provinces that are divided into six economic regions: Red River Delta; Northern Midlands and Mountain areas; North Central and South Central Coast; Central Highlands; South East; and Mekong River Delta. The location distribution of FDI is highly concentrated in the South East region (which consists of Ho Chi Minh City, Dongnai, Baria-Vungtau, Binhduong, Binhphuoc, Ninhthuan, Tayninh and Binhthuan) and Red River Delta (which includes Hanoi, Haiphong, Vinhphuc, Bacninh, Haiduong, Hungyen, Namdinh, Hanam, Thaibinh and Ninhbinh).

Figure 3.4 depicts the share of the six economic regions in total accumulative registered capital, based on GSO statistics in 2015. In a period of 27 years (1988–2014), the South East region makes up nearly half of total registered capital, followed by the Red River Delta with 26% of the total. The two regions account for 68.81% of the total registered capital of the whole country. North Central and South Central Coast is the third most concentrated hub for FDI, with 20.27% of the total. In contrast, those numbers in the Northern Midlands and Mountain areas, Mekong River Delta and Central Highlands are modest because of unfavourable infrastructure, lack of skilled human resources and less appealing policies to attract FDI.

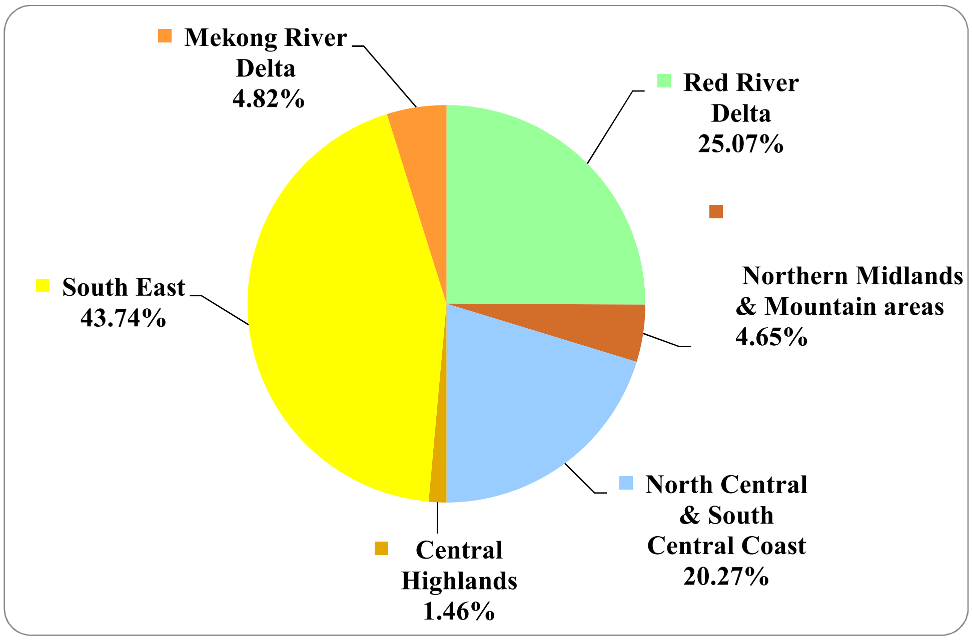

Figure 3.4: Registered capital of inward FDI in Vietnam by economic region (1988–2014)

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Figure 3.5 presents the share of the six economic regions in the total number of FDI projects all over the country from 1988–2014.

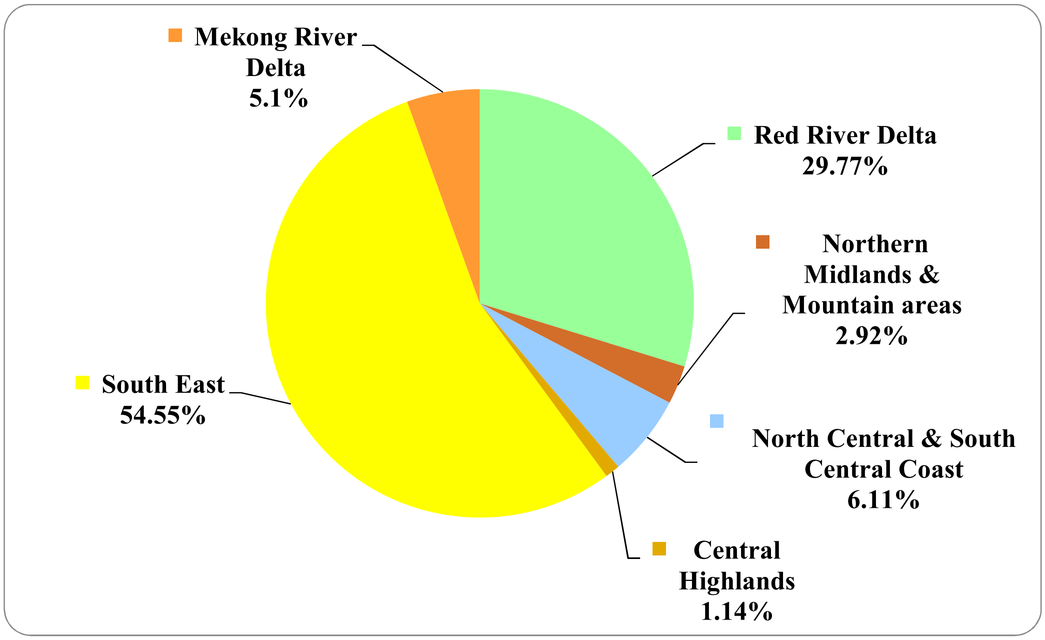

Figure 3.5: Number of inward FDI projects in Vietnam by economic region (1988–2014)

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It can be clearly seen from Figure 3.5 that the South East and the Red River Delta are the two biggest hubs for attracting FDI, while the Northern Midlands and Mountain areas and the Central Highlands are among the two least appealing regions for foreign investors in terms of number of projects. When comparing Figures 3.4 and 3.5, one interesting fact is that the North Central and South Central Coast region tends to attract the relatively big-value projects. The region takes up no more than 6% of the total number of projects, but occupies more than 20% of total registered capital.

3.3 Data Source and Data Quality

Data Source

This research employs firm-level panel data from the Vietnamese Annual Enterprise Survey, which has been conducted by the GSO since 2000. As a government agency, GSO is in charge of gathering, handling, analysing and distributing statistics on enterprises in Vietnam. The Annual Enterprise Survey pursues three general objectives: (i) collecting information on enterprises with a view to constructing the national accounts; (ii) maintaining the business register and establishing the sampling frame for other business sample surveys; and (iii) updating the Vietnamese enterprise databases (GSO, 2004).

An enterprise in the survey is referred to as "an economic unit that independently keeps business account and possesses its own legal status. It may be set up and operated under the regulations of State Enterprise Law, Cooperative Law, Enterprise Law, Foreign Investment Law or the Agreements between the Government of Vietnam and the Governments of Foreign Countries" (GSO, 2008, p.18). Overall, there are three types of enterprise embodied in the surveys.

2irst are state enterprises at the central and local levels, including also enterprises that are under the control of the Communist Party and mass organizations, the capital of which is provided by the government.

!econd are non-state enterprises, which include private enterprises and collective enterprises set up by Cooperative Law (except cooperatives of the agricultural, forestry and fishing sectors). Private enterprises can fall into one of three categories: partnership enterprises, limited liability enterprises and joint-stock enterprises (also including privatized state enterprises and enterprises that have a government capital share of less than 50%).

9hird are foreign enterprises, which consist of wholly owned foreign enterprises and joint-venture enterprises.

The dataset contains the census and surveyed samples of officially registered enterprises performing in all sectors of the economy, namely agriculture, industry and construction, and services, excluding cooperatives in the agricultural, forestry and fishing sectors and business households. Industrial classification is based on the main activity of the enterprise that contributes the largest share to its total gross output. The survey is carried out annually in the second quarter of the year, usually on 1 March. Enterprises are included in the survey if they were still active on 31 December of the previous year. The survey provides a wide range of information about business activities, type of ownership, employees, assets and liabilities, capital stock, business results, the firm's location, the industry in which the firm operates, the firm's contribution to the state budget and so on. As such, the survey is by far the most inclusive dataset available on firms in Vietnam.

As stated earlier, officially registered firms that were in existence on 31 December of the previous year are included in the survey. Each firm in the dataset has its own tax code. The GSO recodes the tax code into a nine-digit enterprise code to preserve confidentiality. The enterprise code is unique and stays unchanged over the years; hence, the code act as a unique identifier that enables researchers to build a panel dataset.

Sampling Method

The Annual Enterprise Survey is conducted based on census and sample survey methods. Firms in the survey belong to three categories of ownership: state-owned, non-state-owned and foreign-invested firms.[5] The census survey method applies to all state-owned enterprises and foreign-owned firms, regardless of size threshold, as well as collectives and private enterprises (non-state enterprises) that have more than 10 employees. The sample survey method is used in two cases: the first is for surveying non-state enterprises that have fewer than 10 employees; and the second is for obtaining production and business costs. It should be noted that all individual business households and collectives of agriculture, forestry and fishery are excluded from the survey.

Questionnaire Design

Despite some adjustments over time, the Annual Enterprise Survey is conducted consistently on the basis of two kinds of questionnaires. The first type is used for obtaining general business information. Every enterprise surveyed needs to fill out this type of questionnaire, either in the long form or short form, depending on its ownership structure and size in terms of number of employees. More concretely, the long form is designed for all SOEs, all foreign-invested enterprises, all non-state enterprises with more than 10 employees and 20% of non-state enterprises with fewer than 10 employees. The short-form questionnaire pertains to the remaining non-state enterprises with fewer than 10 employees, but not to those selected to be surveyed with the long-form questionnaire. It should be noted that every enterprise fills out only a short form or a long form, not both of them. The second type of questionnaire targets business costs, which consists of information on an enterprise's outputs, intermediate consumption and value added. Usually around

[5] There are three types of enterprise ownership in Vietnam: state enterprises, non-state enterprises (collective, private, household) and foreign-invested enterprises. Households are excluded from the survey.

10–15% of the total number of enterprises surveyed come under the coverage of this kind of questionnaire.

Survey Procedure

It is worthy of note that, although GSO bears a general responsibility to undertake the survey, the data collection is mainly carried out by Provincial Statistical Offices (PSOs). The GSO and PSOs share responsibility for data collection. In the first stage, the GSO will design the survey and do the sample selection. After that, it will instruct the staff of PSOs on the survey. Next, PSOs recruit and train enumerators and supervisors on the survey. At the same time, PSOs organize training workshops for chief accountants and statisticians of enterprises on the content of the survey and questionnaires. There are two means that PSOs employ to obtain the data: direct data gathering and indirect data gathering.

- Direct data .atherin.: enumerators interview respondents directly, requesting data and explanations of circumstances. Based on the reported results, the enumerators fill out the questionnaire. This method of data gathering is aimed at the business environment questionnaire and survey units that have not fully followed accounting standards, and/or are unable to fill out the questionnaire themselves, such as small enterprises, enterprises preparing for dissolution, enterprises under investigation and so on.

- 3ndirect data .atherin.: enumerators instruct the survey units directly on how to fill out the questionnaires, where to send them, how to send them and timescale for sending in completed questionnaires. The survey units fill out the questionnaires on their own and send the finished questionnaires back to the survey organizer.

Finally, after enterprises complete the questionnaires, PSOs conduct data collection at survey units. Data checking and data entry are conducted by PSOs. Subsequently, the data will be transferred to the Computer Centre of the GSO for data processing. The results of the survey are usually obtainable at the end of the third quarter annually.

Strengths and Drawbacks of the Data

The major strength of the data originates from its scope, while containing almost all enterprises listed in the Vietnam Standard Industrial Classification (VSIC) code, operating in agriculture, industry and construction, and services. Detailed information on labour, capital, output and other business-relevant indicators is offered in the survey results. The second strength of the data comes from its span of a more than 10-year period, which allows researchers to observe the research objectives over the long term. Having been officially collected by GSO in a standardized way, the data hence offers researchers the chance to compare differences between firms or industries through a long period. Last but not least, the third strength lies in both extensive and intensive data on foreign-invested firms. Although the sampling method for collective and private firms is diverse, the consistent use of the census survey method for retrieving information on all foreign-invested firms as well as SOEs in the whole economy brings researchers the chance to capture clearly and thoroughly the nature and behavior of those firms over time. For the above reasons, the dataset is by far the most comprehensive record of firms in Vietnam.

However, the dataset still contains some weaknesses. First, the data offers incomplete information on exports, imports, and inputs of production and service sectors, and produces no information on work hours and labour skills. Moreover, the inconsistency of measurement units of variables in different years leads to difficulty in building a precise panel dataset. Apart from this, the data excludes firms that were merged or changed their main business activities, and firms that completed the registration procedure but did not start to operate before 31 December of the year preceding the survey year.

Data Reliability and Validity

Bryman and Bell (2003) define the reliability of data as "the consistency of a measure of a concept." Reliability can be examined through three characteristics: the stability of a measure over time, the consistency of indicators and the agreement of observations. Moreover, the two researchers assert that validity of data refers to the issue of whether indicators designed to measure a concept really do measure that concept.

Before 2000, data on enterprises in Vietnam was collected mainly through a statistical reporting system. The aim of the survey was to take a full enumeration of SOEs, which were prominent at that time. The GSO circulated standardized data sheets and sent them out to enterprises. After completing the sheets, the enterprises forwarded them to statistical offices by the identified reporting data. However, the response rate of this method was quite low and the data collected lacked a basis to ensure data comparability (GSO, 2004).

Since 2000, the GSO has been undertaking a new and consistent approach to conducting the survey in an effort to improve the data quality and data collection system. Data is now gathered through a unique annual business survey for all sectors and industries in the economy, starting on 1 March each year. The sampling method, questionnaire design and survey procedure are stable year after year. The main indicators of a company profile, such as labour, capital, output, main business activities, location and so on, are recorded systematically. Therefore, the comparability of the information from year to year is assured.

As mentioned above, the GSO publishes and disseminates the data to users. Unfortunately, the data collection procedure cannot be observed practically, posing some threats of uncertainty about the total reliability and full validity of the data. Nevertheless, although the data stems from an official source, this fact cannot guarantee that the data is absolutely perfect, as there might have been some errors in collecting, checking, inputting, transferring and summarizing data through the data processing procedure. However, with the credibility of the data collector (the GSO) and the skills of specialists in data acquisition, it is worth trusting the reliability and validity of the data. By and large, the data used in this research can be considered to have enough reliability and validity to conduct the research.

3.4 Estimation Samples

Throughout the research, we refer to firms with a foreign partner as “FDI firm” and firms without a foreign partner as “domestic firms” or “domestically owned firms.” Also, in this research domestic firms are defined as including state-owned firms, domestic private firms and non-state collective establishments. Foreign firms are defined as all establishments with foreign investors, as regulated in the Vietnamese Investment Law of 2005.

Current literature on FDI and productivity mainly focuses on the manufacturing sector only (Caves, 1974; Aitken and Harrison, 1999; Blomstrom and Sjoholm, 1999; Hu and Jefferson, 2002; Javorcik, 2004; Haskel et al., 2007; Barbosa and Eiris, 2009; Le and Pomfret, 2011; Tran Toan Thang, 2011). However, our study goes beyond manufacturing to include non-manufacturing production sectors such as utilities (electricity, gas and water supply), construction, science and technology industries, and computer and related activities. These sectors, in turn, include 28 industries at the two-digit level (23 industries in manufacturing, 2 industries in utilities, and 1 industry in each of construction, science and technology activities, and computer and related activities). The industry classification is based on the VSIC. The dataset consists of 166,697 firms from 2001–2010. In this thesis, we categorize these five sectors into two groups: manufacturing sector and non-manufacturing production sectors (which consist of utilities, construction, science and technology activities, and computer and related activities). The wider coverage in our sample is justified on the grounds that the added industries either contribute to production of intermediate and final goods used in manufacturing (as is the case with respect to construction, science and technology and computer-related industries) or they are important for the quality of the infrasturture required for manufacturing production (as is the case with respect to construction and utilities). However, we conduct sensitivity checks to ensure that our reported results are not driven by sample selection.

Table 3.1 illustrates the FDI presence in two groups of sectors and in the full sample that is examined in this thesis. The number of FDI firms in non-manufacturing has been increasing year by year. The number of firms in 2005 was double that in 2001. In 2010, the number of FDI firms was 3.5 times larger compared to those in 2005. However, compared to the number of firms in the manufacturing sector in the same years, these numbers are very small. Moreover, non-manufacturing production FDI firms are small in terms of number of average employees, with around 50–60 persons. The employment size of manufacturing firms ranges between 300 and 400 persons, which is between six and eight times bigger than that of non-manufacturing production sectors. The average real turnover of non-manufacturing production FDI firms has been fluctuating between Vietnamese dong (VND) 40 to 60 billion per year, while those in the manufacturing sector vary from VND 76 to 147 billion. Interestingly, the average turnover of firms in the manufacturing sector is only double their counterparts, while the other indicators above are many times bigger.

Table 3.1: FDI presence in Vietnam (2001–2010)

Indicator \ Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of FDI firms (unit)										
4on--anufacturin. production sectors	89	95	104	134	177	221	332	384	482	619
@anufacturin. sectors	1,509	1,629	1,929	2,241	2,550	2,971	3,474	3,937	4,326	4,561
2ull sa-ple	1,598	1,724	2,033	2,375	2,727	3,192	3,806	4,321	4,808	5,180
Average employees of FDI firms (person)										
4on--anufacturin. production sectors	55	72	66	55	58	49	48	57	56	42
@anufacturin. sectors	285	306	364	388	408	401	414	419	408	397
2ull sa-ple	271	292	348	369	383	376	384	387	374	356
Average real turnover of FDI firms (million VND)										
4on--anufacturin. production sectors	38,165.81	46,376.99	41,280.07	34,142.43	34,686.91	58,166.15	55,358.24	61,633.97	43,804.67	42,219.47
@anufacturin. sectors	76,348.75	91,264.06	103,091.70	103,415.40	108,098.20	115,664.20	122,076.00	117,853.00	120,245.90	147,289.90
2ull sa-ple	74,222.16	88,982.12	100,055.40	99,493.73	103,418.10	111,711.90	116,730.00	113,007.70	112,702.70	135,186.10

!ource: "uthorAs calculation fro- the dataset

All these figures indicate that not only FDI firms in manufacturing but also those in non-manufacturing production sectors are active and present in Vietnam's economic sectors. They inspire us to explore the relationship between FDI and productivity in both manufacturing and non-manufacturing sectors so as to have a thorough investigation of the topic.

Next in this section, we provide brief information on firms through several characteristics (Table 3.2 and Table 3.3) that are examined in this thesis. Table 3.2 summarizes the number of firms in the dataset and in three baseline specifications of three corresponding empirical chapters, respectively (Chapter 4 for direct effects, Chapter 5 for crowding-in/crowding-out effects and Chapter 6 for spillover effects). We investigate the numbers of firms by characteristics such as ownership type (domestic firms and foreign firms), size (small firms and medium-sized and large firms) and R&D status (non-active R&D firms and active R&D firms) through utilizing the e(sample) option in Stata. These characteristics are also examined as sources of heterogeneity in the three following empirical chapters.

Table 3.2: Number of firms in Vietnam (2001–2010) by firm characteristics

Sample size	Total number of firms (1)	By firm ownership type			By firm size			By firm R&D status		
		Domestic (2)	Foreign (3)	(4) =(2)/(3)	Small (5)	Medium and large (6)	(7) =(5)/(6)	Non-active R&D (8)	Active R&D (9)	(10) =(8)/(9)
Whole sample	166,697	159,829	6,868	23	139,704	27,993	5	158,674	8,023	20
Chapter 4 baseline estimation sample	54,353	51,775	2,578	20	44,731	9,622	5	48,938	5,415	9
Chapter 5 baseline estimation sample	64,527	60,068	4,459	13	47,295	17,232	3	56,630	7,897	7
Chapter 6 baseline estimation sample	27,129	25,204	1,925	13	20,548	6,581	3	22,554	4,575	5

Source: Author's calculation from the dataset

From Table 3.2, we reaffirm that this 10-year panel dataset contains more than 166,000 firms. However, when we run the baseline models, the number of firms decreases significantly. In the baseline of Chapter 4, the number is one-third the total number before estimation. In Chapter 5, the number is 64,500, or 38.7% of the full sample before estimation. This may be on the grounds that the missing values of corresponding variables in the models lead to the reduction. In particular, the baseline of the Chapter 6 number further reduces to roughly 27,000. As we work on both contemporaneous and lagged variables in Chapter 6, this downsizing in number of firms is due to the lag structures of the variables of interest. Therefore, the data at hand may be considered as representative of the baseline samples in this thesis.

We then break down the number of firms by three characteristics: firm ownership type, firm size and firm R&D status. In each category, we split them into smaller groups (domestic vs. foreign; small vs. medium and large; non-active R&D vs. active R&D firms) and calculate the ratio between the former and the latter in the same category. The same pattern throughout the three categories is that domestic, small and non-active R&D firms are dominant. In the whole sample, we obtain relatively large ratios between domestic vs. foreign firms and non-active vs. active R&D firms. However, in the firm size category, the ratios range between 3 and 5 for both whole and sub-samples. The numbers in columns 4, 7 and 10 show a consistent between–sample size comparison: while the whole sample generally witnesses big differences between the number of firms in two groups of the same category, the three empirical chapters present fewer dissimilarities after the effects of missing data, as analysed above.

Next, we investigate the numbers of firms by the six economic regions in Vietnam, namely Red River Delta, Northern Midlands and Mountain areas, North Central and South Central Coast, Central Highlands, South East and Mekong River Delta. We find the number of firms in each economic region and correspondingly with the whole sample and sub-samples on three baseline empirical models in Chapters 4, 5 and 6 using `code,oo#` and `code,oo#` with `e(sa-ple` option in Stata, as utilized in Table 3.2. We then calculate the proportion of each number of firms in a cell, with the corresponding total of firms presented in the asterisked columns. All the results are tabulated in Table 3.3.

Table 3.3: Number of firms in Vietnam (2001–2010) by economic region

Sample size	**Total number of firms (*)**	**Red River Delta**		**Northern Midlands and Mountain areas**		**North Central and South Central Coast**		**Central Highlands**		**South East**		**Mekong River Delta**	
		Unit	***% in (*)***	***Unit***	***% in (*)***	***Unit***	***% in (*)***	***Unit***	***% in (*)***	***Unit***	***% in (*)***	***Unit***	***% in (*)***
Whole sample	166,697	45,327	27	12,304	8	20,613	12	4,358	3	68,286	41	15,809	9
Chapter 4 baseline estimation sample	54,353	12,951	24	1,744	3	4,663	9	792	1	29,999	55	4,204	8
Chapter 5 baseline estimation sample	64,527	17,398	27	5,668	9	9,695	15	1,891	3	22,157	34	7,718	12
Chapter 6 baseline estimation sample	27,129	5,890	22	964	4	1,937	7	314	1	15,874	59	2,150	8

!ource: "uthorAs calculation fro - the dataset

From Table 3.3, we see that in the three empirical chapters, Chapter 5 includes more firms and Chapter 6 covers fewer firms in the baseline estimations. Also, we can recognize coherently that the South East region takes up a large proportion of the whole sample as well as in three sub-samples in empirical chapters. The Red River Delta is the second biggest region in terms of number of firms in four investigated sample sizes. North Central and South Central Coast and Mekong River Delta are the third-ranked performers, while Northern Midlands and Mountain areas and Central Highlands rank bottom regarding number of firms. These findings are in line with the findings on the characteristics of the six economic regions in terms of regional rankings presented in Table 4.7 in Chapter 4.

3.5 Methodology

3.5.1 Estimation Strategy

The framework of examining FDI effects on productivity is usually based on estimation of Cobb-Douglas production function. A standard approach is to estimate an augmented production function with proxies for foreign presence (Aitken and Harrison, 1999; Dimelis and Louri, 2004). Assuming perfect competition in factor markets and separability of the conventional inputs (capital and labour) from foreign direct investment (F), the production function can be stated as:

$$Y_{it} = A_{ijt}e^{\lambda t}\left(K_{ijt}^{\alpha}L_{ijt}^{\beta}\right)e^{u_{ijt}} \tag{3.1}$$

Here, ***7*** is deflated output (sales or value added) of the ith firm in industry *B* at time t; ***6*** is deflated physical capital stock; ***5*** is labour (number of employees or hours worked); and A is Hicks-neutral technology, whereby technological change at the rate of λ leaves the capital/labour unchanged. We augment the Cobb–Douglas production function by modelling technology as a function of FDI intensity. This departure is justified if, theoretically, FDI intensity affects technology and through that affects productivity. Hence, let $A_{ijt}e^{\lambda t} = \tilde{A}_{ijt}e^{\lambda t} * F_{ijt}^{\gamma}$, where $\tilde{A}$ captures technology shocks unobservable to the researchers and F is a proxy for observable technological change due to FDI. This specification implies that the Hicks-neutral technology can be decomposed into two components: an unobservable component ($\tilde{A}_{ijt}e^{\lambda t}$) and an observable component (F_{ijt}^{γ}) that depends on FDI intensity. For a given level of unobservable technology, FDI intensity affects the level of technological change by a factor γ. Then Equation 3.1 can be restated as:

$$Y_{it} = \tilde{A}_{ijt}e^{\lambda t}F_{ijt}^{\gamma}\left(K_{ijt}^{\alpha}L_{ijt}^{\beta}\right)e^{u_{ijt}} \tag{3.2}$$

Taking natural logarithms and using lower-case letters to denote the corresponding values, the empirical model can be written as:

$$y_{it} = a_0 + \eta_i + \mu_j + \delta_t + \alpha k_{ijt} + \beta l_{ijt} + \gamma f_{ijt} + u_{ijt} \tag{3.3}$$

The log of unobservable technical change ($\tilde{A}_{ijt}e^{\lambda t}$) yields a constant technology effect (a_0), a firm-specific effect (η_i), an industry-specific effect (μ_j) and a time effect (δ_t). On the other hand, u_{ijt} is a white-noise disturbance term with a zero mean and a constant variance. The coefficients on capital, labour and FDI intensity (α, β and γ) are elasticities of output with respect to two conventional inputs and FDI intensity as a factor that influences technology.

To purge the fixed effects (η_i), the general practice is to estimate the model by first-differencing or using a within estimator (fixed-effect estimator) based on the deviation of the firm/year observations from the firm mean over time. To control for time effects and industry-specific fixed effects, the general practice is to use year and industry dummies. Using a within estimator, the estimated model will look like Equation 3.4, where $\ddot{k}, \ddot{l}$ and $\ddot{f}$ are deviations from firm mean over time, and I_j and T_t are industry and year dummies, respectively:

$$\ddot{y}_{it} = \alpha\ddot{k}_{ijt} + \beta\ddot{l}_{ijt} + \gamma\ddot{f}_{ijt} + I_j + T_t + v_{ijt} \tag{3.4}$$

Moreover, to estimate the spillover effects of FDI on productivity, researchers can apply the alternative approach, which involves three steps. First, Equation 3.4 is estimated with capital and labour (excluding the measure of FDI intensity) for each industry. Formally:

$$\ddot{y}_{it} = \alpha\ddot{k}_{ijt} + \beta\ddot{l}_{ijt} + I_j + T_t + \omega_{ijt} \tag{3.5}$$

In the second step, TFP is obtained by subtracting the output from the estimated contributions of capital and labour, as indicated in Equation 3.6:

$$TFP_{ijt} = y_{ijt} - \left(\hat{\alpha}k_{ijt} + \hat{\beta}l_{ijt}\right) = \hat{a}_0 + \hat{\omega}_{ijt} \tag{3.6}$$

Stated explicitly, TFP is equal to the estimated constant term plus the error term.

In the third step, the TFP is regressed on proxies for FDI intensity (share of foreign investors in firm equity or FDI intensity at the industry level) to estimate the direct and indirect effects of FDI on TFP in accordance with Equation 3.7:

$$TFP_{ijt} = \rho_0 + \rho_1 f_{ijt} + \varepsilon_{ijt} \tag{3.7}$$

The literature does not provide a clear guideline on which approach is preferable. One reason is that both the augmented production function and TFP estimates are based on the assumption of perfect competition, and both are vulnerable to the same set of measurement errors with respect to inputs and outputs. Secondly, different estimation methods are likely to yield different output elasticities, and these differences are conducive to variation in TFP estimates. However, the TFP estimate is subject to additional biases. As first pointed out by Marschak and Andrews (1944), input choices are likely to be correlated with the firm's TFP. To the extent that this is the case, efficient firms are likely to hire more inputs. There is also potential selection bias when panel data is used. This is because less efficient firms – those with low $\widehat{\omega}_{ijt}$ – are more likely to exit from the sample because low productivity is associated with higher hazard rates (Ugur et al., 2015). Therefore, we estimate the productivity effects of FDI using the production function approach rather than the TFP approach. However, we conduct sensitivity checks using the baseline model. To obtain robust evidence on the direct and indirect effects of foreign presence on productivity, we control not only for fixed effects but also for potential endogeneity using the dynamic panel estimator proposed by Blundell and Bond (1998, 2000).

The framework for examining the crowding-in/crowding-out effects of FDI on productivity was first developed by Aitken and Harrison (1999). This framework shares a similarity with the augmented Cobb–Douglas production function in the way of regressing firms' output with FDI intensity. The difference between the two frameworks is that the crowding-in/crowding-out framework is usually based on estimation of a turnover equation, which omits the input factors of production. The input factors are excluded with a view to examining the effect of foreign presence on the production scale of domestic firms, rather than productivity.

Throughout the three empirical chapters for direct, crowding-in/crowding-out and spillover effects of FDI on productivity, we check the heterogeneity of the findings by re-estimating the base model by economic regions, firm ownership types, firm size classes, firm R&D status and levels of concentration in the industry. Various approaches have been utilized to deal with variables that may produce sources of heterogeneity in these chapters: (i) splitting the whole sample using dummy variables for firm size classes, firm R&D status and economic region; (ii) restricting the sample using median/25% bottom/25% top values of variables (in case of industry concentration); or (iii) generating the interaction terms between two variables of interest if applicable (for example, the interaction term between foreign presence at firm level and one variable that causes heterogeneity in Chapter 4 to see how the variable influences the direct effects of FDI).

3.5.2 Overview of Productivity Measures

To estimate Model 3.3, researchers can select from a wide range of estimation methodologies, which include: (i) non-parametric methods; (ii) semi-parametric methods; and (iii) parametric methods (Biesebroeck, 2007). Figure 3.6 below provides a visual summary of the potential methods for estimation.

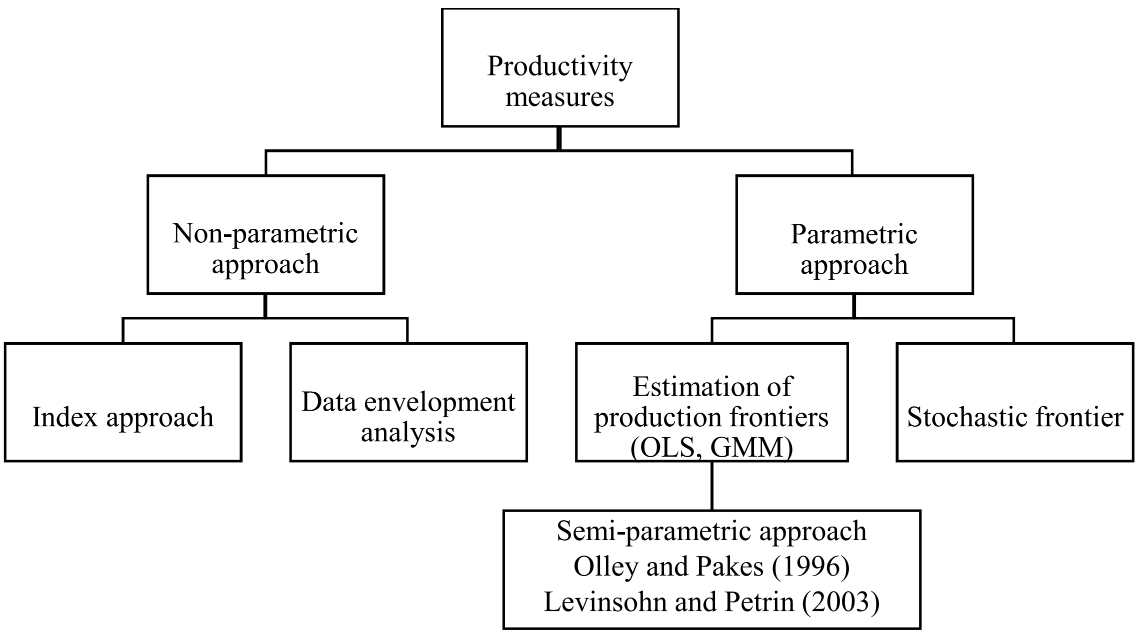

Figure 3.6: Techniques to estimate productivity

Source: Author's analysis based on Biesebroeck (2007)

Data envelopment analysis (DEA) uses linear programming to estimate productivity. As summarized in Biesebroeck (2007), DEA is not concerned with a production function. As an alternative, it focuses on the ratio of a linear combination of outputs over a linear combination of inputs compared across observations. The method presents a piece-wise linear production function frontier in input–output space over the most efficient observations. Biesebroeck suggests that the advantage of DEA is its ability to deal with many outputs in a consistent way, but its disadvantage originates from its non-stochastic nature, which makes the method sensitive to outliers.

Index numbers is another non-parametric method to estimate productivity. A number of assumptions have been put forward in this method: returns to scale are constant; firms maximize profit; and they operate in competitive input and output markets. As an extension of the method, the multilateral index number approach developed by Good et al. (1997) uses a “hypothetical firm” or “reference firm” to measure the proportional difference in the TFP of any firm to a reference firm in each industry. The reference firm is the firm that has the arithmetic mean values of log output, log inputs and cost shares over all firms in the same industry in each year. The main advantages of index numbers are the ease of calculation, the ability to control multiple outputs and a large number of inputs, and the capability of handling flexible and heterogeneous production technology (Biesebroeck, 2007). However, their disadvantage lies in their requirement for the assumptions of firm behaviour and market structure, as mentioned above. Moreover, the index number is not likely to account for outliers or measurement errors.

Semi-parametric methods follow two popular approaches, that of Olley and Pakes (1996) using investment and that of Levinsohn and Petrin (2003) employing the intermediate input cost as proxies to quantify the change in TFP. Olley and Pakes (1996) estimate the productivity effects of restructuring in the telecommunications equipment industry in the USA. Two assumptions are used in this approach. Firstly, productivity, which is a state variable in the firm’s dynamic problem, is supposed to follow a Markov process that is unaffected by the firm’s control variables. Secondly, one of the firm’s control variables, which is investment in this approach, grows to be part of the capital stock with a one-period lag. According to Biesebroeck (2007), the advantages of Olley and Pakes’ (1996) study originate from its flexibility in characterizing productivity when assuming that it is following the Markov process. Apart from that, the demerit is the requirement for non-zero investment observations, for which many datasets fail to build a large number of observations. This weakness is overcome by Levinsohn and Petrin (2003) while employing material input as an alternative for a productivity proxy.

Parametric methods (OLS, stochastic frontier analysis [SFA], GMM etc.) aim to estimate productivity through a production function. Those methods assume constant input elasticities (factor shares) across firms. An additional assumption in polled ordinary least-squares (Pooled OLS) is that the firm-specific effect (the term η_i in Model 3.3.) does not vary across firms. Its main advantage is that the coefficient estimates are (BLUE – best linear unbiased and efficient) if the standard OLS assumptions hold. However, Equation 3.3. is not determined if the firm-specific effects vary across firms. Even if the firm-specific effects are the same across firms, the pooled OLS would yield biased coefficient estimates if there is simultaneity or reverese causality between inputs and outputs in the production function (Marschak and Andrews, 1944).

SFA originates from the studies of Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977). These researchers model productivity as a stochastic from the negative of an exponential or half-normal distribution. SFA estimation is usually with maximum likelihood. The advantage of the method is its ease of implementation. However, the disadvantage is that it consumes many degrees of freedom (Biesebroeck, 2007).

GMM dates back to Blundell and Bond (1998), and Blundell and Bond (2000) were the first to apply it to estimate production functions. Biesebroeck (2007) discusses the pros and cons of the method. The advantages of GMM are its flexibility in generating instruments and the possibility of testing for over-identification if many instruments are used. The disadvantages are its requirement for long panel data and the uncertainty over the reliability and validity of the instrument's work in practice.

As can be clearly seen from the literature survey in Chapter 2 of this thesis, among non-parametric and parametric methods, OLS, FE and RE, GMM, Olley–Pakes and Levinsohn–Petrin are the most popular methods used in this research field.

3.5.3 Estimation Issues

With a view to obtaining consistent and unbiased results from estimating the production function, a number of econometric concerns need to be tackled.

The first issue is o-itted varia,les. Firm-, time- and region-specific factors may exist that may have impacts on the relationship between a firm's productivity and a foreign presence. Those specific factors are known to the firm but unknown to the econometrician. High-quality management and better infrastructure present in a region are examples of those specific factors. According to Haskel et al. (2007), the cure for addressing this problem is by differencing the data to remove any possible correlation between explanatory variables and firm-specific effects.

The second issue is about endo.eneit/ or si-ultaneit/ ,ias. Griliches and Mairesse (1998) and Nickell (1996) propose that inputs should be treated as endogenous variables, since producers choose the level or usage rate based on cost and productivity considerations. These considerations are observed by producers but not by econometricians. Simultaneity bias occurs because productivity is known to firms when they make their input choices, but is unobservable to econometricians (Marschak and Andrews, 1944). Putting this in a technical way, most of the estimation issues arise from the nature of the equation error ε_{it}. If the error term is independently and identically distributed and therefore uncorrelated with input choices, the OLS estimator will be consistent but inefficient, while FE and RE are both consistent and efficient. Under this circumstance, the Hausman test is employed to choose between FE and RE. Conversely, if input choices are correlated with unobservable factors, which are known to a firm's managers but unknown to econometricians, both OLS and FE/RE will be inconsistent. According to Bwalya (2006), unobservable factors emerge from difficulties in observing and quantifying differences in the quality of human capital, capital intensity and productivity shock across firms and industries. Because the differences are barely captured by the survey method, they accumulate in a random term, causing input variables to be correlated with the error term. Moreover, researchers cannot directly observe how firms react to a firm-specific productivity shock. For instance, a firm might respond to a positive productivity shock by enlarging the inputs it uses and vice versa (which the researchers have no chance to assess). As a result, estimating production functions by employing OLS will lead to biased results, as OLS takes no account of unobserved productivity shocks. Moreover, the FE method may solve the simultaneity problem only when the unobserved, firm-specific productivity is assumed to be time invariant. Hence there is a need to employ other methods, including an instrumental variable or system GMM, to detect this endogeneity problem adequately while estimating the parameters of production functions.

Input endogeneity or simultaneity bias is solved in two ways. The first is by employing a semi-parametric method, and the second is by implementing an instrumental variable method, in which lagged levels are used as instruments in the production function. Semi-parametric methods that allow for firm-specific productivity differences to exhibit idiosyncratic changes over time are often used in recent literature. This method can address the simultaneity bias between productivity shocks and input choices. The aim of semi-parametric methods is to find a proxy variable that monotonically replicates productivity dynamics. According to Arellano and Bond (1991), if the error term ε_{it} is found to be non-persistent, a standard GMM estimator will be both consistent and efficient. If, however, the dynamic error processes are highly persistent, lagged levels are supposed to be poor instruments for contemporaneous differences and result in finite sample bias (Blundell and Bond, 1998; Blundell et al., 2000). As Blundell and Bond (1998) point out, both lagged levels and lagged differences are used as instruments in estimating the parameters of the production function. Furthermore, the resulting system GMM estimator is both consistent and efficient. It is noteworthy that standard errors should be taken as robust and corrected for finite sample bias following Windmeijer (2000).

The third issue is selection bias. This arises when foreign firms choose to invest in domestic firms that are more productive, which scholars usually refer to as the "cherry-picking phenomenon." Heckman (1976, 1979) suggests a simple practical solution for such situations, which treats the selection problem as an omitted variable problem. This method is known as the Heckman two-step or the limited information maximum likelihood (LIML) method. Firstly, the Heckman two-step procedure is used to calculate the probability that the firm is included in the sample based on (an) additional variable(s) to be included in the selection equation (probit model) to take care of the identification problem in the second-step estimates. Secondly, the resulting inverse Mills ratio is then included as an explanatory variable in an econometric model.

Another method that can cure selection bias is PSM. This was developed by Rosenbaum and Rubin (1983) and was initially used in labour economics to evaluate the effectiveness of training programs. The basic idea behind PSM is to match each participant (in the treated group) with an identical non-participant (in the control group) and then measure the average difference in the outcome variable between the participants and the non-participants. To be specific, PSM constructs a statistical comparison group that is based on a model of the probability of participating in the treatment, using observed characteristics. Participants are then matched on the basis of this probability, or propensity score, to non-participants. The average treatment effect on the treated is then calculated as the mean difference in outcomes across these two groups. The advantage of PSM compared to other methods that correct for self-selection (like the Heckman procedure) is that it goes beyond correlation analysis and provides an estimate of the causal effect.

Olley and Pakes (1996) suggest a novel approach to control both simultaneity and selection biases in the estimation of production function coefficients and firm-level productivity. In this approach, simultaneity biases are detected by using investment to proxy for unobserved time-variant productivity shock. Selection biases are addressed by employing survival probabilities. Levinsohn and Pertrin (2003) propose a similar approach to Olley and Pakes (1996), using intermediate inputs rather than investment to control for simultaneity bias, but not for selection bias.

The last issue, but not the least, concerns cluster errors. Moulton (1990, p.334), followed by Bertrand, Duflo and Mullainathan (2004), argues that in the case of regressions performed on micro units yet including aggregated market (in this research, industry) variables, the standard errors from OLS will be underestimated. Therefore, as Moulton states, a serious downward bias in the estimated errors will occur when failing to take this problem into account, leading to spurious findings of statistical significance for the aggregate variable of interest. Javorcik (2004) uses a simple cluster-robust option to address the issue. However, Xu and Sheng (2012) argue that the simple cluster-robust correction is inadequate. They propose to follow Wooldridge's two-stage estimation procedure (2006), which has three main advantages compared to the simple option used by Javorcik (2004). More concretely, the Wooldridge (2006) two-stage method firstly has some explicit assumptions for the intra-group and inter-group components in the random-error term, hence the cluster effects can be better controlled. Secondly, the method helps to avoid the potential multicollinearity and identification problems between industry dummies and region dummies thank to the two-stage estimation.

In this thesis, we rely on system GMM as the estimation method, as proposed by Arellano and Bond (1991) and Blundell and Bond (1998) to deal with the problem of simultaneity bias. System GMM combines equations in the first differences and in the levels. The former eliminates firm-specific fixed effects and uses the lagged levels of variables as valid instruments. The latter utilizes additional moment conditions in the levels equations that allow for the use of lagged differences of variables as valid instruments. The equations in levels address the problem of finite sample bias, which arises from the lagged levels of the variables providing weak instruments for first differences. Hence, as Blundell and Bond (1998) point out, system GMM estimator is both consistent and efficient in estimation of a production function while accounting for endogeneity issue.

Furthermore, from the above analysis, we can indicate that other methods that enable to address endogeneity issue either diverges from the theoretical model by using investment (Olley and Pakes, 1996) or material input (Levinsohn and Petrin, 2003) as production function proxies or they make inefficient use of all available information (e.g., Propensity Score Matching). System GMM method compensates for these shortcomings while employing both first differences and level equations as endogenous instruments in estimation that can address endogeneity issue. Given above rationales, we rely on System GMM as the most suitable, consistent and effificent method for investigating the effects of FDI on productivity of firms in Vietnam.

3.6 Conclusion

In general, this chapter firstly provides an overview of the FDI flows and stocks in Vietnam, with discussion of policy reform in Vietnam and in light of the global competition for attracting FDI. This is followed by detailed information on the dataset employed in the research, including data source, sampling method, questionnaire design and survey procedure. The advantages and disadvantages of the dataset along with the reliability and validity of the data are also analysed, followed by a summary of major indicators of firms surveyed in the whole dataset.

Next, this chapter focuses on methods to measure productivity, estimation issues embodied to estimate the direct and indirect effects of FDI on productivity, as well as the crowding-in/crowding-out effects of FDI. To measure productivity, researchers have a variety of choices: to deploy non-parametric methods (such as DEA or index numbers); parametric methods (such as OLS, FE, RE or GMM); or semi-parametric methods (such as Olley–Pakes and Levinsohn–Petrin). However, four main econometric concerns need to be tackled to obtain consistent and efficient estimation results: the omitted variables issue, the endogeneity issue, selection bias and the cluster errors issue.

Last but not least, this chapter presents the general model that is designed to quantify the direct and indirect effects of FDI on productivity as well as the crowding-in/crowding-out effects of FDI in this research. For the direct effects of FDI, researchers follow a standard approach to estimate an augmented production function with proxies for foreign presence. Regarding the indirect effects, researchers usually follow either the standard approach to estimate an augmented production function, or the alternative approach to obtain indirect effects from TFP as residuals that are not explained by the input factors such as labour and capital of the Cobb–Douglas production function. TFP is then regressed on the proxies of foreign presence. Concerning the estimation of crowding-in/crowding-out effects, the framework is usually based on estimation of a turnover equation, which omits the input factors of production.

In this research, we estimate the productivity effects of FDI using the standard production function approach rather than the TFP approach. To obtain robust evidence on the direct, crowding-in/crowding-out and indirect effects of foreign presence on productivity, we control not only for fixed effects but also for potential endogeneity using the dynamic panel estimator GMM proposed by Blundell and Bond (1998, 2000).

CHAPTER 4: DIRECT EFFECTS OF INWARD FDI ON PRODUCTIVITY: THE CASE OF VIETNAM

4.1 Introduction

As stated in the literature review, the effect of FDI on firm productivity can be either direct or indirect. The direct effect allows for inference about whether the foreign capital invested (or a proxy thereof) is conducive to higher levels of productivity among resident firms in the recipient country. It also allows for estimating the rate of increase in firm productivity when the level of foreign capital invested (or proxies thereof) increases by one unit. As such, it can be interpreted as the direct effect of inward FDI when a firm with an FDI presence increases its FDI intensity by one unit, or when a firm without FDI switches from a purely domestic status to a joint ownership status.

The first aim of this chapter is to establish whether higher levels of FDI intensity at the firm level are associated with higher firm productivity on average. Its second aim is to investigate the sources of heterogeneity, if any, in the relationship between FDI presence and firm productivity. To do this, we first re-estimate our base model with a quadratic specification for FDI intensity, to verify if the direct productivity effect varies at different levels of FDI intensity. Stated differently, we establish whether the direct productivity effect of FDI is linear or non-linear. Then we re-estimate the base model by economic regions, firm size classes, firm R&D status and levels of concentration in the industry. Hence, unlike existing empirical work that mostly reports the evidence of a direct effect and brings these findings to an end, we go further along two dimensions: we check for non-linearities in the FDI–productivity relationship and verify if the effect size estimates are heterogeneous. Our findings can inform a wider range of policy and practice by providing a richer set of estimates in a country that has attracted a relatively smaller number of investigations.

The chapter is organized as follows. In the next section, the model used and the estimation issues, as well as the dataset, are explained. The third section is devoted to the analysis of econometric findings and discussions, while the last section recapitulates the chapter.

4.2 Model, Estimation Issues and Data

4.2.1 Model

Baseline model

With a view to examining the direct effect of FDI on productivity, we adopt the approach that has been used extensively in the literature (see Konings, 2001; Damijan, 2003; Vahter, 2005). The method follows the seminal paper by Griliches (1992), who postulates a Cobb–Douglas augmented production function including both internal and external factors of production. The presence of such external influences on the firm is the consequence of externalities in production, due to formal or informal linkages between firms. Hence, the traditional production function is extended through introducing FDI as a source of capital accumulation as well as a generator of knowledge.

We therefore build an empirical model as follows:

$$y_{1ijt} = \beta_{10} + \beta_{11} k_{ijt} + \beta_{12} l_{ijt} + \beta_{13} FDI\_firm_{ijt} + \eta_{1i} + \mu_{1j} + \phi_{1t} + e_{1ijt} \qquad (4.1)$$

in which subscript i denotes firm, j denotes industry and t denotes year.

The dependent variable y_{1ijt} is the real value added of firm i operating in industry j at year t. We follow Nickell (1996) and Griffith et al. (2006) in calculating value-added output as the sum of total employment cost, operating profit before tax, accumulated depreciation and interest payment. Then real value added is obtained by deflating with the Producer Price Index (PPI) at an industry level. The PPI is supplied by the Vietnam GSO for each industry over years.

k_{1ijt} is the real value of the fixed assets of firm i operating in industry j at the beginning of each year of study, deflated by the gross fixed capital formation;

l_{1ijt} is the total employees of firm i operating in industry j at the beginning of each year of study;

y_{1ijt}, k_{1ijt} and l_{1ijt} are all in natural logs.

FDI_firm_{ijt} is firm-level FDI, measured by the foreign share of a firm's equity. It presents the foreign ownership participation in total equity of a firm. Following the existing literature on direct effects of FDI on productivity, we observe this FDI intensity at firm level at contemporaneousness only, without any lags. However, we argue that a lagged structure of FDI intensity at firm level might be appropriate in this case. Further study should be devoted to examine whether the lag structure is adequate in this model.

The three sets of dummy variables $\eta_{1i}, \mu_{1j}, \phi_{1t}$ are made use of to control for firm-, industry- and time-specific effects, respectively. Firms and industry dummy variables are used in the regression model in order to capture firm- and industry-specific effects, and year dummy variables are included with a view to accounting for trend effects. Notably, as the thesis utilizes system GMM to deal with endogeneity in estimating production functions, the firm effect is eliminated at differenced equations (the first step of GMM); however, in level equations (the second step of GMM), the firm effects are not removed.

The direct effect of FDI on productivity is captured from β_{13} in Equation 4.1. A positive and significant β_{13} suggests that foreign presence enhances the productivity of all firms on average, signalling a positive direct effect of FDI on productivity.

To check whether there is a non-linear relationship between FDI intensity and firm productivity, we include a squared term of FDI intensity at firm level in the baseline specification. Accordingly, the model with the non-linear specification is:

$$y_{1ijt} = \beta_{20} + \beta_{21} K_{ijt} + \beta_{22} L_{ijt} + \beta_{23} FDI\_firm_{ijt} + \beta_{24} FDI\_firm^2_{ijt} + \eta_{2i} + \mu_{2j} + \phi_{2t} + e_{2ijt} \quad (4.2)$$

If the coefficients on both β_{23} and β_{24} are statistically significant, they indicate evidence of a non-linear relationship between FDI intensity and productivity. Accordingly, the turning point for FDI intensity (TFP_{FDI_int}) is calculated as follows: $TFP_{FDI\_int} = \frac{-\beta_{23}}{2\beta_{24}}$

Direct effects of FDI by economic region

Regional variations in productivity have been extensively discussed within a variety of economic schools, such as New Classical, Endogenous Growth and more recently New Economic Geography. Scholars have emphasized several factors that cause regional economic disparities. These are factors that are behind the divergent economic performance of regions, ranging from institutional factors and regional and industry characteristics to the behaviour of firms. While being controversial on the origins and persistence of regional economic imbalances, all three theories agree that regional variations lead to a divergence in productivity.

From the above theoretical framework, in this chapter we intend to investigate empirically whether the direct effects differ by economic regions in Vietnam. Vietnam constitutes of 64 provinces that are divided into six economic regions: Red River Delta; Northern Midlands and Mountain areas; North Central and South Central Coast; Central Highlands; South East; and Mekong River Delta. Each province has its own code in the dataset, and we follow the division of the GSO to arrange the 64 provinces into six groups by economic regions. We hence split the sample into six groups to quantify and compare the direct effects between these groups.

Direct effects of FDI and firm size

There are various arguments about the impact of firm size on productivity growth. On the one hand, some researchers, such as Farole and Winkler (2012), suggest that large firms could be more efficient in production as they could use more specialized inputs and better coordinate their resources. On the other hand, other researchers, such as Tybout (2000) and Dhawan (2001), protest that small firms could be more efficient because they have flexible, non-hierarchical structures. Hence, we introduce a new control variable regarding the size of firm to incorporate in the baseline specification in Equation 4.1 to investigate how firm size can influence the productivity of firms through the channel of direct effects of FDI. The specification of our empirical estimation equations is illustrated in Equation 4.3:

$$/_{1iBt} = \beta_{30} + \beta_{31}\#_{iBt} + \beta_{32}\mathrm{l}_{iBt} + \beta_{33}\mathbf{2}\mathrm{D}\mathbf{3}\_\mathrm{fir}\text{-}_{iBt} + \beta_{34}(\mathbf{2}\mathrm{D}\mathbf{3}\_\mathrm{fir}\text{-}_{iBt} * !\text{-}\mathrm{all}\_\mathrm{fir}\text{-}_{iBt}) + \eta_{3i} + \mu_{3B} + \phi_{3t} + \mathrm{e}_{3iBt} \quad (4.3)$$

In Equation 4.3, $!\text{-}\mathrm{all}D\mathrm{fir}\text{-}_{iBt}$ is a dummy variable, indicating the firm size in the sample. The variable equates to 1 if the firm's headcount of employees is equal to or less than 50 and equates to 0 otherwise. This definition is in line with the small firm classification of the European Commission, the United Nations Industrial Development Organization (UNIDO) and the GSO. The significant coefficient β_{34} on the interaction term between FDI intensity at firm level and the dummy variable for small firm status $\mathbf{2}\mathrm{D}\mathbf{3}D\mathrm{fir}\text{-}_{iBt}E!\text{-}\mathrm{all}D\mathrm{fir}\text{-}_{iBt}$ indicates whether small foreign-invested firms capture more direct effects than medium-sized and large foreign-invested firms.

Direct effects of FDI and firm R&D status

In a seminal study, Cohen and Levinthal (1989) show that R&D does indeed have two different functions: it is undertaken (i) to generate innovation and/or (ii) to increase the firm's absorptive capacity. Therefore, R&D should be considered as a complement to the external source of knowledge. This argument is supported by Cohen and Levinthal (1989, 1990), Cantwell (1993) and Perez (1997), reaffirming that R&D investment can enhance a firm's absorptive capacity. Hence, we examine in this section whether a firm with an active R&D status gains more direct effects from FDI. To do so, we incorporate the R&D status of firms as an additional independent variable in Equation 4.1. The R&D status, R&D_firm$_{ijt}$, is a dummy variable, indicating whether firms have employed scientists and technicians for production in at least two years in the panel. Subsequently, we generate an interaction term between R&D status and FDI intensity at firm level. We investigate the direct effects of FDI with the investigation of the R&D status of firms as follows:

$$/_{1iBt} = \beta_{40} + \beta_{41}\#_{iBt} + \beta_{42}l_{iBt} + \beta_{43}\mathbf{2}D\mathit{3}\ \_\ \mathrm{fir-}_{iBt} + \beta_{44}(\mathbf{2}D\mathit{3}\ \_\ \mathrm{fir-}_{iBt} * R\ \&\ D\ \_\ \mathrm{fir-}_{iBt}) + \eta_{4i} + \mu_{4B} + \phi_{4t} + e_{4iBt} \quad (4.4)$$

A significantly positive β_{44} indicates a positive relationship between FDI intensity at firm level and the number of scientists and technicians at the firms. More concretely, it infers that when FDI firms hire more scientists and technicians, the direct effect becomes more pronounced.

In contrast, a negative and significant β_{44} produces evidence of a negative relationship between firm R&D status and productivity gain from direct effects.

Direct effects of FDI and industry concentration

To examine the effect of industry concentration in the direct effects of FDI, we interact FDI intensity at firm level with the levels of concentration in the industry.

$$/_{1iBt} = \beta_{5(} + \beta_{51}\#_{iBt} + \beta_{52}l_{iBt} + \beta_{53}\mathbf{2}D\mathit{3}\ \mathit{D}\ \mathrm{fir-}_{iBt} + \beta_{54}(\mathbf{2}D\mathit{3}\ \mathit{D}\ \mathrm{fir-}_{iBt}\ \mathit{E}\ \$\$\mathit{3}_{Bt} + \eta_{5i} + \mu_{5B} + \phi_{5t} + e_{iBt} \quad (4.5)$$

In Equation 4.5, ***$$3*** refers to the Herfindahl–Hirschman index of sales concentration, which is calculated as the sum of the squared market shares of all firms in the industry:

$$HHI_{jt} = \sum \left(\frac{S_{ijt}}{\sum_{i \in j} S_{ijt}} \right)^2 \qquad (4.6)$$

The coefficient β_{54} on the interaction term between FDI intensity at firm level and the HHI 2D3Dfir - iBtE$ $3Bt indicates whether foreign firms that operate in a more concentrated industry have higher or lower productivity. Nickel (1996) argues that firms in more concentrated industries are expected to have lower productivity growth because they have monopoly power, which tends to reduce the rate of innovation and leads to no incentive to improve productivity. In the same way, Javorcik (2004) postulates that an industry with a lower concentration ratio may indicate more intense competition between firms, therefore inducing a positive effect on their productivity level.

We decide not to test the 3 hypotheses of firm size, firm R&D status and HHI together in this chapter although the dependent variable is the same. The reason lies behind our decision is that to make this empirical chapter consistent with other two empirical chapters. As using interaction terms are not always valid in all cases, in chapter 5 and 6, we check the heterogeneity of the findings by employing dummy variables for investigating firm size and firm R&D status, splitting the samples for examining industry concentration. Hence, testing the hypotheses one by one is the best way to see coherently how firm size, firm R&D status, and HHI individually and differently impact on each type of FDI-productivity effects over the three chapters. However, the disadvantage of this approach is that we cannot compare the signs and magnitudes that firm size, firm R&D status and industry concentration simultaneously affect the direct effects in this chapter, though they are all regressed on the same dependent variable.

4.2.2 Estimation Issues

In this chapter, we employ the GMM approach proposed by Arellano and Bond (1991) and Blundell and Bond (1998) to deal with problematic simultaneity bias. As an empirical matter, specification tests proposed by Arellano and Bover (1995) are applied to test the validity of the instruments in our GMM estimation. First, the Arellano–Bond test for serial correlation is adapted to test whether there is a second-order serial correlation in the first-differenced residuals. The null hypothesis is that the residuals are serially uncorrelated. If the null hypothesis cannot be rejected, it provides evidence that there is no second-order serial correlation and the GMM estimator is consistent. Second, the Hansen J-test and the diff-in-Hansen test are applied to test the null hypothesis of instrument validity and the validity of the additional moment restriction necessary for system GMM, respectively. Failure to reject this null hypothesis means that the instruments are valid. Furthermore, we adopt some approaches to improve the efficiency of system GMM estimation. Firstly, according to Roodman (2009), we collapse the instrument sets and take the orthogonal option. Secondly, industry-specific and time-specific effects are included in our regression equations in order to capture industry-specific effects and trend effects. We also run the OLS levels and FE estimator in order to justify the GMM results obtained. The lag structure of dependent variables is included as an additional explanatory variable in the estimation. The econometrics package used is Stata 13.

4.2.3 Data

This study focuses only on firms in the five industrial groups of manufacturing, utility (electricity, gas and water supply), construction, science and technology activities, and computer and related activities, including a total of 28 industries, based on the sectoral classification of enterprises at the two-digit level of the VSIC, with a study period from 2001–2010. Table 4.1 shows descriptive statistics of the main variables used in this empirical estimation.

Table 4.1: Data descriptive statistics

No	Variable	Description	Obs	Mean	Std dev.	Min	Max
1	Real_VA_ouput	Real value added of output	264,887	8,414.809	307,610.9	0	97,800,000
2	Ln_real_VA_ouput	Log of real value added of output	263,986	6.45	1.80	-5.15	18.40
3	Ln_net_fa	Log of net value of fixed asset	256,186	.699	1.79	-5.67	12.24
4	Ln_ld11	Log of number of employees	455,400	2.981	1.44	0	11.30
5	FDI_firm	FDI intensity at firm level	494,264	6.019	23.39	0	100
6	FDI_firm^2	Squared FDI intensity at firm level	491,331	527.4	2193.89	0	10,000
7	Small_firm	Dummy for firms with fewer than or equal to 50 employees	467,497	.781	.419	0	1
8	R&D _firm	Dummy for firms that employ scientists and technicians in at least 2 years in panel	494,635	.135	.341	0	1
9	HHI	Herfindahl–Hirschman Index	492,331	.0245	.084	.001	.98
10	FDI_firm*Small_firm	Interaction between FDI intensity at firm level and dummy for small firms	467,158	2.11	14.17	0	100
11	FDI_firm* R&D _firm	Interaction between FDI intensity at firm level and dummy for firms that employ scientists and technicians in at least 2 years in the panel	494,264	1.97	13.54	0	100
12	FDI_firm* HHI	Interaction between FDI intensity at firm level and HHI	491,971	.156	1.388	0	98.1

Source: Author's calculation from the dataset

Table 4.2: Correlations matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Real_VA_ouput	1											
2. Ln_real_VA_ouput	0.081	1										
3. Ln_net_fa	0.062	0.723	1									
4. Ln_ld11	0.070	0.837	0.644	1								
5. FDI_firm	0.025	0.361	0.329	0.337	1							
6. FDI_firm^2	0.023	0.352	0.321	0.331	0.996	1						
7. Small_firm	-0.043	-0.689	-0.518	-0.821	-0.322	-0.315	1					
8. R&D_firm	0.021	0.44	0.36	0.508	0.242	0.235	-0.481	1				
9. HHI	0.044	-0.12	-0.034	-0.028	0.008	0.008	0.015	-0.011	1			
10. FDI_firm*Small_firm	-0.0006	0.088	0.086	0.037	0.534	0.533	0.048	0.078	0.0070	1		
11. FDI_firm* R&D _firm	0.023	0.281	0.263	0.265	0.688	0.681	-0.259	0.40	0.007	0.251	1	
12. FDI_firm* HHI	0.023	0.181	0.168	0.155	0.452	0.449	-0.141	0.113	0.123	0.255	0.321	1

Source: Author's calculation from the dataset

4.3 Estimation Results and Discussion

Baseline specifications of direct effects of FDI in Vietnam

The panel estimation results are reported in Table 4.3. The first two columns of Table 4.3 report the results using the OLS levels and FE estimators, respectively. The third column presents the results using one-step system GMM. As mentioned by Bond et al. (2001), omitting variables (i.e., unobserved firm-specific effects) will give an estimate of the coefficient on lagged real value added that is upward biased. The FE will cause an estimate of this coefficient to be seriously downward biased. However, the OLS levels will produce upward bias. Thus, the estimated coefficient on lagged real value added from OLS and FE can be regarded as an approximate upper bound and lower bound, respectively. A consistent estimate of the coefficient can be expected to lie within these two bounds.

Table 4.3: Direct effects of FDI on productivity in Vietnam (2001–2010): Baseline specifications

Dep. variable: Ln real value added	OLS	FE	SYS GMM
Ln lagged real value added	.339***	-.047***	.125 ***
	(.003)	(0.004)	(.023)
Ln fixed asset	.193***	.145***	.199 ***
	(.002)	(.003)	(.028)
Ln employment	.557***	.593***	.643***
	(.003)	(.006)	(.035)
FDI_firm	.0028***	.0004	.0064**
	(.0001)	(.0012)	(.0028)
Constant	2.36***	4.414***	3.14***
	(.019)	(.072)	(.186)
Firm-year observations	107,729	107,729	107,729
Firms	54,353	54,353	54,353
Adjusted R-squared	0.879	0.435	.906
Instrument			43
Hansen test			[0.481]
AR(1)			[0.000]
AR(2)			[0.958]

Notes:
All industry and time dummies are included but not reported to save space. Standard errors are in parentheses, p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real value added, fixed asset, employment and FDI intensity at firm level as endogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Beginning with the OLS results, the estimated coefficients on lagged real value added, capital, employment and foreign presence are statistically significant and with the expected sign. Then when an FE estimator is employed, the coefficients on lagged real value added and foreign presence become negative. The estimated coefficients on capital and employment are significant with the expected sign.

The last column of Table 4.3 illustrates the one-step system GMM estimator. The results of the Arellano–Bond tests indicate that there is no second-order serial correlation. We do not reject the null hypothesis of the Hansen test, which indicates the validity and reliability of the GMM estimator. The estimated coefficient on lagged real value added (0.125) is significant and lies above the corresponding FE estimate (-.047) and below the corresponding OLS estimate (.339). The estimated coefficient on foreign presence is significant and positive, indicating a positive direct effect on the productivity of FDI firms in Vietnam. As the GMM estimator is less biased and more efficient than OLS, we rely on the estimation produced by GMM to interpret the result. More specifically, one unit of increase in FDI intensity at firm level can result in a 0.64% increase in the productivity of FDI firms. This evidence of a direct effect is consistent in sign but relatively small in magnitude compared to the findings in previous studies, such as Konings (2001), Schoors and Tol (2002), Damijan et al. (2003), Lutz and Talavera (2003), Sgard (2001) and Vahter (2005).

We also re-estimate the baseline specification with the sample of manufacturing firms only to compare with the direct effects in the full sample, which consists of both manufacturing and non-manufacturing production firms (in utility, construction, science and technology activities, and computer and related activities sectors). As can be seen in Table 4.4, coefficient estimates based on manufacturing sector data are similar to those based on the baseline sample with respect to sign, significance and magnitude. The only difference is that the estimate for the manufacturing sample is slighltly smaller (0.004) compared to that obtained from the baseline sample (0.0064). Given the sign consistency between both samples, we use the baseline sample that contains more information to verify the potential sources of heterogeneity in the FDI's direct productivity effects.

Table 4.4: Direct effects of FDI on productivity in Vietnam (2001–2010): Baseline specification with manufacturing firms only

Dep. variable: Ln real value added	All sample	Manufacturing firms
Ln lagged real value added	.125 ***	.170***
	(.023)	(.046)
Ln fixed asset	.199 ***	.198***
	(.028)	(.045)
Ln employment	.643***	.643***
	(.035)	(.050)
FDI_firm	.0064**	.004***
	(.0028)	(.002)
Constant	3.14***	3.18***
	(.186)	(.146)
Firm-year observations	107,729	62,350
Firms	54,353	28,617
Adjusted R-squared	.906	.946
Instrument	43	77
Hansen test	[0.481]	[0.289]
AR(1)	[0.000]	[0.000]
AR(2)	[0.958]	[0.874]

Notes: All industry and time dummies are included but not reported to save space. Standard errors are in parentheses, p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real value added, fixed asset, employment and FDI intensity at firm level as endogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

From Table 4.4, we report evidence of positive direct effects of FDI on manufacturing firms in Vietnam; however, the magnitude is smaller than that of the whole sample. As there are few differences in terms of estimation results when we estimate the baseline with the two sample sizes, we decided to utilize the full sample in our subsequent estimations in this chapter. The full sample with a bigger sample size is expected to convey more information from our dataset that is being used in the estimations.

It is noticeable that in the estimation above, all firms with foreign equity are defined as foreign firms. However, there is another approach that defines foreign firms as those with at least 10% foreign equity (OECD, 2008). We apply this 10% threshold to check the robustness of the result of the estimated direct effect above using OLS, FE and GMM.

Table 4.5: Direct effects of FDI on productivity in Vietnam (2001–2010): With 10% threshold for FDI firms

Dep. variable: Ln real value added	OLS	FE	SYS GMM
Ln lagged real value added	.339***	-.047***	.126***
	(.003)	(.004)	(.023)
Ln fixed asset	.193***	.145***	.195***
	(.0028)	(.003)	(.028)
Ln employment	.557***	.593***	.646***
	(.003)	(.006)	(.035)
FDI_firm	.0028***	.0003	.0064**
	(.0001)	(.0012)	(.0024)
Constant	2.35***	4.414***	3.13***
	(.019)	(.072)	(.186)
Firm-year observations	7,483	7,483	7,483
Firms	2,585	2,585	2,585
Adjusted R-squared	0.879	0.435	.906
Instrument			43
Hansen test			[0.372]
AR(1)			[0.000]
AR(2)			[0.983]

Notes:
All firms are with a minimum threshold of 10% for FDI intensity. All industry and time dummies are included but not reported to save space. Standard errors are in parentheses, p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real value added, fixed asset, employment and FDI intensity at firm level as endogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

As reported from Table 4.5, all coefficients are positive and significant as expected, and the GMM results for FDI firm intensity that satisfies the 10% threshold are the same as the estimated direct effect without the threshold.

Moreover, we also check if a quadratic specification is valid by including square values of FDI intensity at firm level. The results are presented in Table 4.6.

Table 4.6: Direct effects of FDI on productivity in Vietnam (2001–2010): Quadratic specification

Dep. variable: Ln real value added	OLS	FE	SYS GMM
Ln lagged real value added	.335***	-.048***	.142**
	(.003)	(.004)	(.052)
Ln fixed asset	.193***	.145***	.189***
	(.002)	(.003)	(.035)
Ln employment	.560***	.593***	.767***
	(.003)	(.006)	(055)
FDI_firm	.019***	.004	.040*
	(.001)	(004)	(.021)
FDI_firm_square	-.00017***	-.00003	-.00037*
	(.000018)	(.00003)	(.0002)
Constant	2.36***	4.41***	2.74***
	(.019)	(.072)	(.14)
Firm/year observations	107,522	107,522	107,522
Firms	54,268	54,268	54,268
Adjusted R-squared	.880	.438	.907
Instrument			50
Hansen test			[0.434]
AR(1)			[0.000]
AR(2)			[0.952]

Notes:
All firms are without a minimum threshold of 10% for FDI intensity. All industry and time dummies are included but not reported to save space. Standard errors are in parentheses, p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real value added, fixed asset, employment and FDI intensity at firm level as endogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The GMM test results reveal that the quadratic terms are significant, indicating that the quadratic specification is valid. More specifically, the significance and opposite signs of coefficients on FDI intensity and squared FDI intensity at firm level suggest that productivity of FDI firms increases with FDI intensity at firm level; however, this effect diminishes with further increases in FDI intensity. Therefore, we can conclude that there is evidence of an inverted U-shape relationship of FDI intensity at firm level and the productivity of FDI firms.

As a robustness check, we investigate whether a quadratic specification is valid in the case of the 10% threshold for FDI firms. The test results reaffirm the inverted U-shape relationship between FDI intensity at firm level with 10% restriction and productivity, and can be found in Table A4 in the Appendix.

In a nutshell, we report positive but small direct effects on the productivity of firms in Vietnam. As such, this may conceal a high degree of heterogeneity, depending on the scale of FDI intensity, R&D activity, size of firm, economic regional characteristics and industry concentration. In the following sections, we investigate the direct effects with heterogeneity in firm, industry and economic regions.

Direct effects of FDI in Vietnam by economic region

There are six economic regions in Vietnam: Red River Delta; Northern Midlands and Mountain areas; North Central and South Central Coast; Central Highlands; South East; and Mekong River Delta. In searching for differences in the direct effects of FDI on productivity, we approach each region by its labour, capital and FDI-related facts and figures.

Table 4.7 summarizes some characteristics of the six economic regions in geographical order in terms of proportion of FDI firms in total firms, mean of FDI intensity at industry level, average trained workers in total workforce, average value-added output per employee and capital–labour ratio.

Table 4.7: Characteristics of six economic regions in Vietnam

Economic region	Proportion of FDI firms in total firms		Mean of FDI intensity at industry level		Average trained worker in total workforce		Average value-added output per employee		Average capital–labour ratio	
	%	*Ranking*	*Unit*	*Ranking*	*Unit*	*Ranking*	*Unit*	*Ranking*	*Unit*	*Ranking*
Red River Delta	3.5	2	3.5	2	18.76	2	75.89	2	75.89	2
Northern Midlands & Mountain areas	1.1	6	1.1	6	7.72	6	37.47	5	37.47	5
North Central and South Central Coast	1.9	3	1.9	3	12.46	3	40.90	4	40.90	4
Central Highlands	1.2	5	1.2	5	11.14	5	34.87	6	34.87	6
South East	6.5	1	6.5	1	20.52	1	89.45	1	89.45	1
Mekong River Delta	1.8	4	1.8	4	11.96	4	64.90	3	64.90	3

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From Table 4.7, we can see that in terms of proportion of FDI firms in total firms, the South East performs best among these regions, followed by Red River Delta and North Central and South Central Coast. In the same manner, the worst performers in terms of FDI intensities at industry level are Northern Midlands and Mountain areas, Central Highlands and Mekong River Delta. Regarding the average trained workers in total workforce, the three best performers are South East, Red River Delta and North Central and South Central Coast. It is noticeable that Mekong River Delta rank third top in terms of average value-added output per employee, which is higher than those of North Central and South Central Coast, Central Highlands and Northern Midlands and Mountain areas. The same pattern is detected when calculate average capital-labor ratio across the economic regions while South East, Red River Delta and Mekong River Delta are once again the top performers.

We can therefore arrange the six economic regions into three groups based on their performance in five FDI-related indicators. The top regions are South East and Red River Delta. The middle-ranking regions are North Central and South Central Coast and Mekong River Delta. The bottom regions are Northern Midlands and Mountain areas and Central Highlands.

Table 4.8 depicts the direct effects of inward FDI in Vietnam by economic region. It can be seen clearly that all the results of the Arellano–Bond tests indicate that there is no second-order serial correlation. The values in the Sargan/Hansen test confirm that we do not reject the null hypothesis that the instruments are valid. To sum up, our test statistics confirm the validity and reliability of the GMM estimator.

From the table, there is evidence of direct effects in five out of six economic regions in Vietnam (2001–2010). The Northern Midlands and Mountain areas is an exceptional case where no evidence for direct effects is detected. This finding may originate from the characteristics of the region, where the related facts and figures are relatively low compared to other regions. Among the five other economic regions that report evidence of direct effects, the effect is most noticeable in the South East, followed by Red River Delta and North Central and South Central Coast. The effect is less apparent in the Mekong River Delta and Central Highlands. All these findings are consistent with our earlier analysis of the performance in the related indicators of the six regions in Table 4.7: the higher the indicators, the larger the direct effects of FDI. Noticeably, all the significant direct effects by economic region are larger in magnitude than the coefficient of effects obtained in the baseline specification. This may be due to the fact that when we split the whole sample by economic region, the sample sizes vary, leading to different means, different standard errors and hence different estimation results for the coefficients of interest.

Table 4.8: Direct effects of FDI by economic region in Vietnam (2001–2010)

Dep. variable: Ln real value added	Red River Delta	Northern Midlands and Mountain areas	North Central and South Central Coast	Central Highlands	South East	Mekong River Delta
Ln real value added						
L1	.11***	.242***	.13***	.085*	.140***	.125***
	(.014)	(.053)	(.030)	(.049)	(.019)	(.043)
L2	.087***	.097**	.099***	.118**	.057***	.152**
	(.016)	(.046)	(.022)	(.048)	(.006)	(.031)
Ln fixed asset	.16**	.128**	.112*	.242***	.257***	.143***
	(.079)	(.061)	(.067)	(.070)	(.032)	(.042)
Ln employment	.806***	.607***	.776***	.686***	.580***	.745***
	(.075)	(.077)	(.063)	(.082)	(.036)	(.058)
FDI_firm	.012**	.035	.010**	.0081*	.019***	.009**
	(.005)	(.084)	(.004)	(.004)	(.005)	(.005)
Constant	2.38***	2.04**	2.32***	2.51***	2.96***	2.43***
	(.144)	(.827)	(.263)	(.416)	(.161)	(.175)
Firm-year observations	8,949	1,490	3,172	461	37,081	4,201
Firms	5,885	941	1,932	294	15,854	2,140
Adjusted R-squared	.958	.98	.960	.943	.916	.894
Instrument	45	59	48	77	49	66
Sargan/Hansen test	[0.169]	[0.676]	[0.498]	[0.361]	[0.109]	[0.165]
AR(1)	[0.000]	[0.000]	[0.000]	[0.036]	[0.000]	[0.000]
AR(2)	[0.768]	[0.043]	[0.692]	[0.483]	[0.001]	[0.386]
AR(3)		[0.191]			[0.164]	

Notes: All industry and time dummies are included but not reported to save space. Standard errors are in parentheses, p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real turnover measure, fixed asset, employment and FDI intensity at firm level as endogenous. The value reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1), AR(2) and AR(3) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Direct effects of FDI and firm size

When we control for firm size through introducing the interaction term between small firms (firms with fewer than or equal to 50 employees) and FDI intensity at firm level, we have the results in Table 4.9.

Table 4.9: Direct effects of FDI and firm size in Vietnam (2001–2010)

Dep. variable: Ln real value added	OLS	FE	SYS GMM
Ln lagged real value added			
L1	.305***	-.045***	.127***
	(.005)	(.007)	(.016)
L2	.131***	.004	.135***
	(.003)	(.005)	(.013)
Ln fixed asset	.177***	.143***	.081***
	(.002)	(.004)	(.023)
Ln employment	.472***	.551***	.768***
	(.005)	(.009)	(.014)
FDI_firm	.001***	-.002	.003***
	(.0001)	(.002)	(.0004)
FDI_firm*Small_firm	.002***	.002**	.003**
	(.0003)	(.0007)	(.0004)
Constant	2.17***	4.93***	2.60***
	(.024)	(.098)	(.058)
Firm/year observations	55,528	55,528	55,528
Firms	27,129	27,129	27,129
Adjusted R-squared	0.90	0.404	0.928
Instrument			44
Hansen test			[0.136]
AR(1)			[0.000]
AR(2)			[0.143]

Notes:All industry and time dummies are included but not reported to save space. Standard errors are in parentheses, p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real value added, fixed asset and employment as endogenous; FDI intensity at firm level and the interaction term as exogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The results of the Arellano–Bond tests presented in the system GMM indicate that there is no second-order serial correlation. We do not reject the null hypothesis of the Hansen test, which implies that the test statistics present the validity and reliability of the GMM estimator. The estimated coefficient on lagged real value added (0.262) is significant and lies above the corresponding FE estimate (-0.441) and below the corresponding OLS estimate (0.436). The significantly positive coefficient on the interaction term of FDI intensity and the small firm dummy indicates that the smaller the FDI firm, the larger the direct effect. This interesting finding is similar to the finding of Dimelis and Louri (2004) that small foreign firm size is found to generate more FDI productivity than large foreign firm size, when they examined a sample of 3,742 manufacturing firms operating in Greece in 1997. This may come from the fact that small firms are more flexible and more responsive to changes in the business environment. Hence, they are more adaptable when they operate in a new overseas market and gain more productivity.

Direct effects of FDI and firm R&D status

Table 4.10: Direct effects of FDI and firm R&D status in Vietnam (2001–2010)

Dep. variable: Ln real value added	OLS	FE	SYS GMM
Ln lagged real value added	.306***	-.046***	.125***
L1	(.005)	(.007)	(.016)
L2	.131***	.003	.136***
	(.003)	(.005)	(.013)
Ln fixed asset	.176***	.143***	.083***
	(.002)	(.004)	(.023)
Ln employment	.468***	.549***	.763***
	(.005)	(.009)	(.014)
FDI_firm	.002***	-.0015	.003***
	(.0001)	(.003)	(.0003)
FDI_firm* R&D_firm	-.00001	-.00001	.0007**
	(.0002)	(.004)	(.0003)
Constant	2.18***	4.95***	2.50***
	(.024)	(.098)	(.059)
Firm/year observations	55,528	55,528	55,528
Firms	27,129	27,129	27,129
Adjusted R-squared	0.909	0.403	.927
Instrument			44
Hansen test			[0.148]
AR(1)			[0.000]
AR(2)			[0.122]

Notes:
All industry and time dummies are included but not reported to save space. Standard errors are in parentheses, p-values in square brackets.

GMM regression uses robust standard errors and treats the lagged real value added, fixed asset and employment as endogenous; FDI intensity at firm level and the interaction term as exogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

From Table 4.10, the positive and significant coefficient of the interaction term in the GMM estimation demonstrates evidence of firm R&D status and productivity: the more FDI firms invest in R&D, the more productivity they obtain. This finding reaffirms those of Arrow (1962) and Romer (1986), who assert that growth is driven by the accumulation of knowledge. The finding corroborates the views of Cameron (1998) and Bernanke and Gurkanyak (2001) in detecting the positive contribution of R&D to firm productivity.

Direct effects of FDI and industry concentration

When we control for industry concentration through introducing the interaction term between the level of concentration in the industry and FDI intensity at firm level, we have the results in Table 4.11.

Table 4.11: Direct effects of FDI and industry concentration in Vietnam (2001–2010)

Dep. variable: Ln real value added	OLS	FE	SYS GMM
Ln lagged real value added	.338***	-.047***	.133***
	(.003)	(.004)	(.023)
Ln fixed asset	.193***	.145***	.183***
	(.002)	(.003)	(.028)
Ln employment	.557***	.593***	.657***
	(.003)	(.006)	(.034)
FDI_firm	.0026***	.0002	.004***
	(0001)	(.001)	(.001)
FDI_firm*HHI	.010**	.007*	-.040***
	(.005)	(.003)	(.014)
Constant	2.36***	4.40***	3.27***
	(.019)	(.072)	(.194)
Firm/year observations	107,728	107,728	107,728
Firms	54,352	54,352	54,352
Adjusted R-squared	0.88	0.438	.907
Instrument			46
Hansen test			[0.396]
AR(1)			[0.000]
AR(2)			[0.856]

Notes:
All industry and time dummies are included but not reported to save space. Standard errors are in parentheses, p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real value added, fixed asset, employment, FDI intensity at firm level and the interaction term as endogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

As can be seen from Table 4.11, the coefficient on the interaction term of FDI intensity and industry concentration HHI is significant and negative, suggesting that foreign firms that operate in a more concentrated industry have a lower productivity level. The findings are in line with the arguments of Nickel (1996) and Javorcik (2004) on the inverse relationship between industry concentration and productivity.

In the next step, we investigate how the direct effects vary when industry concentration varies. From Equation 4.5 we have: $$\text{Direct effects} = \frac{\partial /_{1iBt}}{\partial \mathbf{2}\text{or}\_\text{share}_{iBt}} = \beta_{53} + \beta_{54}.\boldsymbol{\$\$3} \qquad (4.7)$$

From Table 4.11, we can obtain $\beta_{53} = 0.004$ and $\beta_{54} = -0.04$. Also, we report HHI at 0; minimum; 10th, 20th, 30th, 40th, 50th, 60th, 70th, 80th and 90th percentiles; and maximum values, and their corresponding HHI values. The conditional direct effects of FDI are then calculated following Equation 4.7. Moreover, we report the p-value of the coefficients of corresponding conditional direct effects in the last column of Table 4.12 using the linco- command in Stata.

It can be seen from Table 4.12 below that conditional direct effects decrease when industry concentration increases. Moreover, the coefficients of conditional direct effects are mostly significant at 1% and 5%, except at the 90th HHI percentile, which is significant at 10%. Last but not least, there are differences between the mean value of estimated coefficients $\beta_{53} = 0.004$ and the conditional direct effects. These suggest that examining the mean value of estimated coefficients only, without considering the values of related covariates, may lead to a low level of accurate results.

Table 4.12: Conditional direct effects of FDI with various levels of industry concentration in Vietnam (2001–2010)

HHI percentiles	Corresponding HHI values	Conditional direct effects	p_value
0	0	.004142	0.004***
Min	0	.004142	0.004***
10th percentile	.0012683	.0040912	0.004***
20th percentile	.0014272	.0040848	0.004***
30th percentile	.0017657	.0040712	0.004***
40th percentile	.0046089	.0039572	0.006***
50th percentile	.0056141	.0039169	0.006***
60th percentile	.0084035	.0038051	0.008***
70th percentile	.0118211	.0036681	0.011**
80th percentile	.0173941	.0034447	0.019**
90th percentile	.0339098	.0027825	0.070*
Max	.981014	-.0351872	0.013**

4.4 Conclusion

This chapter investigates the direct effect of FDI on the productivity of firms with foreign capital in Vietnam. We utilize a rich dataset compiled by the Vietnamese GSO from 2001–2010. An unbalanced panel consisting of 166,697 firms with a total of 504,642 observations in 28 industries is utilized in three different estimators: OLS, FE and GMM. The dynamic panel data approach to GMM proposed by Arellano and Bond (1991) and Blundell and Bond (1998) is employed to control for firms' unobserved heterogeneity, inputs and ownership endogeneity, as well as measurement errors.

We report that the share of foreign capital in firm equity has a positive and significant effect on the productivity of foreign-owned firms in Vietnam. This reinforces the theoretical background on MNEs by Hymer (1960, 1976) and Buckley and Casson (1976) that MNEs with their firm-specific advantages can enhance the productivity of FDI firms in the host country. On the evidence base, the finding of the positive direct effect of FDI on productivity coincides with the findings of Konings (2001), Schoors and Tol (2002), Damijan et al. (2003), Lutz and Talavera (2003), Sgard (2001) and Vahter (2005). The estimate from the full sample (0.0064) indicates that a doubling of the FDI intensity is associated with less than 1% increase in firm productivity, which is relative small in size compared to other literature on the topic. Besides, we go further than the existing literature and also investigate whether the FDI intensity and productivity of FDI firms are linear or non-linear, and report evidence of an inverted U-shaped relationship between them. Also, direct effects are dependent on economic regional characteristics: a region with higher output and better trained employee, along with higher FDI intensity (South East, Red River Delta and North Central and South Central Coast) will reap the larger the magnitude of the direct effects. In addition, FDI firms with fewer than or equal to 50 employees obtain more direct effects (0.3% higher in terms of firm productivity) than FDI firms with a larger headcount. Firm R&D status is found to have an influence on the size and magnitude of the direct effects in a sense that active R&D firms gain 0.07% more from direct effects than non-active firms. Moreover, the direct effects are found to depend on industry concentration, which means that FDI firms have a higher level of productivity if they operate in less concentrated industries.

All findings on the direct effects presented in this chapter are more valuable in the specific case of Vietnam, an under-researched country where rich firm-level panel data exists; however, research has rarely explored this topic. These findings imply the roles of human capital, technology improvement and competitiveness of industries in enhancing the extent of the direct effects of FDI. Based on the findings in this chapter, we therefore urge policy makers in Vietnam to develop and implement more effective policies to reach a higher quality of education and training, along with a more level playing field between firms in the economy.

CHAPTER 5: CROWDING-IN/CROWDING-OUT EFFECTS OF INWARD FDI: DYNAMIC PANEL EVIDENCE ON VIETNAMESE FIRMS

5.1 Introduction

As analysed in the literature review in Chapter 2, theoretically the impact of a foreign presence on the host country's industrial structure and competition is controversial. Therefore, whether the effect of MNEs on the performance of host-country firms is, on average, positive or negative is ambiguous and needs to be decided empirically. This chapter aims to investigate whether a foreign presence improves or hampers the performance of domestic firms in terms of turnover. The chapter is expected to bridge the evidence gap on the crowding-in and crowding-out effects that have remained below the radar of many studies on developed and developing countries. Moreover, this research endeavours to contribute to the evidence base by estimating the crowding-in/crowding-out effects with an extensive focus on their sources of heterogeneity.

This chapter first presents empirical models to quantify the crowding-in/crowding-out effects of inward FDI on the turnover of domestically owned firms. The more substantial part of the chapter is devoted to demonstrating and discussing empirical evidence of the crowding-in/crowding-out effects. These effects are examined in both linear and non-linear specifications, with and without a 10% threshold of FDI intensity at firm level. We then verify whether the estimated results are robust for firms in different size classes, ownership types, R&D statuses and economic regions. Furthermore, industry concentration has also been found to affect the size and magnitude of the effects. The last part of this chapter summarizes all the key findings and suggest some policy implications.

5.2 Model, Estimation Issues and Data

5.2.1 Model

Baseline model

When MNEs invest in a host-country market, their subsidiaries or joint ventures may attract demand away from domestically owned enterprises due to superior technological, marketing and branding capabilities. This is the "market-stealing effect" (Aitken and Harrison, 1999) or crowding-out effect of FDI. It is measured by the turnover size of FDI firms relative to domestically owned firms. When domestic firms reduce production, they may experience a higher average cost as fixed costs are spread over a smaller scale of production, therefore leading to less productivity for those firms.

In this research, we replicate Aitken and Harrison's (1999) test of the crowding-out/crowding-in effect by estimating the turnover equation, which omits the input factors of production. The input factors are excluded with a view to examining the effect of foreign presence on the production scale of domestic firms, rather than productivity, as shown in Equation 5.1:

$$\begin{aligned} Y_{ijt} = {} & \delta_{10} + \delta_{11} FDI\_firm_{ijt} + \delta_{12} FDI\_industry_{jt} + \delta_{13}(FDI\_firm_{ijt} * FDI\_industry_{jt}) \\ & + \lambda_{1i} + \gamma_{1j} + \varphi_{1t} + \varepsilon_{1ijt} \end{aligned} \quad (5.1)$$

in which subscript i denotes firms, j denotes industry and t denotes year.

The dependent variable Y_{ijt} is the real turnover of firm i operating in industry j at the end of each year of study. Y_{ijt} is the log of turnover deflated by PPI and measured in VND.

In Equation 5.1, FDI_firm_{ijt} is firm-level FDI, measured by the foreign share of a firm's equity. It presents the foreign ownership participation in the total equity of a firm. On the other hand, $FDI\_industry_{jt}$ measures the extent of the foreign presence in industry j at time t. It is computed as the turnover-weighted average of firm-level FDI at the two-digit industry level of the VSIC. Finally, the coefficient on the interaction between firm level and industry level of FDI is captured through $FDI\_firm_{ijt} * FDI\_industry_{jt}$. It allows us to determine whether FDI intensity at industry level affects crowding-in/crowding-out effects. The three sets of dummy variables $\lambda_{1i}, \gamma_{1j}, \varphi_{1t}$ are also used to control for firm-, industry- and time-specific effects, respectively.

Crowding-in/crowding-out effects are captured through estimated coefficients δ_{11} and δ_{13} in Equation 5.1. A positive and significant δ_{11} suggests that firms with foreign capital tend to have a relatively larger turnover compared to average firms, indicating a crowding-out effect of FDI firms on domestic firms. More specifically, δ_{11} indicates that a one-unit increase in firm FDI is associated with a 100* δ_{11} unit of increase in the firm's turnover. On the other hand, a positive and significant δ_{13} indicates further crowding out through FDI concentration in the industry.

A positive and significant δ_{12} indicates that, on average, the turnover of both FDI and domestic firms is higher in industries with higher FDI intensity. However, it does not allow a crowding-in/crowding-out effect to be inferred. Higher average turnover in industries with higher FDI intensity may be due to a higher turnover by FDI firms, domestic firms or both.

Unlike other researchers who infer a crowding-in/crowding-out effect solely from the individual estimated coefficients of δ_{11} and δ_{13}, we calculate the total effect of crowding in/crowding out from the estimation of the linear model in accordance with Equation 5.1, as follows:

$$\frac{\partial y_{2ijt}}{\partial FDI\_firm_{ijt}} = \delta_{11} + \delta_{13} FDI\_industry_{jt} \qquad (5.2)$$

Additionally, we are going to examine whether a quadratic specification is valid for quantifying crowding-in/crowding-out effects or not through estimating the following equation:

$$\begin{aligned} y_{2ijt} = \delta_{20} &+ \delta_{21} FDI\_firm_{ijt} + \delta_{22} FDI\_firm^{2}_{ijt} + \delta_{23} FDI\_industry_{jt} \\ &+ \delta_{24} (FDI\_firm_{ijt} \times FDI\_industry_{jt}) + \lambda_{2i} + \gamma_{2j} + \varphi_{2t} + \varepsilon_{2ijt} \qquad (5.3) \end{aligned}$$

We then calculate the total effect of crowding in/crowding out from the estimation of the non-linear model in accordance with Equation 5.3, as follows:

$$\frac{\partial y_{2ijt}}{\partial FDI\_firm_{ijt}} = \delta_{21} + 2\delta_{22} FDI\_firm + \delta_{24} FDI\_industry \qquad (5.4)$$

We evaluate the total crowding-in/crowding-out effects of Equations 5.2 and 5.4 at the median of FDI intensity at firm and/or industry level. The interpretation of the findings is as follows:

If $\frac{\partial y_{2ijt}}{\partial FDI\_firm_{ijt}} > 0$, we infer a crowding-out effect.

If $\frac{\partial y_{2ijt}}{\partial FDI\_firm_{ijt}} < 0$, we infer a crowding-in effect.

If $\frac{\partial y_{2ijt}}{\partial FDI\_firm_{ijt}} = 0$, we infer no crowding-in/crowding-out effect.

Crowding-in/crowding-out effects of FDI by economic region

Regional variations in productivity have been investigated within a range of economic schools, such as new classical, endogenous growth and, more recently, new economic geography. Scholars have emphasized several factors that cause regional economic disparities. They are factors that are behind the varying economic performance of regions, ranging from institutional factors and regional and industry characteristics to the behaviour of firms. While being controversial on the origins and persistence of regional economic imbalances, all three theories agree that an important role in the process of convergence belongs to the diffusion of technology and knowledge through spillover mechanisms.

New classical models propose that regional variations in productivity are a temporary consequence of differences in capital–labour ratios and technological progress (Barro and Sala-I-Martin, 1991; Gardiner et al., 2004; Altomonte and Colantone, 2008). In the world of perfect competition, constant returns to scale, complete information and full divisibility of factors, the diffusion of technology across markets takes place freely and instantaneously, irrespective of regional or national administrative borders, and paves the way for regional productivity convergence.

However, endogenous growth models suggest that the diffusion of technology across markets does not take place instantaneously, as stated in new classical models. In addition, endogenous growth scholars argue that inter-regional productivity differences may persist and become wider over time. This strand of literature correlates regional variations in productivity with components of regional innovation potential, namely knowledge base, technological intensity of industries and proportion of workforce in knowledge-intensive activities (Romer, 1986, 1990; Aghion and Howitt, 1998). Moreover, the leadership of some regions in innovativeness provides their firms and industries with a competitive advantage in the goods and services markets (Gardiner et al., 2004) and attracts an inflow of knowledge and highly skilled workers from other regions (Aumayr, 2007).

New economic geography models hypothesize that localized increasing returns correlate with a spatial concentration of economic activity and other related externalities. These externalities originate from the accumulation of skilled labour, local knowledge spillovers, specialized suppliers and services, cooperation between firms and scientific institutions, as well as professional agencies (Krugman, 1991; Fujita et al., 1999; Fujita and Thisse, 2002; Baldwin et al., 2005; Hafner, 2013;

Stojcic et al., 2013). Furthermore, the emergence of agglomerations in particular locations is viewed as an outcome of socio-cultural, political and institutional structures. These factors explain why regions with initially similar underlying structures endogenously differentiate into rich "core" regions and less wealthy "peripheral" regions (Ottaviano and Puga, 1998; Altomonte and Colantone, 2008).

From the above theoretical framework, we intend to investigate empirically whether crowding-in/crowding-out effects differ by economic regions in Vietnam. Vietnam constitutes of 64 provinces that are divided into six economic regions: Red River Delta; Northern Midlands and Mountain areas; North Central and South Central Coast; Central Highlands; South East; and Mekong River Delta. Each province has its own code in the dataset, and we follow the division of the GSO to arrange the 64 provinces into six groups by economic regions. From our dataset, we report the mean of FDI intensity at industry level of the six regions over the ten years studied in descending order: (1) South East; (2) Red River Delta; (3) Mekong River Delta; (4) North Central and South Central Coast; (5) Central Highlands; and (6) Northern Midlands and Mountain areas. More analyses on each economic region in terms of several indicators can be found in Table 4.7 of Chapter 4.

Crowding-in/crowding-out effects of FDI and firm size and ownership types

Recent literature emphasizes that a firm's size is an influencing variable that can affect firm performance (Shepherd, 1972; Scherer, 1973; Caves and Porter, 1977; Amato and Amato, 2004). While the strengths of large firms lie mostly in their resources, those of small firms are discussed in terms of behavioural characteristics. In this context, the question of whether firm size manipulates the sign and magnitude of the crowding-in/crowding-out effects of FDI in terms of a firm's turnover is, therefore, an open and interesting question.

In this chapter, we investigate the crowding-in/crowding-out effects in small firms and medium-sized and large firms. Small firms are defined as those with fewer than or equal to 50 employees, while medium-sized and large firms are those with more than 50 employees. We introduce a dummy variable, !-allDfir-$_{iBt}$, which indicates the firm size in the sample. The variable equates to 1 if the firm's headcount of employees is equal to or less than 50 and equates to 0 otherwise. We use the dummy variable !-allDfir-$_{iBt}$ to restrict the full sample presented in Equation 5.1 to two sub-samples (small firms and medium-sized and large firms) to compare the effects between the two types of firm size.

We also investigate the sizes of the crowding-in/crowding-out effects in private firms only. In this circumstance, we generate a dummy variable for private firms and restrict the sample to private firms only, with a view to comparing the effects with average firms in the full sample presented in Equation 5.1.

Crowding-in/crowding-out effects of FDI and firm R&D status

One motivation for firms to undertake R&D is the increase in product and process innovation outputs. These benefits also relate to the development of the firm's capabilities and enhanced absorptive capacity, whereby the firm can utilize external knowledge and technology to improve productivity, as is well documented in the literature by Pavitt (1984), Cohen and Levinthal (1990) and Teece and Pisano (1998). McAdam and Keogh (2004) investigated the relationship between firms' performance and their familiarity with innovation and research. The two researchers suggest that firms' engagement with innovation is vital in a competitive environment in order to obtain higher competitive advantage.

We split the full sample in Equation 5.1 by the R&D status of firms. Notably, R&D status, $R\&D\_firm_{ijt}$, is a dummy variable, indicating whether firms have employed scientists and technicians for production in at least two years in the panel. We therefore investigate whether firms with an active R&D status experience fewer or more crowding-in/crowding-out effects from a foreign presence.

Crowding-in/crowding-out effects of FDI and industry concentration

The levels of industry concentration are calculated following Equation 4.6 in Chapter 4. Subsequently, to investigate how industry concentration affects the sign and magnitude of the crowding-in/crowding-out effects, we split the sample into two sub-samples based on the median value of FDI intensity at industry level: industries with a high level of concentration that lie above the median; and industries with a low level of concentration that lie below the median.

We then calculate the total effect of crowding in/crowding out from the estimation of the linear model in accordance with Equation 5.2.

5.2.2 Estimation Issues

In this chapter, we employ the system GMM approach developed by Arellano and Bond (1991) and Blundell and Bond (1998) to deal with the issue of endogeneity. System GMM combines equations in the first differences and in the levels. The former eliminates firm-specific fixed effects and uses the lagged levels of variables as valid instruments. The latter utilizes additional moment conditions in the levels equations that allow for the use of lagged differences of variables as valid instruments. The equations in levels address the problem of finite sample bias, which arises from the lagged levels of the variables providing weak instruments for first differences.

Like in Chapter 4, we adopt some approaches to improve the efficiency of system GMM estimation, such as collapsing the instrument sets and/or taking the orthogonal option in some cases. Besides, industry-specific and time-specific effects are included in our regression equations with a view to capturing industry-specific effects and trend effects. We also run the OLS levels and FE estimator in order to justify the GMM results obtained. The lag structure of dependent variables is included as an additional explanatory variable in the estimation. The econometrics package used is Stata 13.

5.2.3 Data

This study focuses only on firms in the five industrial groups of manufacturing, utility (electricity, gas and water supply), construction, science and technology activities, and computer and related activities, including a total of 28 industries, based on the sectoral classification of enterprises at the two-digit level of the VSIC, with a study period from 2001–2010. Table 5.1 shows descriptive statistics of the main variables used in this empirical estimation.

Table 5.1: Data descriptive statistics

No	Variable	Description	Obs	Mean	Std dev.	Min	Max
1	Real_turnover	Real turnover	492,331	19,652.38	261,077	-251,483	56,000,000
2	Ln_real_turnover	Log of real turnover	473,027	7.33	2.14	-1.06	17.84
3	FDI_firm	FDI intensity at firm level	494,264	6.02	23.40	0	100
4	FDI_firm^2	Squared FDI intensity at firm level	491,331	527.4	2193.8	0	10,000
5	FDI_industry	FDI intensity at industry level	494,635	19.72	18.87	0	99.37
6	Small_firm	Dummy for firms with fewer than or equal to 50 employees	467,497	.781	.419	0	1
7	R&D_firm	Dummy for firms that employ scientists and technicians in at least 2 years in the panel	494,635	.135	.341	0	1
8	HHI	Herfindahl–Hirschman Index	492,331	.0245	.084	.001	.98
9	FDI_firm* FDI_industry	Interaction between FDI intensity at firm and industry levels	491,331	219.6	983.89	0	9,937.13
10	FDI_firm* R&D _firm	Interaction between FDI intensity at firm level and dummy for firms that employ scientists and technicians in at least 2 years in the panel	494,264	1.97	13.54	0	100
11	FDI_firm* HHI	Interaction between FDI intensity at firm level and HHI	491,971	.156	1.38	0	98.1

Source: Author's calculation from the dataset

The number of observations in this chapter is drastically different compared with that of the previous chapter (492,331 obs vs. 264,887 obs). Noticeably, in chapter 4, Real Value Added is used as the dependent variable while in this chapter Real Turnover is utilized as the dependent variable. The difference in the number of observations comes from the fact that the real turnover is available in the dataset, however, the real value added need to be calculated from the data. We follow Nickell (1996) and Griffith et al. (2006) in calculating value-added output as the sum of total employment cost, operating profit before tax, accumulated depreciation, and interest payment. Hence, due to the missing value of the variable(s) in the calculation process, the observations in chapter 4 decreases to lower than that of this chapter.

Table 5.2 below present the correlations matrix of this chapter.

Table 5.2: Correlations matrix

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Real_turnover	1										
2. Ln_real_turnover	0.195	1									
3. FDI_firm	0.085	0.284	1								
4. FDI_firm^2	0.08	0.276	0.996	1							
5. FDI_industry	0.038	0.123	0.266	0.264	1						
6. Small_firm	-0.12	-0.589	-0.262	-0.256	-0.141	1					
7. R&D_firm	0.066	0.345	0.152	0.144	0.063	-0.377	1				
8. HHI	0.034	-0.138	0.008	0.007	0.028	0.038	-0.027	1			
9. FDI_firm* FDI_industry	0.092	0.267	0.917	0.916	0.330	-0.253	0.131	0.025	1		
10. FDI_firm* R&D _firm	0.075	0.20	0.58	0.571	0.148	-0.198	0.358	0.006	0.516	1	
11. FDI_firm* HHI	0.102	0.141	0.437	0.434	0.173	-0.112	0.070	0.143	0.504	0.262	1

Source: Author's calculation from the dataset

From Table 5.2, we observe that the variable for FDI intensity at firm level and the square term of that variable are highly correlated (0.996). Nevertheless, we argue that this high correlation is not an issue that needs to be dealt with in this case by checking the VIF between the two variables. The value of VIF is 1, detecting no collinerity between the two variables.

5.3 Estimation Results and Discussion

Baseline specification

The baseline panel estimation results of crowding-in/crowding-out effects are reported in Table 5.3 using the OLS levels and FE estimators and one-step system GMM, respectively.

As can be seen from Table 5.3, regarding GMM estimation, the sum of estimated coefficients on lagged log of real turnover in GMM (0.592 + 0.224 = 0.816) lies above the corresponding FE estimate (0.150 + 0.011 = 0.161) and below the corresponding OLS estimate (0.718 + 0.201 = 0.919). The results of the Arellano–Bond tests indicate that there is no second-order serial correlation. The values of the Sargan/Hansen test confirm that we do not reject the null hypothesis that the instruments are valid. To sum up, our test statistics affirm the validity and reliability of the GMM estimator.

Table 5.3 reveals that all estimated coefficients on lagged log of real turnover are significant. In addition, we can see evidence of a crowding-out effect at firm level through positive significant coefficients of FDI_firm in OLS and GMM estimations. As OLS tends to produce an upward biased result, we rely more on the estimation from GMM. On average, a one-unit increase in FDI intensity at firm level leads to a 4.4% increase in FDI firms' turnover. This result coincides with the findings of Aitken and Harrison (1999), Hu and Jefferson (2002) and Hsieh (2006) on the crowding-out effect of FDI on market share in transitional economies. The estimated coefficient on the interaction between FDI_firm and FDI_industry is reported significantly in both OLS and GMM, although the signs are opposite. The GMM estimation indicates a crowding-in effect through FDI concentration in the industry.

Table 5.3: Crowding-in/crowding-out effects of FDI in Vietnam (2001–2010): A baseline specification

Dep. variable: Ln real turnover	OLS	FE	SYS GMM
Ln real turnover			
L1	.718***	.150***	.592***
	(.003)	(.005)	(.123)
L2	.201***	.011***	.224**
	(.003)	(.003)	(.088)
FDI_firm	.002***	.0007	.044***
	(.00019)	(.001)	(010)
FDI_industry	-.0003	-.0027***	.091***
	(.00039)	(.0003)	(.015)
FDI_firm* FDI_industry	.000015***	.000015**	-.0012***
	(4.47e-06)	(6.65e-06)	(.00029)
Constant	.665***	6.68***	-.869**
	(.016)	(.093)	(.392)
Overall effect at median values of FDI industry	0.0022***	0.0009***	0.027***
Firm-year observations	206,511	206,511	206,511
Firms	64,527	64,527	64,527
Adjusted R-squared	0.789	0.038	0.907
Instrument			41
Hansen test			[0.939]
AR(1)			[0.000]
AR(2)			[0.262]

Notes:
All industry and time dummies are included but not reported to save space.
Standard errors are in parentheses; p-values in square brackets.
One-step GMM regression uses robust standard errors and treats the lagged real turnover measure, FDI intensity at firm level, FDI intensity at industry level and the interaction term between firm and industry FDI intensity as endogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

As analysed above, we evaluate the overall effect of crowding-in/crowding-out effects at the median FDI intensity at the industry level. As such, the crowding-in/crowding-out effects would be:

$$\frac{\partial \text{real turnover}}{\partial FDI\_firm} = \delta_{11} + \delta_{13} FDI\_industry = 0.044 + (-0.0012)(13.82) = 0.027 \qquad (5.5)$$

This result reinforces the evidence of the crowding-out effect of FDI in Vietnam when the full sample of firms is examined.

Additionally, when we combine the FDI intensity at industry level to calculate the total effect, the “external economies of scale” can be caught based on the coeffients δ_{12}, δ_{13} and median of FDI intensity at firm level as follows:

$$\text{External economies of scale} = \delta_{12} + \delta_{13} FDI\_firm = 0.091 + (-0.0012).(6.01) = 0.083 \qquad (5.6)$$

This positive value indicates that foreign presence increases the turnover size of the industry that the FDI firms operate. Hence, all firms in the industry, including both domestic firms and foreign firms benefit the enlargement in terms of turnover from the foreign presence. This confirms the positive external economies of scale that foreign presence brings when they enter Vietnamese market.

Moreover, when a 10% threshold of FDI intensity at firm level is applied (Table A5.1 in the Appendix), all the regression results of OLS, FE and GMM indicate the same implication as when there is no restriction in FDI intensity at firm level, as presented in Table 5.3.

Next, we would like to investigate how the crowding-in/crowding-out effects vary when FDI intensity at industry level varies. From Equation 5.2 we have:

$$\text{Crowding-in/Crowding-out effects} = \frac{\partial Y_{ijt}}{\partial FDI\_firm_{ijt}} = \delta_{11} + \delta_{13} FDI\_industry_{jt} \qquad (5.7)$$

From Table 5.3, we can note that $\delta_{11} = 0.044$; $\delta_{13} = -0.0012$. Also, we report FDI intensity at industry level ($FDI\_industry_{jt}$) at 0; minimum; 10th, 20th, 30th, 40th, 50th, 60th, 70th, 80th and 90th percentiles; and maximum values, and calculate the corresponding crowding-in/crowding-out effects following the above equation. Last but not least, we report the p_value of the coefficients of conditional crowding-in/crowding-out effects in the last column of Table 5.4.

Clearly, the conditional crowding-out effects decrease when the FDI intensity at industry level increases. More interestingly, after the 70th percentile the effects change size and become crowding-in effects. Noticeably, all the coefficients of conditional crowding-in/crowding-out effects are highly statistically significant at 1%, except the one at the 80th percentile of FDI intensity at industry level. Moreover, at the 50th percentile, the conditional effects are equal to the overall effects calculated at the median FDI intensity at industry level (0.027), as shown below.

Table 5.4: Conditional crowding-in/crowding-out effects of FDI with FDI intensities at firm and industry levels in Vietnam (2001–2010): Linear specification

FDI_industry percentiles	Corresponding FDI_industry values	Conditional crowding-in/ crowding-out effects	P_value
0	0	.0438544	0.000***
Min	0	.0438544	0.000***
10th percentile	2.209741	.0411608	0.000***
20th percentile	2.219946	.0411484	0.000***
30th percentile	2.972984	.0402304	0.000***
40th percentile	4.702096	.0381227	0.000***
50th percentile	13.82567	.0270013	0.000***
60th percentile	23.96901	.0146368	0.000***
70th percentile	29.78906	.0075424	0.000***
80th percentile	38.3632	-.0029093	0.164
90th percentile	47.86025	-.0144859	0.001***
Max	99.37131	-.0772765	0.000***

These findings suggest that examining conditional effects, considering the variance of the related covariate, would lead to a higher level of accurate results than investigating the overall effects at the mean/median of the covariate only.

We also re-estimate the baseline specification with manufacturing firms only, to check whether the crowding-in/crowding-out effects are consistent within the two different sample sizes. The estimation results are displayed in Table 5.5.

Table 5.5: Crowding-in/crowding-out effects of FDI in Vietnam (2001–2010): Baseline specification with manufacturing firms only

Dep. variable: Ln real turnover	All sample	Manufacturing firms
Ln real turnover		
L1	.592***	.388***
	(.123)	(.024)
L2	.224**	.057***
	(.088)	(.011)
FDI_firm	.044***	.094***
	(010)	(.007)
FDI_industry	.091***	.011***
	(.015)	(.003)
FDI_firm* FDI_industry	-.0012***	-.0003***
	(.00029)	(.00008)
Constant	-.869**	3.42***
	(.392)	(.241)
Overall effect at median values of FDI industry	0.027***	0.084
Firm-year observations	206,511	123,032
Firms	64,527	36,382
Adjusted R-squared	0.907	.945
Instrument	41	51
Hansen test	[0.939]	[0.235]
AR(1)	[0.000]	[0.000]
AR(2)	[0.262]	[0.313]

Notes: All industry and time dummies are included but not reported to save space.
Standard errors are in parentheses; p-values in square brackets.
One-step GMM regression uses robust standard errors and treats the lagged real turnover measure, FDI intensity at firm level, FDI intensity at industry level and the interaction term between firm and industry FDI intensity as endogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

From Table 5.5, we detect evidence of a crowding-out effect at firm level in the manufacturing sector. However, this effect is more pronounced in comparison with the effect for the whole sample. Furthermore, we find evidence of crowding-in effects at industry level for the manufacturing sector. When calculating the overall effect at the median of FDI intensity, we witness the same pattern of crowding-out effects as in the whole sample examined. This implies that firms in the manufacturing sector are more affected by a foreign presence in terms of turnover compared to average firms in the whole sample. Nevertheless, as both sample sizes illustrate the same pattern of crowding-out effects in Vietnam, we decided to explore the full sample in the following sections of this chapter, with the expectation that the bigger sample will be more informative.

Moreover, a quadratic specification is checked for validity through including square values of FDI intensity at firm level in estimations with and without the 10% threshold. The test results for quadratic specification employing OLS, FE and GMM without restriction are presented in Table 5.6.

Table 5.6: Crowding-in/crowding-out effects of FDI in Vietnam (2001–2010): Quadratic specification

Dep. variable: Ln real turnover	OLS	FE	SYS GMM
Ln real turnover			
L1	.718***	.150***	.637***
	(.004)	(.005)	(.007)
L2	.201***	.011***	.122***
	(.003)	(.003)	(.005)
FDI_firm	.004***	.0019	.098***
	(.0007)	(.0029)	(.028)
FDI_firm_square	-.00002***	-.000011	-.0008**
	(7.01e-06)	(.00002)	(.0002)
FDI_industry	-.0003	-.002***	.054***
	(.0003)	(.0003)	(.005)
FDI_firm* FDI_industry	.00001***	.000015 **	-.0002**
	(4.48e-06)	(6.65e-06)	(.0001)
Constant	.809***	6.68***	.467***
	(.016)	(.093)	(.158)
Firm/year observations	206,511	206,511	206,511
Firms	64,527	64,527	64,527
Adjusted R-squared	0.788	0.038	0.907
Instrument			50

Hansen test	[0.288]
AR(1)	[0.000]
AR(2)	[0.544]

Notes: All firms are without a minimum threshold of 10% for FDI intensity. All industry and time dummies are included but not reported to save space. Standard errors are in parentheses; p-values in square brackets.
One-step GMM regression uses robust standard errors and treats the lagged real turnover measure and all other independent variables as endogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The GMM test results reveal that the quadratic terms are significant in both cases, indicating that the quadratic specification is valid. The estimation results for quadratic specification in the case of a 10% threshold of FDI intensity at firm level can be found in Table A5.2 in the Appendix.

In this case, following Equation 5.4, the overall crowding-in/crowding-out effects at the median of FDI intensity at firm and industry level would be:

$$\frac{\partial /_{2ijt}}{\partial \boldsymbol{2}D\mathit{3}\,\boldsymbol{D}\ \mathrm{fir}-_{ijt}} = \delta_{21} + 2\delta_{22}\boldsymbol{2}D\mathit{3}\,\boldsymbol{D}\ \mathrm{fir}- + \delta_{24}\boldsymbol{2}D\mathit{3}\,\boldsymbol{D}\,\mathrm{industr}/$$
$$= 0.103 + 2 * (\text{-}0.0008) * 0. + (-0.0002)(13.82) = 0.100 \tag{5.8}$$

In tandem with the conditional crowding-in/crowding-out effects in the linear specification, we also investigate these conditional effects in a non-linear condition here. The calculations in Table 5.7 below also follow Equation 5.4. Notably, δ_{21}=0.103; δ_{22}=-0.0008; δ_{24}=-0.0002 in these calculations.

Table 5.7: Conditional crowding-in/crowding-out effects of FDI with various FDI intensities at firm and industry levels in Vietnam (2001–2010): Non-linear specification

Percentiles	Corresponding FDI_firm values	Corresponding FDI_industry values	Conditional crowding-in/ crowding-out effects	P_value
Min	0	0	.0980483	0.000***
1st	0	0.8479367	.0978211	0.000***
5th	0	1.416411	.0976688	0.000***
10th	0	2.209741	.0974563	0.000***
25th	0	2.972984	.0972518	0.000***
50th	0	13.82567	.0943441	0.000***
75th	0	33.89655	.0889666	0.000***
90th	0	47.86025	.0852254	0.000***
95th	100	53.1949	-.0810424	0.002***
99th	100	72.8875	-.0863185	0.002***
Max	100	99.37131	-.0934141	0.001***

From Table 5.7, we first notice that in the non-linear specification, the conditional crowding-out effects decrease when the related covariates increase and, from the 95th percentile, negative values of conditional effects are obtained. This pattern coincides with the trend in the linear specification above, confirming that crowding-in effects will replace crowding-out effects at high percentiles. This striking pattern cannot be recognized when examining the effects without the variance of the covariates of interest. It infers that the approach to examining the effects in a context of variance of covariates should produce a higher level of accuracy compared to the approach that does not take account of the variance.

Crowding-in/crowding-out effects of FDI by economic region

Table 5.8 presents the baseline crowding-in/crowding-out effects by six economic regions. Again, in these estimations we employ GMM for estimation to address the issue of endogeneity.

Table 5.8: Crowding-in/crowding-out effects of FDI in Vietnam by economic region (2001–2010)

Dep. variable: Ln real turnover	Red River Delta	Northern Midlands and Mountain areas	North Central and South Central Coast	Central Highlands	South East	Mekong River Delta
Ln real turnover						
L1	.467***	.522***	.591***	.642***	.686***	.583***
	(.078)	(.023)	(.031)	(.038)	(.156)	(.030)
L2	.174***	.077***	.143***	.209***	-.084*	.084**
	(.045)	(.014)	(.011)	(.039)	(.049)	(.033)
FDI_firm	-.010**	.032**	-.051***	.011*	-.029**	.022**
	(.004)	(.013)	(.013)	(.006)	(.008)	(.007)
FDI_industry	-.061***	.057**	-.075***	.007**	-.192***	.046**
	(.010)	(.025)	(.014)	(.003)	(.027)	(.019)
FDI_firm* FDI_industry	.0002***	-.0007**	.0006***	-.00031*	.001***	-.0002*
	(.00006)	(.0003)	(.0001)	(.00017)	(.00015)	(.00015)
Constant	4.48**	1.96**	3.62***	.955**	5.07***	2.08***
	(.444)	(.734)	(.354)	(.470)	(1.02)	(.464)
Overall effect at median values of FDI industry	-0.0068*	0.029**	-0.048***	0.00657**	-0.00503**	0.018***
Firm-year observations	52,844	18,704	32,483	6,164	67,233	28,525
Firms	17,398	5,668	9,590	1,881	21,992	7,799
Adjusted R-squared	.905	. 881	.872	.847	.927	.894
Instrument	45	48	48	23	46	47
Sargan/Hansen test	[0.230]	[0.462]	[0.410]	[0.600]	[0.323]	[0.664]
AR(1)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	[0.159]	[0.505]	[0.738]	[0.503]	[0.625]	[0.954]

Notes: Except in the Central Highlands estimation, all industry and time dummies are included but not reported to save space. Standard errors are in parentheses; p-values in square brackets. GMM regression uses robust standard errors and treats the lagged real turnover measure, FDI intensity at firm level, FDI intensity at industry level and the interaction term between firm and industry FDI intensity as endogenous. The values reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Two opposite patterns are depicted in the results. On the one hand, there is evidence of a crowding-out effect at firm level and a crowding-in effect at industry level in the Northern Midlands and Mountain areas and Mekong River Delta. On the other hand, the opposite patterns are found in the other four economic regions (Red River Delta, North Central and South Central Coast, Central Highlands and South East): there is evidence of a crowding-in effect at firm level and a crowding-out effect at industry level.

When overall effects in the six economic regions are examined at the median of the variables following Equation 5.2, we can quantify that the three top economic regions in terms of output, education level of employees and FDI intensity (North Central and South Central Coast, Red River Delta and South East) receive a crowding-in effect from FDI, while the three bottom economic regions (Northern Midlands and Mountain areas, Mekong River Delta and Central Highlands) suffer a crowding-out effect from FDI. This indicates that domestically owned Vietnamese firms in the Northern Midlands and Mountain areas, Mekong River Delta and Central Highlands tend to lose market share to their foreign-owned competitors when they compete head to head. However, domestic firms in the North Central and South Central Coast, Red River Delta and South East can expand their market share thanks to the foreign presence. These findings imply that levels of average value added, trained workers, capita-labour ratio, and FDI intensity can affect the sign of the crowding-in/crowding-out effects. Also, the findings are in line with the analyses of related indicators for the six regions in Chapter 4, which are presented in Table 4.7. The estimation results here reaffirm that firms with higher performing indicators will benefit more from a foreign presence than the others.

It is noteworthy that when the crowding-in/crowding-out effects are examined in the total sample, not splitting it into economic regions, evidence of overall crowding-out effects is obtained. This suggests that the crowding-out effects in the three least FDI-intensive regions outweigh the crowding-in effects in the three most FDI-intensive regions. In this case, if the negative effect of crowding out in the three least FDI-intensive regions could be minimized, or even altered to become positive, total crowding-in effects of FDI in Vietnam could be achieved. This urges policy makers to develop strategies that can increase FDI intensity in those three regions. Those strategies should aim to enhance investment incentives for prospective foreign investors, such as additional tax breaks or a tax holiday, in these three remote and mountainous regions. Further effort to improve the legal system, infrastructure and labour quality would be other suggestions for policy makers in this scenario. Last but not least, enhancing the absorptive capacity of domestic firms would be a prerequisite to making use of the positive effects of foreign presence.

Crowding-in/crowding-out effects and firm size and ownership types

In order to investigate firm heterogeneity and the size and magnitude of crowding-in/crowding-out effects, we test the baseline model in the full sample, the sample of private firms only, the sample of medium-sized and large firms, and the sample of small firms. We run all estimations in GMM and present the results in Table 5.9.

Table 5.9: Crowding-in/crowding-out effects of FDI in Vietnam by firm size and firm ownership type (2001–2010)

Dep. variable: Ln real turnover	Full sample	Private firms only	Small firms	Medium-sized and large firms
Ln real turnover				
L1	.592***	.717***	.659***	.443***
	(.123)	(.117)	(.097)	(.063)
L2	.224**	.137**	.112*	.081***
	(.088)	(.066)	(.063)	(.027)
FDI_firm	.044***	.028*	.060***	-.019***
	(010)	(.018)	(.023)	(.003)
FDI_industry	.091***	.187***	-.066***	-.037***
	(.015)	(.037)	(.011)	(.007)
FDI_firm* FDI_industry	-.0012***	-.0008*	-.001**	.0005***
	(.00029)	(.0005)	(.0007)	(.00008)
Constant	-.869**	-3.10***	3.17***	6.08**
	(.392)	(1.08)	(.412)	(.487)
Overall effect at median values of FDI industry	0.027***	0.022***	0.046***	-0.012***
Firm-year observations	206,511	101,937	138,667	67,609
Firms	64,527	32,335	52,295	19,613
Adjusted R-squared	.907	.916	.762	.938
Instrument	41	41	44	46
Hansen test	[0.939]	[0.961]	[0.386]	[0.482]
AR(1)	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	[0.262]	[0.207]	[0.810]	[0.442]

Notes:
All industry and time dummies are included but not reported to save space.
Standard errors are in parentheses; p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real turnover measure, FDI intensity at firm level, FDI intensity at industry level and the interaction term between firm and industry FDI intensity as endogenous. The values reported for the Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The results for private firms provide evidence of a crowding-out effect at firm level; however, the magnitude is smaller compared to the full sample. More concretely, on average, a one-unit increase in FDI intensity at firm level leads to a 3.3% increase in FDI firms' turnover in the sample of private firms only. At industry level, there is also evidence of a crowding-in effect: a one-unit increase in FDI intensity at industry level leads to a 0.08% decrease in FDI firms' turnover in the sample of private firms only.

As calculated above, we evaluate the overall effect of crowding in/crowding out at the median of FDI intensity at industry level:

$$\frac{\partial y_{Fit}}{\partial FDI\_firm_{it}} = \delta_{11} + \delta_{13} FDI\_industry = 0.044 + (-0.0012)\times(13.82) = 0.027 \qquad (5.9)$$

When we evaluate the total effect of crowding in/crowding out on private firms at the median of FDI intensity at industry level, we have the following:

$$\frac{\partial y_{Fit}}{\partial FDI\_firm_{it}} = \delta_{11} + \delta_{13} FDI\_industry = 0.033 + (-.0008)\times(13.82) = 0.022 \qquad (5.10)$$

Private firms in Vietnam have substantially weaker access to various production resources like capital, land and technology compared to SOEs (Tenev et al., 2003, chapter 3). The main obstacle to the development of the private sector in Vietnam is arguably unfair competition from SOEs, which is mainly manifested in problems with market access, financing and access to land (Hakkala & Kokko, 2007, p.32). Therefore, the weak competitiveness of the private sector has resulted in a greater vulnerability that exists among private firms when there are foreign entrants.

Regarding the estimation results for small firms, these show a crowding-out effect at firm level and a crowding-in effect at industry level, which coincides with the implication for all firms and private firms in the sample. Noticeably, the effects for small firms are larger at firm level and larger at industry level compared to average firms. When the total effects are examined, we have the following:

$$\frac{\partial /_{2iBt}}{\partial \mathbf{2}\mathrm{D}3\,D\ \mathrm{fir-}_{iBt}} = \delta_{11} + \delta_{13}\mathbf{2}\mathrm{D}3\,D\,\mathrm{industr/} = 0.060 + (\text{-}0.001)'(13.82) = 0.046 \qquad (5.11)$$

As such, there is evidence of a crowding-out effect of FDI on small firms with fewer than 50 employees in Vietnam (2001–2010). This crowding-out effect is most apparent among different firm sizes and firm ownership types. These findings support the arguments of Aitken and Harrison (1999) and Zhang, Li and Zhou (2010), which point out that small domestic firms (in terms of employment or output) may have less competitiveness compared with large firms; therefore, they suffer more significant losses from the presence of foreign investors compared to large firms. On the same theme, Zhang, Li and Zhou (2010) allege that large domestic firms with more internal capabilities and stronger capacity than small ones can benefit more from a foreign presence.

In contrast, there is evidence of a crowding-in effect at firm level (a one-unit increase in FDI intensity at firm level leads to a 1.9% decrease in FDI firms' turnover) and a crowding-out effect at industry level (a one-unit increase in FDI intensity at firm level leads to a 0.05% increase in FDI firms' turnover in the industry). This interesting finding suggests that when FDI firms enter, they enhance the turnover of large domestic firms in the same industry. When total crowding-in/crowding-out effects are calculated following Equation 5.2, we have:

$$\frac{\partial /_{2iBt}}{\partial \mathbf{2}\mathrm{D}3\,D\ \mathrm{fir-}_{iBt}} = \delta_{11} + \delta_{13}\mathbf{2}\mathrm{D}3\,D\,\mathrm{industr/} = -0.019 + (0.0005)'(13.82) = -0.012 \qquad (5.12)$$

This number produces evidence of a crowding-in effect of FDI on medium-sized and large firms in Vietnam in the period under study, 2001–2010.

In a nutshell, crowding-out effects of FDI in Vietnam are pronounced on the sample of all firms, private firms and small firms; however, a crowding-in effect is apparent in the sample of medium-sized and large firms. These findings imply heterogeneity in crowding-in/crowding-out effects of FDI in Vietnam in terms of firm size.

Crowding-in/crowding-out effects and firm R&D status

Table 5.10 depicts the GMM estimations when we split the whole sample into active R&D firms and non-active R&D firms.

Table 5.10: Crowding-in/crowding-out effects of FDI in Vietnam by firm R&D status (2001–2010)

Dep. variable: Ln real turnover	**Active R&D**	**Non-active R&D**
Ln real turnover		
L1	.735***	.654***
	(.026)	(.009)
L2	.122***	.125***
	(.017)	(.007)
FDI_firm	.024***	.047***
	(.005)	(.004)
FDI_industry	.046***	.072***
	(.010)	(.012)
FDI_firm* FDI_industry	-.0008***	-.001***
	(.0001)	(.0001)
Constant	.674	-.091
	(.446)	(.326)
Overall effect at median values of FDI industry	0.013***	0.033***
Firm-year observations	48,407	158,104
Firms	7,897	56,630
Adjusted R-squared	.949	.869
Instrument	45	45
Sargan/Hansen test	[0.270]	[0.190]
AR(1)	[0.000]	[0.000]
AR(2)	[0.863]	[0.947]

Notes:
All industry and time dummies are included but not reported to save space.
Standard errors are in parentheses; p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real turnover measure, FDI intensity at firm level, FDI intensity at industry level and the interaction term as endogenous. The values reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

From Table 5.10, it can be seen clearly that all of the test results indicate evidence of a crowding-out effect at firm level and a crowding-in effect at industry level. However, the magnitude of the crowding-out effect at non-active R&D firms is double that of active R&D firms. In the same manner, active R&D firms gain more from the crowding-in effect at industry level than their non-active counterparts, although the magnitudes are both small. When we calculate the overall effect at the median of FDI intensity at industry level, we report that a crowding-out effect is more evident in non-R&D firms rather than active firms. To the best of our knowledge, this finding is the first that indicates the relationship between R&D status and crowding-in/crowding-out effects in this research field. It strengthens the argument of Cohen and Levinthal (1990) and Teece and Pisano (1998) that firms will enhance their capabilities and absorptive capacity through R&D engagement, which helps them to suffer less from turnover lost due to a foreign presence.

Crowding-in/crowding-out effects and industry concentration

We split the whole sample by the restrictions regarding the level of industry concentration (HHI). We use the median value of HHI to divide the sample into a high level of concentration with HHI values lying above the median and a low level of concentration with HHI values lying below the median. The estimation results are presented in Table 5.11.

From Table 5.11, we can see evidence of crowding out at firm level and crowding in at industry level, which is consistent with the previous findings in the baseline and other model specifications in this chapter. Clearly, the crowding-out effect is more evident in less competitive industries (0.018) than in highly competitive industries (0.015). In the same manner, the crowding-in effect at industry level at the former industries (-.0025) is smaller than that in the latter industries (-.0001). Given the median value of FDI intensity at industry level, we report an overall larger crowding-out effect of FDI in less competitive industries than in highly competitive industries (0.016 vs. 0.014).

Table 5.11: Crowding-in/crowding-out effects of FDI in Vietnam by industry concentration (2001–2010)

Dep. variable: Ln real value-added output	High level of concentration	Low level of concentration
Ln real value-added output		
L1	.695***	.410***
	(.064)	(.022)
L2	.092**	-.013
	(.046)	(.020)
FDI_firm	.018***	.015***
	(.004)	(.001)
FDI_industry	.005	.016***
	(.007)	(.002)
FDI_firm* FDI_industry	-.0025***	-.0001***
	(.0001)	(.00002)
Constant	1.55***	4.67***
	(.347)	(.320)
Overall effect at median values of FDI industry	0.016***	0.014***
Firm-year observations	99,896	106,615
Firms	38,987	40,975
Adjusted R-squared	.949	.842
Instrument	46	36
Sargan/Hansen test	[0.104]	[0.525]
AR(1)	[0.000]	[0.000]
AR(2)	[0.294]	[0.320]

Notes: All industry and time dummies are included but not reported to save space.
Standard errors are in parentheses; p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real turnover measure, FDI intensity at firm level, FDI intensity at industry level and the interaction term as endogenous. The values reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The results indicate that domestic firms that operate in a less competitive market environment will lose more in terms of turnover when foreign investors enter. This implies a positive relationship between industry concentration and the crowding-out effect: the more concentrated the industry, the greater the crowding-out effect, and vice versa.

5.4 Conclusion

This chapter investigates whether the presence of firms with foreign capital has a crowding-out effect on domestically owned firms. The dynamic panel data approach to GMM proposed by Arellano and Bond (1991) and Blundell and Bond (1998) is employed to control for firms' unobserved heterogeneity, inputs and ownership endogeneity, as well as measurement errors.

We identify opposing dynamics at work at baseline specifications. On the one hand, we observe a firm-level crowding-out effect due to higher shares in turnover as the level of foreign capital increases. On the other hand, we observe an industry-level crowding-in effect, as the share of foreign-owned firms in turnover is lower when the industry level of foreign capital intensity increases. The findings indicate that domestically owned Vietnamese firms tend to lose market share to their foreign-owned competitors when they compete head to head; but they also tend to benefit from higher levels of foreign capital invested in their industry. When evaluating crowding-in/crowding-out effects at both firm and industry levels simultaneously, we conclude that there is evidence of a crowding-out effect of FDI on the turnover share of domestically owned Vietnamese firms. On average, a one-unit increase in FDI intensity lead to a 2.7% increase in FDI firms' turnover, which implies a shrink in turnover of domestic firms in Vietnam given that the total turnover of firms in the market is constant. We also find that the quadratic specification is valid in this model, indicating an inverted U-shaped relationship between FDI intensity and turnover of firms.

We also verify whether the results above are robust for firms in different economic regions, size classes and ownership types. Regarding the effects by economic region, we find evidence of crowding-in effects in the regions with higher levels of output, FDI intensity, capital-labor ratio, and educated workers (South East, Red River Delta and North Central and South Central Coast). However, the crowding-out effects are apparent in the regions with lower levels of the above indicators (Northern Midlands and Mountain Areas, Central Highlands, and Mekong River Delta). In addition, crowding-out effects of FDI in Vietnam are evident in the sample of all firms, private firms and small firms; however, a crowding-in effect is apparent in the sample of medium-sized and large firms. Concretely, the foreign presence enhances the turnover of medium-sized large domestic firms by 1.2% while it reduces the turnover of small domestic firms by 4.6%. These findings imply heterogeneity in the crowding-in/crowding-out effects of FDI in Vietnam in terms of firm size. Finally, we report that the R&D status of firms can influence the magnitude of the crowding-out effect. Non-active R&D firms lose more in terms of turnover compared to active R&D firms ((3.3% vs. 1.3%)) because of a foreign presence. In addition, we detect evidence of a positive relationship between crowding-out effect and industry concentration, implying that domestic firms that operate in a less competitive market environment will lose more in terms of turnover when foreign investors enter.

The findings in this chapter infer that foreign presence can do harm to domestic firms in Vietnam, particularly for small private firms or firms with non-active R&D status. In addition, the turnover loss would be more pronounced in low FDI-intensive regions or in a less competitive market. This sounds an alarm to policy makers on how to take full advantage of the tangible and intangible assets of FDI while minimizing the detrimental effect that the foreign presence brings about.

CHAPTER 6: INWARD FDI AND PRODUCTIVITY SPILLOVERS: EVIDENCE FROM VIETNAMESE MICRODATA

6.1 Introduction

Since the first theoretical background for spillover effects on productivity was established by Marshall (1890), Arrow (1962), Romer (1986), and Jacobs (1969), theorists have agreed that FDI can generate technological externalities, whereby innovations and improvements occurring in one firm can increase the productivity of other firms without full compensation by the latter. However, existing evidence on spillovers of FDI and firm productivity is varied and often conflicting. This chapter aims to contribute to the existing evidence base and knowledge base by estimating and discussing a wide range of FDI spillovers, namely horizontal, vertical backward and vertical forward, in the context of a developing country, Vietnam, which has recorded remarkable success in terms of attracting inward FDI.

One of the main contributions of this chapter is to investigate the spillover effects of FDI with an extensive focus on their sources of heterogeneity, while utilizing GMM to tackle the issue of endogeneity bias in estimation of a production function. This effort is relevant and more valuable in the context of Vietnam, where most studies on the topic of FDI spillovers and productivity are immature.

This chapter first presents empirical models to quantify horizontal, backward and forward linkages of inward FDI on firm productivity. The more substantial part of the chapter is devoted to demonstrating and discussing the empirical evidence of these three distinctive effects. We then verify whether the estimated results above are robust for economic regions and for firms in different size classes, ownership types and R&D statuses. Industry concentration has also been investigated, with the objective of justifying how it can affect the size and magnitude of FDI spillovers. The last part of this chapter summarizes all the key findings and suggests some policy implications.

6.2 Model, Estimation Issues and Data

6.2.1 Model

Baseline model

With a view to examining the spillover effects of FDI on the productivity of firms in the host country, we follow the approach that has been used extensively in the literature (see Aitken and Harrison, 1999; Javorcik, 2004). The method follows the seminal paper by Griliches (1992), who postulates a Cobb–Douglas augmented production function including both internal and external factors of production. The presence of such external influences on the firm is the consequence of externalities in production, due to formal or informal linkages between firms. In the case of FDI spillovers, technology and managerial skills as well as new products and processes associated with a foreign presence in the host country could be seen as an input to the production of a firm, augmenting the productivity of all other factors (Liu, 2008). Hence, the traditional production function is extended through introducing FDI as a source of capital accumulation as well as a generator of knowledge.

We therefore build an empirical model as follows:

$$/_{1iBt} = \sigma_{1(} + \sigma_{11}\#_{iBt} + \sigma_{12}l_{iBt} + \sigma_{13}\mathbf{2}D\mathit{3}\,\mathit{D}\ fir-_{iBt} + \sigma_{14}\$ori0ontal_{Bt} + \sigma_{15}Cac\#1ard_{Bt} + \sigma_{16}2or1ard_{Bt} + \rho_{1i} + \theta_{1B} + \omega_{1t} + \vartheta_{1iBt} \qquad (6.1)$$

in which subscript i denotes firms, B denotes industry and t denotes year.

The dependent variable $/_{1iBt}$ is the real value-added output of firm i operating in industry B at the end of each year of study. We follow Nickell (1996) and Griffith et al. (2006) in calculating value-added output as the sum of total employment cost, operating profit before tax, accumulated depreciation and interest payment. Then real value-added output is obtained by deflating the value-added output with the PPI, supplied by the GSO by industry over years.

$\#_{1iBt}$ is the real value of fixed assets of firm i operating in industry B at the beginning of each year of study, deflated by the gross fixed capital formation;

l_{1iBt} is the total employees of firm i operating in industry B at the beginning of each year of study;

$/_{1iBt}$, $\#_{1iBt}$ and l_{1iBt} are all in natural logs.

$2D3Dfir-_{iBt}$ is the firm-level FDI, measured by the foreign share of a firm's equity. It presents the foreign ownership participation in total equity of a firm.

$$\$ori0ontal_{Bt} = \left(\sum_{i \in j} \text{ForeignShare}_{it} * Y_{it} \right) \Big/ \left(\sum_{i \in j} Y_{it} \right) \qquad (6.2)$$

$\$ori0ontal$ measures the extent of foreign presence in industry B at time t, defined as a weighted share of the output produced by FDI firms in the total industry output. The weighted share of the output produced by FDI firms is obtained by multiplying the share of foreign investors in the firm with the latter's output.

To generate $\$ori0ontal_{Bt}$ in Stata, we follow these steps. Firstly, we calculate total value-added output by industry. Secondly, we multiply FDI share in the firm with the firm's real value-added output. The product of the two is a measure of the output that can be assigned to foreign ownership within each firm. Thirdly, we sum the product of FDI share in the firm with the firm's real value-added output for each two-digit industry. Finally, for each two-digit industry in each year, we obtain the $\$ori0ontal$ spillover pool by dividing the multiplying product by total industry value-added output.

$Cac\#1ard_{Bt}$ is a proxy for the foreign presence in the industries that are being supplied by industry B. It captures the extent of potential contacts between domestic suppliers and multinational customers. More concretely, $Cac\#1ard_{Bt}$ quantifies the magnitude of foreign presence in the downstream industry (industry $\#$, for example) that is being supplied by industry B:

$$Cac\#1ard_{Bt} = \sum_{\#\ \text{if}\ \# \neq B} \chi_{B\#} \$ori0ontal_{\#t} \qquad (6.3)$$

$\chi_{B\#}$ is the proportion of industry BAs output supplied to industry $\#$, which is taken from the 2007 Input–Output (IO) table compiled by the GSO at the two-digit level of the VSIC. This measure is intended to capture the extent of backward linkages between foreign firms in downstream industries and local firms in upstream industries. Notably, inputs supplied within the sector are not included, since this effect is already captured by the $\$ori0ontal_{Bt}$ variable.

$2or1ard_{Bt}$ is a proxy for the foreign presence in the industries that supply to industry B. It captures the extent of potential contacts between multinational suppliers and domestic customers. More concretely, $2or1ard_{Bt}$ quantifies the magnitude of the foreign presence in the upstream industry (industry $-$, for example) that supplies to industry B:

$$Forward_{jt} = \sum_{m \text{ if } m \neq j} \psi_{jm} Horizontal_{mt} \qquad (6.4)$$

ψ_{jm} is the proportion of industry j's input that is purchased from industry m, which is taken from the 2007 IO table complied by the GSO at the two-digit level of the VSIC. This measure is intended to capture the extent of forward linkages between foreign firms in upstream industries and local firms in downstream industries. For the same reason as analysed above in the $Backward_{jt}$ variable calculation, inputs purchased within the sector are excluded.

In our estimation, we take both contemporaneous and lagged horizontal, backward, and forward variables into account as spillovers take time to manifest themselves (Javorcik, 2004; Liu, 2008). However, how many lag lengths for the spillover variables still remain controversial in the existing literature. Hence, we present the estimation results for 1-lag of the associated variables in this chapter and also use the 2-lag specifications as a sensitivity check, which are presented in the Appendix of this thesis.

The three sets of dummy variables $\rho_{1i}, \theta_{1j}, \omega_{1t}$ are made use of to control for the firm-, industry- and time-specific effects, respectively. Firm and industry dummy variables are used in the regression model in order to capture firm- and industry-specific effects, and year dummy variables are included with a view to accounting for trend effects.

Working with the IO table

We utilize the 2007 IO table (in Excel format), sourced from GSO, to calculate the variables of interest. The table consists of 31 sectors. We first notice that along each row of the IO table, the figures show how many outputs the sector of interest sells to other sectors in the economy. For instance, in the row for sector 1, the figures present how many outputs sector 1 sells to itself, to sector 2, to sector 3…, to sector 31. In this case, sector 1's outputs serve as intermediate inputs to other sectors. By analogy, we detect that along each column of the IO table, the figures show how many inputs the sector of interest buys from other sectors in the economy. For example, in the column for sector 1, the figures show how many inputs sector 1 buys from itself, from sector 2, from sector 3…, from sector 31. In this case, other sectors' outputs serve as intermediate inputs to sector 1.

Secondly, we calculate an IO matrix of technical coefficients by dividing each cell in the table by total intermediate consumption and by total gross output. We then obtain two 31x31 square matrices.

When dividing each cell of the intermediate consumption part of the IO table in row B by the row total, which is total intermediate consumption, we can produce a matrix of technical coefficients for backward linkages. Reading along the same row of the matrix for any sectors gives the contribution of intermediate consumption to the value of total intermediate consumption. For example, along the row of sector 1, it is the proportion of sector 1's output (serving as intermediate inputs) supplied to sector 1 itself, supplied to sector 2, to sector 3…, to sector 31. Clearly, each cell in the row of the matrix is a coefficient of the backward variable in Equation 6.3.

When dividing each cell of the gross output part of the IO table in column B by the column total, which is total gross output, we can produce another matrix of technical coefficients for forward linkages. Reading down the column of the matrix for any sector gives the contributions of the inputs to the value of the total output. For example, along the column for sector 1, it is the proportion of sector 1's output, sector 2's output, sector 3's output…, sector 31's output serving as intermediate inputs that contributes to the total gross output of sector 1. In other words, it is the proportion of sector 1's input purchased from itself, from sector 2, from sector 3…, from sector 31 in total gross output. Hence, each cell in the column of the matrix is a coefficient of the forward variable in Equation 6.4.

Noticeably, inputs purchased within a sector are excluded (Javorcik, 2004) in the calculation of $Cac\#1ard_{Bt}$ and $2or1ard_{Bt}$ variables. To do so, inputs are set to zero if they are supplied within the same industry ($- = B$ or $\# = B$) and the row and column totals are corrected. Practically, all inputs (cells) on the diagonal of the IO table are set to zero and then the row total (total intermediate consumption) and column total (total gross output) are recomputed. We then have an adjusted matrix that excludes inputs purchased within the sector. Again, each cell when moving down a column of the matrix presents coefficients of the forward variable. Similarly, each cell when moving along the same row of the matrix depicts coefficients of the backward variable.

In the next step, we calculate the backward variable in a sector in a year by multiplying the coefficient of the backward variable from the IO table and the value of the horizontal variable in that sector at that year. The level of industrial disaggregation in most cases enables direct translation from the IO table to the two-digit industry code (two-digit VSIC). However, a direct translation is not always possible when the IO table is more aggregated than the VSIC codes. For example, code 10 in IO 2007 is an aggregate of sectors 18 and 19 in the VSIC. In order to assign IO coefficients to industries with a two-digit VSIC code, we use an apportioning procedure based on the averaged horizontal effect within the group of the VSIC industry (see Timmer et al., 2012, pp.34–35 and Faggio et al., 2014, p.8). We then do the summation of all values of the backward variable for all sectors in the year. The backward variables in the years thereafter are calculated similarly.

For the forward variable, we follow the same procedure as applied to calculate the backward variable. Then backward and forward variables for each industry in each year are input into Stata by industry and year for further calculations and estimations.

Spillover effects of FDI by economic region

As indicated in Chapters 4 and 5, regional variations result in assorted findings on the effects of FDI and productivity. Having been extensively discussed in New Classical, Endogenous Growth and New Economic Geography theories, regional variations are proposed to lead to divergence in productivity. Existing empirical studies support these theories when they conclude that inward FDI flows lead to unbalanced regional growth across regions within an FDI recipient country. Noticeably, these studies mainly focus on the developing world, such as Nunnenkamp and Stracke (2007) for India; and Fujita and Dapeng (2001), Jian, Sachs and Warner (1996), Lin and Liu (2000), Ng and Tuan (2006) and Zhang and Zhang (2003) for China. In Vietnam, to the best of our knowledge, only Anwar and Nguyen (2014) have explored the effects of FDI between economic regions.

Similar to the last two chapters, we intend to investigate the spillover effects of FDI by economic regions in Vietnam to observe the disparity. Vietnam constitutes of 64 provinces that are divided into six economic regions: Red River Delta; Northern Midlands and Mountain areas; North Central and South Central Coast; Central Highlands; South East; and Mekong River Delta. Each province has its own code in the dataset, and we follow the division of the GSO to arrange the 64 provinces into six groups by economic regions. Hence, we split the sample into six groups to quantify and compare the spillover effects between these groups in this chapter.

Spillover effects of FDI and firm size

Firm size is expected to control for the absorption of spillovers and productivity-enhancing processes. As noted by Tybout (2000) and Farole and Winkler (2012), larger firms usually have advantages of economies of scale, political clout and better access to government credits, contracts and licenses, particularly in developing countries. They also benefit from a large number of trained and skilled people and more competent management. Hence, they have a higher capability to utilize knowledge spillover from FDI. However, smaller firms have the advantage of more flexible management and being more responsive to changes in the business environment (Tybout, 2000). Therefore, the expectations of firm size and spillover effects are not clear cut. Firm size may have either a positive or negative impact on productivity spillovers.

As analysed in Chapter 2, the literature indicates that forei.n fir- si0e may affect the sign and magnitude of spillover effects. However, empirical evidence seems to produce mixed results. Using a sample of 3,742 manufacturing firms operating in Greece in 1997, Dimelis and Louri (2004) propose that small foreign firm size is found to generate more FDI productivity than large foreign firm size. Lenaerts and Merleved (2015) assert that only medium-sized foreign firms generate spillover effects, while micro, small and, more surprisingly, large foreign firms do not, through employing a firm-level panel dataset for Romanian firms in 1996–2005. Also, si0e of do-estic fir- may have an impact on the presence of spillovers, as it relates to the capacity of domestic firms to reap the benefits from inward investment. Aitken and Harrison (1999) point out that small domestic firms (in terms of employment or output) may have less competitiveness compared with foreign firms; therefore, they might suffer more significant losses. In addition, such firms may have an inability to produce at a sufficient production scale to imitate technology brought in by MNEs. For those reasons, larger domestic firms are supposed to benefit more from the existence of spillover pool. On the same theme, Zhang, Li and Zhou (2010) allege that large domestic firms with more internal capabilities and stronger capacity than small ones can benefit more from FDI spillovers. Conversely, as Dimelis and Louri (2004) point out in their research, large indigenous firms are usually competitive and do not have many differences in technology level in comparison with foreign affiliates; therefore, little technical knowledge transfers from

MNEs to them, while small domestic firms may perform at suboptimal efficiency, differing from foreign firms in terms of technology level, hence they are more influenced by the foreign presence and receive larger spillover effects.

This chapter examines how average firm size affects productivity spillovers. To do so, we split the sample into small firms and medium-sized and large firms. Small firms are defined as those with headcount of employee equal to or lower than 50, while medium-sized and large firms are those with more than 50 employees.

Spillover effects of FDI and firm R&D status

Existing literature has so far identified that in-house R&D effort facilitates the absorption of external knowledge (Cohen and Levinthal, 1990), in both developed and developing countries (Blalock and Gertler, 2005). Firm absorptive capacity is defined as the "ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal 1990). Developments from Cohen and Levinthal (1990) and Blalock and Gertler (2005) have proposed three firm capabilities that may influence technology adoption. Firstly, a firm's investment in absorptive capacity would likely influence its ability to exploit external knowledge. As discussed by Cohen and Levinthal (1990), a firm can build absorptive capacity by engaging in activities requiring prior related knowledge, such as basic related skills, a common language or familiarity with scientific and technical developments in the field. Secondly, Blalock and Gertler (2005) suggest that a firm's human capital may influence its adoption of technology for similar reasons. Having skilled personnel with a sufficient training and educational background to learn quickly may assist firms in observing, adopting or imitating the external technology. Thirdly, a firm's technology gap, which is the distance between the level of its technology and that of its foreign counterpart's best-practice frontier, could affect technology adoption. However, the issue of how to measure the technology gap is problematic, and the direction of such an effect is varied and often conflicting in the existing literature.

In this chapter, we investigate the relationship between a firm's human capital and its ability to exploit external knowledge from FDI. We use a dummy variable, $R\&D\_firm_{ijt}$, to split the sample into active R&D and non-active R&D firms. The R&D active status indicates that firms have employed scientists and technicians for production in at least two years in the panel, and vice versa for non-active R&D firms.

Spillover effects of FDI and industry concentration

Industry concentration refers to the HHI of sales concentration, which is calculated as the sum of the squared market shares of all firms in the industry:

$$HHI_{jt} = \sum \left(\frac{S_{ijt}}{\sum_{i \in j} S_{ijt}} \right)^2 \qquad (6.5)$$

An industry with a lower concentration ratio may indicate more intense competition between firms, and therefore postulates a positive effect on their productivity level (Javorcik, 2004). However, it should be noted that a low market share might also have a negative impact on R&D expenditures, which can generate detrimental effects on productivity level. Hence, the effect of industry concentration on productivity is unclear.

Other arguments also state that the competitiveness of an industry has ambiguous impacts on measured productivity. Increased competition may improve productivity, but may also drive up input prices and thus affect the profitability of incumbent firms, at least in the short run. As postulated by Haskel et al. (2007), the competition variables capture market power and industry competition, and it is important to control for market competition, because competition affects firm efficiency (Nickell, 1996). A foreign firm entry may increase competition and thus productivity. However, the foreign firm entry may also bring an adverse effect on domestic firms, as foreign firms tend to be larger and easily establish dominant market power (OECD, 2002).

We split the sample by the top 25% of high industry concentration and the bottom 25% of low industry concentration to compare the spillover effects between the two groups. Positive and significant estimated spillover coefficients reveal a positive relationship between the level of industry concentration and spillover effects of FDI: the higher the industry concentration, the larger the FDI spillovers, and vice versa. In contrast, the significant negative coefficient indicates that the more concentrated the industry, the less the FDI spillovers.

6.2.2 Estimation Issues

In this chapter, we employ the GMM approach proposed by Arellano and Bond (1991) and Blundell and Bond (1998) to take account of endogeneity problems encountered in the estimation of production functions. Moreover, we adopt some approaches to improve the efficiency of system GMM estimation. In particular, we collapse the instrument sets and take the orthogonal option in some cases, following Roodman (2009). Also, industry-specific and time-specific effects are included in our regression equations in order to capture industry-specific effects and trend effects. The lag structure of dependent and some independent variables is included as an additional explanatory variable in the estimation. The econometrics package used is Stata 13.

6.2.3 Data

This study focuses only on firms in the five industrial groups of manufacturing, utility (electricity, gas and water supply), construction, science and technology activities, and computer and related activities, including a total of 28 industries, based on the sectoral classification of enterprises at the two-digit level of the VSIC, with a study period from 2001–2010. Table 6.1 shows descriptive statistics of the main variables used in this empirical estimation, while Table 6.2 presents the correlation matrix of the variables of interest.

Table 6.1: Data descriptive statistics

No	Variable	Description	Obs	Mean	Std dev.	Min	Max
1	Real_VA_ouput	Real value added of output	264,887	8,414.809	307,610.9	0	97,800,000
2	Ln_real_VA_ouput	Log of real value added of output	263,986	6.45	1.80	-5.15	18.40
3	Ln_net_fa	Log of net value of fixed asset	256,186	.699	1.79	-5.67	12.24
4	Ln_ld11	Log of number of employees	455,400	2.98	1.44	0	11.30
5	FDI_firm	FDI intensity at firm level	494,264	6.019	23.39	0	100
6	Horizontal	Foreign presences intra-industry	494,635	22.69	21.38	0	99.94
7	Horizontal lagged	Lag of foreign presences intra-industry	320,251	24.21	21.87	0	99.94
8	Backward	Foreign presences in downstream industry	494,635	12.74	10.5	1.05	46.96
9	Backward lagged	Lag of foreign presences in downstream industry	320,251	13.33	10.70	1.19	46.96
10	Forward	Foreign presences in upstream industry	494,635	10.64	4.32	1.81	24.67
11	Forward lagged	Lag of foreign presences in upstream industry	320,251	11.09	4.51	1.84	24.67
12	Small_firm	Dummy for firms with fewer than or equal to 50 employees	467,497	.781	.419	0	1
13	R&D _firm	Dummy for firms that employ scientists and technicians in at least two years in the panel	494,635	.135	.341	0	1
14	HHI	Herfindahl–Hirschman Index	492,331	.024	.084	.001	.98
15	HHI* Horizontal	Interaction between HHI and foreign presences intra-industry	492,331	1.01	5.81	0	97.75
16	HHI* Backward	Interaction between HHI and foreign presences in downstream industry	492,331	.393	1.45	.005	17.51
17	HHI* Forward	Interaction between HHI and foreign presences in upstream industry	492,331	.185	.479	.013	12.92

Source: Author's calculation from the dataset

Table 6.2: Correlations matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Real_VA_ouput	1																
2. Ln_real_VA_ouput	0.088	1															
3. Ln_net_fa	0.07	0.73	1														
4. Ln_ld11	0.074	0.85	0.65	1													
5. FDI_firm	0.025	0.37	0.34	0.345	1												
6. Horizontal	0.005	0.11	0.080	0.209	0.241	1											
7. Horizontal lagged	0.011	0.054	0.049	0.16	0.213	0.87	1										
8. Backward	0.008	0.11	0.15	0.23	0.19	0.478	0.469	1									
9. Backward lagged	0.007	0.106	0.142	0.229	0.188	0.482	0.472	0.938	1								
10. Forward	-0.004	0.16	0.07	0.159	0.021	-0.325	-0.383	-0.258	-0.25	1							
11. Forward lagged	-0.006	0.149 -	0.053	0.127	0.0006	-0.363	-0.428	-0.294	-0.317	0.90	1						
12. Small_firm	-0.043	0.717	-0.54	-0.837	-0.322	-0.187	-0.145	-0.207	-0.198	-0.124	-0.09	1					
13. R&D_firm	0.02	0.45	0.36	0.50	0.217	0.142	0.11	0.162	0.15	0.14	0.11	-0.46	1				
14. HHI	0.059	-0.102	-0.032	-0.033	0.017	0.278	0.414	0.107	0.096	-0.163	-0.189	0.017	-0.01	1			
15. HHI* Horizontal	0.003	-0.07	-0.03	-0.023	0.020	0.399	0.359	0.069	0.061	-0.117	-0.133	0.013	-0.012	0.811	1		
16. HHI* Backward	0.068	-0.072	0.002	0.003	0.042	0.305	0.438	0.229	0.209	-0.171	-0.196	-0.01	0.009	0.966	0.763	1	
17. HHI* Forward	0.054	-0.015	0.03	0.054	0.075	0.309	0.403	0.136	0.127	0.038	-0.014	-0.055	0.064	0.903	0.73	0.89	1

Source: Author's calculation from the dataset

From Table 6.2, we notice that the two spillover variables are highly correlated with their lags (the correlation between backward and backward lagged is 0.938 and that of forward and forward lagged is 0.90). However, we argue that these high correlations are not an issue that needs to be dealt with in this case through checking the VIF between the variables. The values of VIF in both cases equal 1, imlying no collinearity between the variables, although they are highly correlated in pairs.

6.3 Estimation Results and Discussion

Baseline specifications

Table 6.3 illustrates the estimation results for the spillover effects of FDI in Vietnam in a 10-year period, from 2001–2010. The system GMM estimator is utilized to tackle the issue of endogeneity and heterogeneity in the estimation of the production function. Haskel et al. (2007) argue that lagged variables are appropriate in the model specifications for spillovers, as FDI effects take time to materialize. This idea corroborates Javorcik (2004) and Liu et al. (2008) when they state that spillovers take time to manifest. However, Haskel et al. (2007) also stress that there is no convincing evidence on exactly how much time FDI spillover effects need to materialize. Hence, following the much-applied solution in the literature, we study both contemporaneous and lagged specifications in this chapter to draw a final conclusion on the spillover effects in Vietnam. We decide to investigate 1-lag and 2-lag specifications and use the latter as a sensitivity check for the former. The estimations for the 1-lag specification are presented in this chapter, while those for the 2-lag specification are reported in Tables A6.1, A6.2, A6.3, A6.4 and A6.5 in the Appendix. In particular, in each estimation result table we also report the variance inflation factor (VIF) and correlation between predicted and actual dependent variables in each estimation to evaluate the goodness of fit of each specification. When comparing the correlation between predicted and actual dependent variables in 1-lag and 2-lag specifications, we find that those in the former case of 1 lag are slightly higher than those in the latter case of the 2-lag specification.

Table 6.3: Spillover effects of FDI in Vietnam (2001–2010):

Baseline specifications with 1 lag

Dep. variable: Ln real value-added output	**All firms**	**Domestic firms**	**Foreign firms**
Ln real value-added output			
L1	.101***	.354***	.299***
	(.016)	(.121)	(.074)
L2	.157***	.084***	.163***
	(.013)	(.036)	(.042)
Ln fixed asset	.140***	.124***	.037*
	(.026)	(.031)	(.019)
Ln employment	.734***	.455**	.415***
	(.017)	(.181)	(.074)

FDI_firm	.004**	_	-.010**
	(.001)		(.005)
Horizontal	-.0002	-.023	-.007*
	(.022)	(.030)	(.004)
Horizontal lagged	.009	.020*	-.0003
	(.006)	(.010)	(.003)
Backward	-.006	-.334	.004
	(.020)	(.220)	(.010)
Backward lagged	.014***	.050**	-.001
	(.005)	(.025)	(.006)
Forward	.192	.072**	-.0003
	(.131)	(.035)	(.016)
Forward lagged	.036**	.112**	-.007
	(.014)	(.050)	(.014)
Constant	.666	4.53**	4.53***
	(1.86)	(2.10)	(.683)
Lincom (Horizontal+L.Horizontal)	.008	-.003	-.007
	(.028)	(.033)	(.004)
Lincom (Backward+L.Backward)	.008	-.284	.002
	(.018)	(.194)	(.011)
Lincom (Forward+L.Forward)	.228	.184***	-.008
	(.144)	(.067)	(.012)
VIF	7.11	7.29	7.64
Correlation predicted and actual dependent variables	0.9353	0.9108	0.8965
Firm-year observations	55,528	50,535	4,993
Firms	27,129	25,209	1,932
Adjusted R-squared	.928	.917	.956
Instrument	50	48	180
Sargan/Hansen test	[0.722]	[0.452]	[0.601]
AR(1)	[0.000]	[0.000]	[0.000]
AR(2)	[0.000]	[0.000]	[0.335]
AR(3)	[0.498]	[0.133]	

Note: System GMM regression uses robust standard errors and treats the lagged real value-added measure and all other independent variables as endogenous. The values reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1), AR(2) and AR(3) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

It can be seen clearly from Table 6.3 that all the results of the Arellano–Bond tests indicate that there is no second-order serial correlation. The values in the Sargan/Hansen test confirm that we do not reject the null hypothesis that the instruments are valid. Also, the value of VIF and the correlation between predicted and actual dependent variables indicate a good fit of the model. To sum up, our test statistics affirm the validity and reliability of the GMM estimator.

In particular, we detect evidence of lagged backward and lagged forward spillovers when the whole sample is examined. Regarding the domestic firm sample only, we detect evidence of lagged horizontal, lagged backward and both contemporaneous and lagged forward spillovers. Those findings suggest that foreign presence encourages the productivity of domestic firms in Vietnam, especially in the long term. The findings imply the beneficial contribution of FDI to productivity improvement in the domestic sector in Vietnam. The positive effects of foreign presence on domestic firms' productivity are consistent with the findings of Liu et al. (2000) and Haskel et al. (2007) for the UK; Wang and Zhao (2008) for China; Dimelis and Louri (2004) for Greece; Baldwin and Gu (2005) for Canada; Halpern and Muraközy (2007) for Hungary; and Pham Xuan Kien (2008), Le and Pomfret (2011) and Anwar and Nguyen (2014) for Vietnam. When only foreign firms are checked, we notice the negative horizontal spillovers between foreign firms, indicating that foreign firms hamper their productivity when they compete head to head in the same industry. Noticeably, the effect of spillovers of foreign presence in the foreign sector has not been investigated before in the context of Vietnam. Hence, this finding could be stressed as an original contribution to the issue.

In general, using `linco-` in Stata to view the linear combination of both contemporaneous and lagged estimators, we found no significant evidence of FDI spillovers on firms in Vietnam, except the positive forward spillover on domestic firms. This implies that foreign presence boosts the productivity of domestic firms in downstream industries. This empirical evidence also corroborates the findings of Schoors and van de Tol (2002) for Hungary, Lin et al. (2009) for China and Le and Pomfret (2011) for Vietnam.

We also re-estimate the baseline model with the sample of firms in the manufacturing sector. The test results are reported in Table 6.4.

Table 6.4: Spillover effects of FDI in Vietnam (2001–2010): Baseline specifications with 1 lag and manufacturing firms only

Dep. variable: Ln real value-added output	All sample	Manufacturing firms
Ln real value-added output		
L1	.101***	.443***
	(.016)	(.030)
L2	.157***	.085***
	(.013)	(.007)
Ln fixed asset	.140***	.144**
	(.026)	(.020)
Ln employment	.734***	.418***
	(.017)	(.049)
FDI_firm	.004**	.002*
	(.001)	(.001)
Horizontal	-.0002	.004
	(.022)	(.009)
Horizontal lagged	.009	-.002
	(.006)	(.002)
Backward	-.006	.037
	(.020)	(.024)
Backward lagged	.014***	-.005*
	(.005)	(.003)
Forward	.192	.103***
	(.131)	(.039)
Forward lagged	.036**	-.058***
	(.014)	(.019)
Constant	.666	1.55***
	(1.86)	(.325)
Lincom (Horizontal+L.Horizontal)	.008	.001
	(.028)	(.007)
Lincom (Backward+L.Backward)	.008	.031
	(.018)	(.026)
Lincom (Forward+L.Forward)	.228	.044*
	(.144)	(.027)
VIF	7.11	7.69
Correlation predicted and actual dependent variables	0.9353	0.9576
Firm-year observations	55,528	34,801
Firms	27,129	15,343

Adjusted R-squared	.928	.946
Instrument	50	65
Sargan/Hansen test	[0.722]	[0.184]
AR(1)	[0.000]	[0.000]
AR(2)	[0.000]	[0.158]
AR(3)	[0.498]	

Note: System GMM regression uses robust standard errors and treats the lagged real value-added measure and all other independent variables as endogenous. The values reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1), AR(2) and AR(3) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations.
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The test results reveal no significant evidence of horizontal and backward spillovers in the sample for manufacturing firms only, which is consistent with the findings for the whole sample. However, positive forward spillovers are detected in the manufacturing sector, indicating that manufacturing firms benefit from a foreign presence in upstream industries. Hence, we conclude that the findings for the sub-sample of manufacturing firms only are consistent with the findings for the full sample, except for the forward linkages. As in the two empirical chapters above, we aim to investigate the full sample of both manufacturing and non-manufacturing production firms in our estimation in this chapter.

The absence of spillover effects is related to the imperfect nature of the spillover measures commonly used in the literature and uncertainty about the lag structure of spillovers. Spillovers are difficult to measure directly, because data on the actual flow of knowledge, capital and labour across firms is unavailable. Therefore, researchers employ proxies to quantify spillovers and to estimate their effects on firm productivity in the host country. Unfortunately, proxies bring with them uncertainty about the extent to which they represent the variables of interest. As discussed in Gorg and Strobl (2001), the use of proxies for foreign presence in an industry through foreign output, employment, capital, equity, asset or sales/revenue/turnover shares might lead to over- or underestimated productivity effects. How adequate and relevant proxies are for productivity spillovers are still open questions in both theoretical and empirical approaches. Moreover, in the literature on FDI and spillover effects so far, the choice of lag is also not discussed adequately. Researchers argue that spillovers take time to manifest themselves. However, how long the lag is remains absent. Hence, our findings indicate that the effects of FDI spillovers on productivity should be taken with caution, given the ambiguity about the lag structure and the imperfect nature of spillover measures.

Spillover effects of FDI by economic region

Recalling Table 4.7 in Chapter 4, overall, we can arrange the six economic regions into three groups of indicators (proportion of FDI firms in total firms, mean of FDI intensity at industry level, average trained workers in total workforce, average value-added output per employee and capital–labour ratio). The top regions are the South East and Red River Delta. The mid-ranked regions are the North Central and South Central Coast and Mekong River Delta. The bottom regions are the Northern Midlands and Mountain areas and Central Highlands.

Table 6.5 illustrates the spillover effects of FDI in Vietnam (2001–2010) by economic region. The first pattern is that spillover effects are more pronounced in the better-performing regions (South East and Red River Delta North Central) rather than in worse-performing regions (Northern Midlands and Mountain areas and Central Highlands). The second pattern is that long-term horizontal and long-term forward spillovers are the most apparent linkages (in five out of six regions), while long-term backward and short-term forward spillovers are the least obvious (in one out of six regions). Another pattern is that while horizontal and backward effects are mixed between regions, the positive forward effects seem to be identical among the six regions.

Table 6.5: Spillover effects of FDI in Vietnam (2001–2010) by economic region with 1 lag

Dep. variable: Ln real value-added output	Red River Delta	Northern Midlands and Mountain areas	North Central and South Central Coast	Central Highlands	South East	Mekong River Delta
Ln real value-added output						
L1	.10***	.313***	.145***	.157**	.662***	.093**
	(.032)	(.075)	(.027)	(.065)	(.075)	(.042)
L2	.090***	.080*	.102***	.167***	-.108***	.086**
	(.026)	(.043)	(.020)	(.063)	(.037)	(.035)
Ln fixed asset	.120***	.101**	.086**	.227***	.096***	.223***
	(.043)	(.043)	(.043)	(.074)	(.028)	(.023)
Ln employment	.843***	.449**	.785***	.665***	.319***	.572***
	(.041)	(.201)	(.049)	(.081)	(.068)	(.086)
FDI_ firm	.016***	.006*	.006*	.017***	.007***	.067*
	(.004)	(.003)	(.003)	(.005)	(.002)	(.038)
Horizontal	-.049***	.0007	.004	.005	-.040	-.048**
	(.008)	(.009)	(.009)	(.019)	(.024)	(.022)
L. Horizontal	-.010***	-.004**	.004**	.001	.008***	.048***
	(.002)	(.001)	(.001)	(.016)	(.003)	(.014)
Backward	.070*	-.086*	-.011	-.001	-.116***	.014*
	(.037)	(.045)	(.022)	(.028)	(.031)	(.034)
L. Backward	-.011	-.014	.013	-.0001	.053***	-.044
	(.014)	(.028)	(.016)	(.022)	(.012)	(.038)
Forward	.026	-.029	-.015	-.033	-.099***	-.013
	(.038)	(.073)	(.020)	(.066)	(.034)	(.046)
L. Forward	-.074***	.049	.054***	.105*	.066***	.149**
	(.020)	(.053)	(.017)	(.054)	(.014)	(.063)
Constant	3.93***	4.23***	1.69***	1.54**	3.30***	3.43***
	(.793)	(.952)	(.607)	(.717)	(.580)	(1.22)
Lincom (Horizontal+L.Horizontal)	-.060***	-.003	.008	.007	-.031	-.0001
	(.010)	(.010)	(.008)	(.013)	(.021)	(.020)
Lincom (Backward+L.Backward)	.058*	-.100	.001	-.002	-.062**	-.101*
	(.034)	(.063)	(.029)	(.021)	(.029)	(.057)
Lincom (Forward+L.Forward)	-.047	.020	.039	.071*	-.033	.136
	(.050)	(.055)	(.033)	(.040)	(.032)	(.093)

VIF	8.31	15.35	10.37	19.17	7.46	9.22
Correlation predicted and actual dependent variables	0.8815	0.9236	0.7952	0.9243	0.9163	0.7099
Firm-year observations	8,949	1,490	3,172	461	37,081	4,201
Firms	5,885	941	1,932	294	15,854	2,140
Adjusted R-squared	.958	.981	.961	.947	.916	.915
Instrument	77	66	99	42	58	67
Sargan/Hansen test	[0.363]	[0.884]	[0.161]	[0.852]	[0.370]	[0.310]
AR(1)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	[0.720]	[0.231]	[0.651]	[0.261]	[0.002]	[0.000]
AR(3)					[0.150]	[0.819]

Notes: All industry and time dummies are included but not reported to save space. Standard errors are in parentheses; p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real value-added output measure, labour, capital and FDI intensity at firm level, horizontal spillovers, backward spillovers and forward spillovers as endogenous. The values reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1), AR(2) and AR(3) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Comprehensively, in the South East region we detect evidence of positive horizontal, backward and forward spillovers in the long term, but negative backward and forward spillovers in the short term. In the Red River Delta, both short-term and long-term negative horizontal spillovers are found, along with positive short-term backward spillovers and negative long-term forward spillovers. In the Mekong River Delta, we can observe a negative horizontal effect in the short term, but a positive effect in the long term. Long-term backward and forward spillovers are also evident in this region. It can be observed that the magnitude of positive long-term forward spillovers in the Mekong River Delta is the biggest over the six regions. On average, a one-unit increase in FDI presence in the upstream industry leads to a 14.9% increase of firm productivity in the downstream industry. This may partly result from better performing in related indicatiors of this region, as illustrated in Table 4.7 in Chapter 4. In the North Central and South Central Coast, positive long-term horizontal and forward spillovers have been uncovered, while in the Central Highlands only long-term positive forward spillovers can be revealed; however, the magnitude is the second biggest in the six regions. In the Northern Midland and Mountain areas, both negative long-term horizontal and short-term backward linkages are detected.

Using lincom, we generally report negative or insignificant FDI spillovers across regions in Vietnam, except the positive backward linkages in the Red River Delta and the positive forward linkages in the Central Highlands. Those findings are consistent with the overall findings in the baseline specification that we also analyse via lincom.

The findings in Table 6.5 report unbalanced effects of spillovers across regions, thus providing a firm explanation for the regional disparities in productivity over time, as discussed in the New Classical, Endogenous Growth and more recently New Economic Geography literature. The findings are consistent with those of Anwar and Nguyen (2014) when they suggest that the impact of FDI spillovers varies considerably across regions in Vietnam. Unlike most existing empirical studies on FDI spillovers in Vietnam, which usually neglect the regional effects, to the best of our knowledge this study is the first to examine FDI spillovers across regions thoroughly and innovatively, employing GMM in the research.

Spillover effects of FDI and firm sizes

As has been discussed in the literature, firm size may affect the sign and magnitude of FDI spillovers. Therefore, in this chapter we analyse firm size and FDI spillovers by splitting the sample into two groups: small firms and medium-sized and large firms. Table 6.6 depicts all GMM estimation results along with lincom, VIF and goodness-of-fit measures of the model specifications.

It can be seen clearly from Table 6.6 that all the results of the Arellano–Bond tests indicate that there is no second-order serial correlation. The values in the Sargan/Hansen test confirm that we do not reject the null hypothesis that the instruments are valid. VIF and goodness-of-fit values indicate the good measure of the model specifications. To sum up, our test statistics confirm the validity and reliability of the GMM estimator.

Table 6.6: Spillover effects of FDI and firm size in Vietnam (2001–2010) with 1 lag

Dep. variable: Ln real value-added output	Small firms	Medium-sized and large firms
Ln real value-added output		
L1	.439***	.343***
	(.050)	(.094)
L2	.15***	.137**
	(.019)	(.053)
Ln fixed asset	.133***	.103***
	(.041)	(.022)
Ln employment	.203**	.209**
	(.088)	(.094)
FDI_ firm	.010**	.004***
	(.004)	(.001)
Horizontal	-.058***	.007
	(.015)	(.006)
L.Horizontal	-.004***	-.015**
	(.001)	(.004)
Backward	.095*	-.013
	(.054)	(.010)
L. Backward	.0002	-.002
	(.006)	(.006)
Forward	.022	.017
	(.028)	(.012)
L. Forward	-.004	-.015**
	(.015)	(.006)
Constant	2.68***	4.11***
	(.670)	(.44)
Lincom (Horizontal+L.Horizontal)	-.062***	-.008*
	(.016)	(.004)
Lincom (Backward+L.Backward)	.095*	-.016
	(.049)	(.010)
Lincom (Forward+L.Forward)	.017	.002
	(.038)	(.013)
VIF	7.88	7.61
Correlation predicted and actual dependent variables	0.9221	0.9373
Firm-year observations	39,017	16,511
Firms	21,548	6,907
Adjusted R-squared	.805	.953
Instrument	57	97
Sargan/Hansen test	[0.431]	[0.698]
AR(1)	[0.000]	[0.000]
AR(2)	[0.340]	[0.636]

Notes: All industry and time dummies are included but not reported to save space. Standard errors are in parentheses; p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real value-added output measure, labour, capital and FDI intensity at firm level, horizontal spillovers, backward spillovers and forward spillovers as endogenous. The values reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

From Table 6.6, we recognize the evidence of negative short-term and long-term horizontal spillovers in small firms, but only negative long-term horizontal spillovers in medium-sized and large firms. Also, the magnitude of long-term horizontal spillovers in small firms (-0.004) is greater than that of medium-sized and large firms (-0.015). Moreover, positive short-term backward spillovers in small firms and negative long-term forward spillovers in medium-sized and large firms are detected.

Using linco-, we detect evidence of positive backward linkages of a foreign presence on small firms, while no significant evidence is found on horizontal and forward spillovers. Regarding medium-sized and large firms, we see evidence of negative horizontal spillovers and no significant evidence of backward and forward linkages. Those findings are comparable with the estimation results when we go further in terms of lag spillover variable (the 2-lag specification), which is reported in Table A6.3 in the Appendix.

The finding that small firms can benefit more from spillovers than large firms is similar to those of Dimelis and Louri (2001), Girma and Wakelin (2001) and Sinani and Meyer (2004). Dimelis and Louri (2001) affirm that only small domestic firms with fewer than 50 employees obtain productivity spillovers. In the same vein, Girma and Wakelin (2001) point out that small indigenous firms with a high proportion of skilled employees reap the largest benefit from productivity spillovers, while large domestic firms with highly skilled labourers gain no profit. They defend their findings by saying that medium-sized and large firms are the nearest to foreign affiliates regarding technology and market share, and they may already operate at the "technological frontier," hence they do not benefit from a foreign presence. The reverse applies for small firms. Sinani and Meyer (2004) corroborate those findings while stating that FDI productivity spillovers bring more effects on small firms, not medium-sized and large firms, in Estonia. In the specific case of Vietnam, the existing literature on firm size and FDI productivity is scant. The findings in this section, therefore, are expected to bridge the evidence gap on the issue in Vietnam through utilizing the GMM method applied to unbalanced panel data in a 10-year period.

Spillover effects of FDI and firm R&D status

Table 6.7 depicts how the firm's R&D status affects the sign and magnitude of its FDI spillovers. We examine the two sub-samples by splitting the whole sample into firms with active R&D status and non-active R&D status.

It can be seen clearly from Table 6.7 that all the results of the Arellano–Bond tests indicate that there is no second-order serial correlation. The values in the Sargan/Hansen test confirm that we do not reject the null hypothesis that the instruments are valid. To sum up, our test statistics consolidate the validity and reliability of the GMM estimator.

We report an interesting finding that FDI spillover-effects are more pronounced among non-R&D firms. When summed over the contemporaneous and lagged effects, the non-R&D firms enjoy both backward and forward spillover effects of 0.258 and 0.152, respectively. The corresponding effects for R&D-active firms are both insignificant. In the case of horizontal spillovers, the effects are insignificant for both R&D-active and non-R&D firms.

Table 6.7: Spillover effects of FDI and firm R&D status in Vietnam (2001–2010) with 1 lag

Dep. variable: Ln real value-added output	Active R&D	Non-active R&D
Ln real value-added output		
L1	.179***	.102***
	(.065)	(.018)
L2	.176***	.131***
	(.047)	(.016)
Ln fixed asset	.044*	126***
	(.024)	(.035)
Ln employment	.617***	.774***
	(.033)	(.024)
FDI_ firm	.004**	.004*
	(.002)	(.002)
Horizontal	-.025	.013
	(.020)	(.022)
L. Horizontal	.007	-.004***
	(.005)	(.0008)
Backward	.010	.221***
	(.024)	(.047)
L. Backward	.013**	.016***
	(.006)	(.003)
Forward	-.078**	.130***
	(.035)	(.045)
L. Forward	.049**	.022*
	(.020)	(.013)
Constant	3.26***	-1.73
	(.353)	(1.42)
Lincom (Horizontal+L.Horizontal)	-.017	.009
	(.015)	(.023)
Lincom (Backward+L.Backward)	.024	.238***
	(.029)	(.049)
Lincom (Forward+L.Forward)	-.029	.152***
	(.019)	(.055)
VIF	7.68	8.67
Correlation predicted and actual dependent variables	0.9335	0.9180
Firm-year observations	14,487	41,041
Firms	4,575	22,554
Adjusted R-squared	.968	.897
Instrument	57	53
Sargan/Hansen test	[0.424]	[0.357]
AR(1)	[0.000]	[0.000]
AR(2)	[0.042]	[0.000]
AR(3)	[0.272]	[0.124]

Notes: All industry and time dummies are included but not reported to save space.
Standard errors are in parentheses; p-values in square brackets.
GMM regression uses robust standard errors and treats the lagged real value-added output measure, labour, capital and FDI intensity at firm level and horizontal, backward and forward spillovers as endogenous. The values reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity.
The values reported for AR(1), AR(2) and AR(3) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Using linco - to formulate the overall effects of spillovers, we found no significant effect of FDI spillovers on active R&D firms in Vietnam, while evidence of backward and forward linkages is pronounced for non-active R&D firms. The 2-lag specification in Table A6.4 in the Appendix also confirms the same patterns. These striking findings indicate that non-active firms benefit from vertical spillovers compared to their counterparts with no significant effects of spillovers found. Noticeably, backward and forward linkages are the interaction between domestic and foreign firms in upstream and downstream industries. Hence, the knowledge in these supplier–customer relationships is closely related; and foreign firms have fewer incentives to prevent knowledge flows from them to domestic partners. One possible explanation for positive backward and forward linkages between foreign and non-active R&D domestic firms in Vietnam is that the technology gap between them is large enough for the latter to benefit from the former. This finding supports the arguments of Lapan and Bardhan (1973), Perez (1997) and Kinoshita (2001) that in order to benefit from FDI spillovers, domestic firms must have a "moderate" technology gap with foreign partners, since the gap will increase the possibility of domestic firms acquiring an upper level of efficiency via imitation of foreign technology. If the gap is too large, domestic firms cannot fully receive benefits from the technological advantages of MNEs, as technology diffusion is not an automatic procedure from senders to recipients – it also requires recipients to have enough capacity to absorb and adopt such technology. However, the gap should not be too narrow, as domestic firms only gain slight benefit from the modern technology of foreign investors in this case.

The findings in this section also raise the issue of why R&D engagement cannot help firms improve their absorptive capacity to reap the benefit of FDI spillovers. The R&D active status has not been an effective catalyst to transmit spillovers from foreign to domestic firms in Vietnam. Hence, although it has not been investigated thoroughly in this thesis, the issue of the absorptive capacity of R&D firms in Vietnam should be paid further research attention.

The existing literature on firm R&D and productivity spillovers from FDI in Vietnam is under-investigated. The findings in this section are expected to be the first to bridge the evidence gap on whether in-house firm R&D effort facilitates the absorption of external knowledge in the specific case of Vietnam. More studies using different measures of R&D investment should be implemented to explore this under-researched field in Vietnam.

Spillover effects of FDI and industry concentration

Table 6.8: Spillover effects of FDI and industry concentration in Vietnam (2001–2010) with 1 lag

Dep. variable: Ln real value-added output	Bottom 25% level of concentration	Top 25% level of concentration
Ln real value-added output		
L1	.137*	.163***
	(.080)	(.061)
L2	-.017	.094*
	(.047)	(.048)
Ln fixed asset	.153**	.170***
	(.062)	(.037)
Ln employment	.844***	.684***
	(.111)	(.044)
FDI_ firm	.009***	.013***
	(.002)	(.003)
Horizontal	-.017**	-.007**
	(.007)	(.003)
L.Horizontal	.042***	-.004***
	(.009)	(.0009)
Backward	-	-.006
		(.004)
L. Backward	-.041**	-.004**
	(.019)	(.002)
Forward	-.025*	.074***
	(.013)	(.011)
L. Forward	.170***	-.030*
	(.019)	(.008)
Constant	1.90***	2.85***
	(.559)	(.182)
Lincom (Horizontal+L.Horizontal)	.024***	-.011**
	(.008)	(.004)
Lincom (Backward+L.Backward)	-.041**	-.011**
	(.019)	(.005)
Lincom (Forward+L.Forward)	.144***	.043***
	(.028)	(.008)
VIF	7.50	11.52
Correlation predicted and actual dependent variables	0.8593	0.9351

Firm-year observations	11,955	14,493
Firms	7,976	8,259
Adjusted R-squared	.865	.956
Instrument	37	82
Sargan/Hansen test	[0.856]	[0.116]
AR(1)	[0.000]	[0.000]
AR(2)	[0.256]	[0.208]

Notes: All industry and time dummies are included but not reported to save space. Standard errors are in parentheses; p-values in square brackets. GMM regression uses robust standard errors and treats the lagged real value-added output measure, labour, capital and FDI intensity at firm level, and horizontal, backward and forward spillovers as endogenous. The values reported for the Sargan/Hansen test are the p-values for the null hypothesis of instrument validity. The values reported for AR(1), AR(2) and AR(3) are the p-values for first- and second-order auto-correlated disturbances in the first differences equations. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 6.8 illustrates how industry concentration affects the signs and magnitudes of FDI spillovers in Vietnam in the 10-year period (2001–2010). As analysed above, we split the sample into two sub-samples based on industry concentration. The first group is the bottom 25% of industry concentration, which indicates the case of a very high competitive environment. The second group is the top 25% of industry concentration, which implies the case of a very high concentration environment. We detect evidence of spillover effects of FDI in both cases, although the negative effects are more pronounced. Concretely, in the bottom group, we found evidence of negative short-term but positive long-term horizontal and forward linkages. Also, the backward linkages in the long term are negative. Regarding the top group, negative horizontal effects are reported in both the short and long term, while positive short-term and negative long-term forward linkages are detected.

Utilizing `linco-` to depict the general picture, we find positive horizontal and forward linkages, but negative backward linkages of FDI spillovers within the bottom group. We report the negative horizontal and also negative backward and positive forward linkages for the top group. In detail, the bottom group benefits more from forward linkages (0.144 unit vs. 0.043 unit), but experiences more loss from backward linkages (-0.041 unit vs. -0.011 unit) compared to the top group. In other words, industry concentration boosts forward spillovers but hinders backward spillovers. More concretely, when foreign investors begin to operate, they reduce the productivity of firms in upstream industries while enhancing the productivity of their counterparts in the downstream industry. This implies that firms in highly competitive industries will benefit more from forward spillovers. However, a highly competitive market may infer a low market share, which might also have a negative impact on R&D expenditures; therefore, it can generate detrimental effects on the productivity level. This is the case in this specification, where firms suffer negative effects from foreign investors in backward linkages. The negative relationship between industry concentration and spillovers is consistent with Huong Xuan Tran (2014) for the specific case of Vietnam, and Castillo et al. (2014) for Chilean firms in the manufacturing sector.

The effect of industry concentration on horizontal effects is ambiguous, with a positive effect on the bottom group but a negative effect on the top group of industry concentration. This indicates that firms in a highly competitive market benefit from a foreign presence in the same industry. However, when the market becomes more concentrated, firms bear negative horizontal spillovers from foreign counterparts. Noticeably, all the signs of the estimated coefficients for spillover variables in this 1-lag specification are consistent with those in the 2-lag specification reported in Table A6.5 in the Appendix.

6.4 Conclusion

This chapter investigates the spillover effects of FDI on the productivity of firms in Vietnam. We utilize a rich dataset compiled by the GSO from 2001–2010 with a large number of firms and observations in 28 industries. The dataset is built to examine thoroughly the horizontal, forward and backward linkages of FDI spillovers and their heterogeneity sources. As applied in the empirical studies in Chapters 4 and 5, the dynamic panel data approach to GMM proposed by Arellano and Bond (1991) and Blundell and Bond (1998) continues to be employed to control for firms' unobserved heterogeneity, inputs and ownership endogeneity, as well as measurement errors in this chapter.

We report evidence of the insignificant spillover effects of FDI on average firms in Vietnam in the baseline specifications. When domestic firms only are examined, there is evidence of insignificant horizontal and forward linkages, but positive backward spillover effects of FDI. We also detect unbalanced effects of spillovers across six economic regions in Vietnam. The effects are negative and significant in the regions with high levels of output, educated employees, capital-labour ratio, FDI intensity. However, no significant evidence is found on other lower score regions. These spillover effects of FDI are also dependent on firm size, ownership type, firm R&D status and industry concentration in the period of study. Interestingly, small firms experience positive backward spillovers, while larger firms gain nothing in our investigation. Moreover, non-active R&D firms benefit from vertical spillovers, whereas active R&D firms reap no return from a foreign presence. Last but not least, industry concentration affects the spillover linkages in the opposite directions on backward and forward linkages. All these findings reaffirm that firm and industry heterogeneity do have an impact on the significance, sign and magnitude of FDI spillovers.

In sum, we detect evidence of either insignificant or negative and small FDI spillovers in Vietnam from 2001–2010, with the exception of positive backward linkages on small firms and positive forward and backward spillovers on non-active R&D firms. Our formal evidence confirms that the spillover effects differ by firm ownership type, firm size, firm R&D status, industry concentration and regional characteristics. We argue that the absence of spillover effects is related to the imperfect nature of the spillover measures commonly used in the literature and uncertainty about the lag structure of the spillovers.

Our findings also have important policy implications, in that they point out the need for region- and industry-specific support policies and counter-measures that would ameliorate the divergence between FDI-poor regions and industries. To reap the full benefit of FDI as well as to minimize any negative effects and undesirable results for welfare, other policies should be put forward. From all the findings in this chapter, the policies for strengthening the absorptive capacity of domestic firms through investing in knowledge and human capital formation may be superior to policies that provide concessions for FDI. There is also a need for further institutional reforms, including to the political and legal system, economic management, government administration and trade policies, in order to develop a more competitive environment and a level playing field for all firms in all sectors in Vietnam.

Overall, our findings contribute to existing knowledge by bridging the evidence gap with respect to an understudied country (Vietnam) and making a strong case for investigating the extent of heterogeneity in the productivity effects of inward FDI. It also infers clear policy implications on the issue of the relationship between the host country and FDI. This chapter is devoted to producing an extensive and intensive study on horizontal, backward and forward spillovers and their heterogeneity sources, while employing GMM methods to tackle the endogeneity problem in estimation of a production function in the context of a developing country. To the best of our knowledge, this is the first study to examine thoroughly how FDI spillovers vary across regions, and how firm size and firm R&D status can affect FDI spillovers in Vietnam.

CHAPTER 7: CONCLUSIONS

Inward FDI flows into host countries have given rise to concerns about the relationship between a foreign presence and the productivity of host-country firms. Although the mainstream theoretical framework predicts a positive relationship between FDI intensity and firm productivity in the host countries, the existing empirical evidence is more diverse and often conflicting. By focusing on the specific case of Vietnam, an under-investigated country where rich firm-level panel data exists, this research provides novel evidence on the relationship between inward FDI and firm performance in Vietnam along three dimensions: direct effects, crowding-in/crowding-out effects and indirect (spillover) effects. We utilize system GMM to quantify these effects and verify the extent of homogeneity/heterogeneity in the estimated effects.

7.1 Main Findings of the Research

This thesis contributes to existing knowledge and evidence base concerning the relationship between inward FDI and productivity of firms in the host country through investigating the direct, crowding-in/crowding-out and indirect effects of FDI on firm productivity and market share.

In Chapter 4, we report that the share of foreign capital in firm equity (FDI intensity) has a positive and significant direct effect on the productivity of firms in Vietnam. This effect, however, is small compared to what is reported in the existing literature such as Konings (2001), Schoors and Tol (2002), Damijan et al. (2003), Lutz and Talavera (2003), Sgard (2001) and Vahter (2005). The estimate from the full sample (0.0064) indicates that a one percentage point increase in FDI intensity is associated with 0.6% increase in firm productivity. Furthermore, the average effect estimate conceals a high degree of heterogeneity. For example, the effect is relatively larger (around 0.01 – 0.02) in geographic regions with higher levels of output, trained employees and FDI intensity (South East, Red River Delta and North Central and South Central Coast). In contrast, the effect estimates are much smaller or insignificant in regions that score lower with respect to these economic indicators (Northern Midlands and Mountain Areas, Central Highlands, and Mekong River Delta).

This finding goes some way to explain the concentration of the inward FDI in the high-productivity-effect regions, which account for about 90% of the FDI stock in Vietnam. The finding also suggests the observed conglomeration of FDI in three regions is likely to continue in the medium term. Moreover, we detect that small FDI firms with fewer than or equal to 50 employees have a 0.3% higher in terms of firm productivity compared to larger firms. One of the possible explanation is that small firms are more flexible and more responsive to changes in the business environment. Hence, they are more adaptable when they operate in a new overseas market and may consequently gain more productivity. R&D status of firm is found to have a positive effect on the direct effects in a sense that active R&D firms gain 0.07% more from direct effects than non-active firms. Also, the direct effects are found to depend on industry concentration, which means that FDI firms have a larger direct effect if they operate in less concentrated industries. More interestingly, going further than the existing literature, we also observe an inverted U-shaped relationship between FDI intensity and the productivity of FDI firms, implying the nonlinearity direct effects of FDI on firm output.

In Chapter 5, we investigate whether a foreign presence improves or hampers the performance of domestic firms in Vietnam in terms of turnover. We report evidence of the crowding-out effect of FDI on the turnover share of domestically owned Vietnamese firms. On average, a one percentage point increase in FDI intensity lead to a 2.7% increase in FDI firms' turnover, which implies a shrink in turnover of domestic firms in Vietnam given that the total turnover of firms in the market is constant. The magnitude of the effects are comparable with Aitken and Harrison (1999), Hu and Jefferson (2002) and Hsieh (2006). Secondly, we find that quadratic specification is valid in this model, indicating the inverted U-shaped relationship between FDI intensity and turnover of firms.

We also report that the crowding-out effect estimates also vary by different size classes, ownership types, R&D status, economic regions and industry concentrations. While the foreign presence enhances the turnover of large domestic firms by 1.2%, it reduces the turnover of small domestic firms by 4.6%. These opposite effects of FDI on firm turnover come from the fact that small domestic firms have less competitiveness and internal capabilities compared with large firms; therefore, they suffer more significant losses from the presence of foreign investors. Additionally, we report the magnitude of crowding-out effects in non-R&D firms are larger than that of active R&D firms (3.3% vs. 1.3%). It may origin from the fact that active R&D firms will enhance their capabilities and absorptive capacity through R&D engagement, which helps them to suffer less from turnover lost due to a foreign presence. Moreover, the regions with lower levels of output, educated employees, capital-labour ratio and FDI intensity endure crowding-out effects, whose turnover loss range from 0.6% to 2.9%. Conversely, the opposite pattern of crowding-in effects is detected in the regions with higher output, more educated employees, larger capital-labour ratio and more FDI intensity (South East, Red River Delta and North Central and South Central Coast), with the ranges from 0.5% to 4.8%. Lastly, we report an overall larger crowding-out effect (1.6% vs. 1.4%) of FDI on turnover in less competitive industries than in highly competitive industries. The results indicate that domestic firms that operate in a less competitive market environment will lose more in terms of turnover when foreign investors enter.

In Chapter 6, drawing on the theoretical background on spillover effects on productivity established by Marshall (1890), Arrow (1962), Romer (1986), and Jacobs (1969) we empirically quantify and evaluate the horizontal, backward and forward linkages of inward FDI on firm productivity in Vietnam. In general, we found no significant evidence of FDI spillovers in Vietnam from 2001–2010, except the positive forward spillover when the sample is restricted to domestic firms only. Similar to direct effects and the crowding-in/crowding-out effects, we find that the spillover-effect estimates also vary by firm and industry characteristics.

We report unbalanced effects of spillovers across six economic regions in Vietnam: the effects are negative and significant in the regions with high levels of output, educated employees, capital-labour ratio, FDI intensity. However, no significant evidence is found in other regions with lower scores for those economic indicators. Besides, small firms experience positive backward spillovers of 9.5% increase in productivity, while larger firms gain nothing in our investigation. Furthermore, whilst non- R&D firms benefit from both vertical backward and forward spillovers, R&D-active firms reap no benefits from a FDI in own industry or other industries. Last but not least, we report that the spillover-effect estimates differ by market concentration levels. On the one hand, firms in the bottom 25% of market concentration index benefit from horizontal FDI spillovers (0.024) and forward spillovers (0.141) but incurs productivity loss from backward spillovers. On the other hand, firms in the top 25% of the market concentration index benefits only from forward spillovers at a lower rate (0.0043) but incur productivity loss from both horizontal and backward FDI spillovers.

Given the sources of heterogeneity investigated throughout the research, we observe that small and R&D-active foreign firms gain more direct effects than non-R&D and large foreign firms. Besides, the small and non- R&D domestic firms tend to incur turnover loss due to crowding-out effects. However, when interacting with foreign firms in upstream and downstream industries, small and non-active R&D firms benefit from vertical spillovers while other firm categories gain nothing.

7.2 Contributions of the Research

Through conducting an empirical analysis in a dynamic model using system GMM, our work contributes to the growing body of research on FDI and productivity in terms of both the knowledge base and the evidence base, in the following several ways.

Firstly, this thesis is innovative in terms of the scope of the study. Unlike previous literature on the topic of FDI and productivity, which focuses mainly on indirect (spillover) effects, this research estimates a wider range of inward FDI effects on productivity. In the specific case of Vietnam, to the best of our knowledge this is the first study to examine the direct effects of FDI on productivity and its crowding-in/crowding-out effects in tandem with the indirect effects of FDI on productivity. This advantage in terms of the scope of the study produces critical and thorough perceptions of the actual effects of FDI on the productivity of firms in Vietnam.

Secondly, this thesis exhibits an advantage in the methodology applied that contributes to the knowledge base on estimating a production function. A large proportion of recent studies on the topic usually employ OLS and FE/RE in estimation, which tends to produce biased estimation results. This research has its own strength in utilizing the GMM approach proposed by Arellano and Bond (1991) and Blundell and Bond (1998) to detect the endogeneity issue in estimating the relationship between factor inputs and the level of productivity. GMM estimation is proved to be efficient and provides unbiased estimates in the presence of endogeneity.

Thirdly, this thesis contributes to the evidence base with an extensive focus on the sources of heterogeneity that influence inward FDI effects on the productivity of firms. Studying the effects on their own without integrating them with firm and industry characteristics may lead to a vague conclusion. This thesis differs from most recent studies on the topic in investigating systematically how firm size, firm ownership type, firm R&D status, geographical region and industry concentration can affect the signs and magnitudes of three different effect types (direct effects, crowding-in/crowding-out effects and indirect/spillover effects). These provide disaggregated and robust evidence on the effects of inward FDI on productivity.

Finally, this research has an advantage in terms of timespan, while exploiting a rich firm-level panel dataset of 10 years from 2001–2010. This panel has a longer time dimension compared to other, earlier studies for analysing the effects of inward FDI on productivity. It helps to investigate the effects of interest in both the short and long term, which is impossible in cross-sectional or short panel data.

As such, the research produces both comprehensive and robust evidence on the direct and spillover effects of FDI on the productivity of firms, as well as the crowding-in/crowding-out effects of FDI in Vietnam.

7.3 Implications of the Research

Overall, the findings in this thesis imply that FDI has positive but small impact on productivity growth of Vietnam. Therefore, it justifies that the policy to attract FDI in Vietnam is a pay-off.

Although inward FDI has an overall positive effect on productivity in Vietnam, inward FDI might widen productivity gaps across regions, leading to greater disparities in growth between regions. This is because firms at regions with higher output, higher FDI intensity, more educated labors, higher capital-labor ratio benefits more from foreign presence than firms at lower score regions. Hence, policy makers should introduce policies that can generate new incentives for foreign firms to locate in low score regions such as tax holiday or preferential rents. More importantly, these findings also urge for policies that can improve education and infrastructure that can help those regions more attractive.

Additionally, active R&D firms benefit more from direct effects and experience less loss from crowding-out effects. These findings imply for the need of enhancing firm absorptive capacity through investing in knowledge and human capital formation. The Government should have policies for higher schooling rate, better vocational training…. for a more educated and skilled labor force. Besides, firms should develop their own policies to engage more in R&D, which in turn will enhance their absorptive capacity and competitiveness.

7.4 Limitations of the Research

One of the limitations of this research is the uncertainty in the measurement of spillover effects. The issue has long been a challenge for researchers on this topic. Spillovers are difficult to measure directly, because data on the actual flow of knowledge, capital and labour across firms is unavailable. Hence, proxies are employed to quantify spillovers and to estimate their effects on firm productivity in the host country. In this thesis, we employ foreign presence in terms of output share in the same industry, and in downstream and upstream industries to examine horizontal, backward and forward spillovers. However, proxies bring with them uncertainty about the extent to which they represent the variables of interest. Gorg and Strobl (2001) propose that the use of proxies for spillover pool in an industry, whether as foreign output, employment, capital, equity, asset or sales/revenue/turnover shares, might lead to over- or underestimated productivity effects. Adequate and relevant proxies for productivity spillovers are still absent in empirical research. Another measurement issue for spillovers is whether the relationship between spillovers and productivity is contemporaneous or occurs with lags. Javorcik (2004) and Liu (2008) argue that spillovers take time to manifest; however, the length of the time lag is still an open question. This study has not made a breakthrough against these limitations while following the usual routine and the identical approach to former researchers in dealing with the topic.

Another limitation lies in the unavailability of data for the firm-level price deflator, which drives us to use an industry-level price deflator as an alternative. However, as Melitz (2000) and De Loecker (2011) propose, the use of a common industry-level price deflator is inappropriate if products are heterogeneous. Hence, the estimation results might be more or less affected.

7.5 Future Research

As investigated in Chapters 4 and 5, there is a non-linear relationship between foreign presence and direct and crowding-in/crowding-out effects. However, the issue becomes more complicated when examining spillover effects and has not been explored in this thesis. Hence, further research could investigate whether a quadratic specification for spillovers is valid.

In addition, other factors such as mode of entry of foreign firms (greenfield or mergers and acquisitions), country source of FDI or the technology gap between foreign and domestic firms, which could affect the sign and magnitude of the effects of FDI on productivity, should be taken into consideration in future research.

Moreover, alternative ways to measure productivity, such as gross output or labour productivity, and other ways to quantify FDI spillovers, such as spillovers in terms of employment share, are suggested for examination as a robustness check for the estimated results presented in this thesis.

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APPENDIX

Table A2. 1: Studies investigating the direct effects of foreign ownership on FDI-firm productivity

Authors	Country	Period	Data type	Level of aggregation	Sampling	Dependent variable	Foreign ownership measure	Estimation method	Direct effects
Haddad and Harrison (1993)	Morocco	1985-1989	Panel	Firm	n.a	Output per worker	Asset share	OLS	-
Globerman et al (1994)	Canada	1986	Cross section	Firm	n.a	Value added per worker	Dummy FDI	OLS	+
									n.s while controlling for capital intensity and size of firms
Aitken and Harrison (1999)	Venezuela	1976-1989	Panel	Firm	43,010 obs	Output	Share of foreign equity at firm level	OLS	+
Konings (2001)	Bulgaria Romania Poland	1993-1997 1994-1997 1993-1997	Panel Panel Panel	Firm Firm Firm	2,321 firms 3,844 firms 262 firms	Sales	Sales share	OLS	n.s Bulgaria + Romania + Poland
								GMM	n.s Bulgaria n.s Romania + Poland
Sgard (2001)	Hungary	1992-1999	Panel	Firm	33,033 obs	Output	Share of foreign equity at firm level	OLS	+
								First difference	+
								Long difference	+
Vahter (2004)	Estonia	1996-2001 1994-2000	Panel Panel	Firm Firm	326 firms 982 firms	Sales per employee	Dummy variable FDI	FE	+ Estonia + Slovenia

	Slovenia							RE	+ Estonia + Slovenia
Benfratello & Sembenelli (2006)	Italia	1992-1999	Panel	Firm	2026 firms	Output	Dummy variable FDI	GMM	n.s
Taymaz & Yilmaz (2008)	Turkey	1990-1996	Panel	Firm	29,513 obs	Total factor productivity	Dummy variable FDI	OLS	+
Arnold& Javorcik (2009)	Indonesia	1983-2001	Panel	Firm	308,439 firms	Total factor productivity	Dummy variable FDI	PSM	+
Batool et al. (2009)	Pakistan	1994-2007 (Food & Tobacco)	Panel	Firm	12 firms	Output	Dummy variable FDI	RE	+
		1995-2007 (Financial Business)			32 firms				+

Source: Author's summary

N.B: All papers are arranged by year ascending.

Table A2. 2: Studies investigating the Crowding-out effect of foreign ownership on domestic firms' market share

Authors	Country	Period	Data type	Level of aggregation	Sampling	Dependent variable	Foreign ownership measure	Estimation method	Crowding-out effect
Aitken and Harrison (1999)	Venezuela	1976-1989	Panel	Firm	43,010 obs	Output	Share of foreign equity at firm level	OLS	+
Hu and Jefferson (2002)	China	1995-1999	Panel	Firm	n.a	Value-added	Share of foreign equity at firm level	OLS	+
Hsieh (2006)	China	1998-2004	Panel	Firm	n.a	Gross output	Share of foreign equity at firm level	OLS	+

Source: Author's summary

N.B: All papers are arranged by year ascending.

Table A2. 3: FDI presence and non-FDI firm productivity:

Studies investigating effects through horizontal and vertical spillovers

Authors	Country	Period	Data type	Level of aggregation	Sampling	Dependent variable	Measure of FDI presence	Estimation method	Horizontal spillover effect	Vertical spillover effect (through forward linkages)	Vertical spillover effect (through backward linkages)
Caves (1974)	Australia	1966	CS	Industry	n.a	Value added per worker	Employment share	OLS	+		
Globerman (1979)	Canada	1972	CS	Industry	n.a	Value added per worker	Value added share	2SLS	+		
Blomstrom and Pearson (1983)	Mexico	1970/1975	CS	Industry	n.a	Value added per worker	Employment share	OLS	+		
Kokko (1994)	Mexico	1970	CS	Industry	n.a	Value added per worker	Employment share	OLS	+		
Blomstrom and Sjohom (1999)	Indonesia	1991	CS	Firm	13,037 firms	Value added per worker	Output share	OLS	+		
Aslanoglu (2000)	Turkey	1993	CS	Firm	500 firms	Value added per worker	Employment share Assets share; Sales share; Value added share	OLS OLS OLS OLS	n.s n.s n.s n.s		
Kokko et al. (2001)	Uruguay	1988	CS	Firm	763 firms	Value added per worker	Output share	OLS	+		

Haddad and Harrison (1993)	Morocco	1985-1989	Panel	Firm		Output per worker	Asset share	OLS	n.s
Aitken and Harrison (1999)	Venezuela	1976-1989	Panel	Firm	4,000 firms	Output	Foreign equity participation averaged overall plants in industry weighted by each plant's share in industrial employment	WLS	–
Liu et al., (2000)	UK	1991-1995	Panel	Industry	240 firms	Value added per worker	Employment share/Capital share	OLS	+
								FE	+
								RE	+
Djankov and Hoeckman (2000)	Czech Republic	1992-1996	Panel	Firm	513 firms	Sales growth	Asset share	OLS	–
								RE	–
Kathuria (2000)	India	1975–1989	Panel	Firm	368 firms	Value added	Sales share	OLS	–
Konings (2001)	Bulgaria, Romania Poland	1993-1997 1994-1997 1993-1997	Panel	Firm	2,321 firms 3,844 firms 262 firms	Sales	Sales share	OLS	- Bulgaria + Romania n.s Poland
								GMM	- Bulgaria; - Romania n.s Poland
Barrios and Strobl (2002)	Spain	1990-1998	Panel	Firm	2,174 firms	Total factor productivity	Sales share	OLS	–
								FE	+
Dimelis and Louri (2004)	Greece	1997	CS	Firm	3,742 firms	Sales/Number of employees	Fixed capital share	OLS	+
Girma and Gorg (2005)	UK	1980-1992	Panel	Firm	2,968 firms	Total factor productivity	Employment share	Quantile regression	+
Baldwin and Gu (2005)	Canada	1990-1999	Panel	Firm	1,403 firms	Value added per worker	Employment share	OLS	+

Balsvik and Haller (2006)	Norway	1979-2000	Panel	Firm	10,400 firms	Output	Employment share	OLS	Mixed (-greenfiel) (+acrquisition)		
Murakami (2007)	Japan	1994-1998	Panel	Firm	n.a	Total factor productivity	Employment share	OLS	- Short run + Long run		
Haskel et al. (2007)	UK	1973-1992	Panel	Firm	68,000 firms	Gross output	Employment share	GMM	+		
Gorg et al. (2009)	Hungary	1992-2003	Panel	Firm	41,986 firms	Total factor productivity	Turnover share	Levinsohn & Petrin	n.s		
Jude (2012)	Romani	2000-2008	Panel	Firm	1,902 firms	Sales per employee	Employment share	PSM	+		
Kugler (2001)	Colombia	1974-1998	Panel	Industry	n.a	Total factor productivity	Capital formation	OLS	+ machinery equipment		+
Schoors and van de Tol (2002)	Hungary	1997-1998	Panel	Firm	1,084 firms	Total turnover	Turnover share	OLS	+	+	_
								Treatment effects	+	n.s	_
Smarzynska (2002)	Lithuania	1996-2000	Panel	Firm	2,636 firms	Total factor productivity	Equity share weighted by output share	OLS	+	n.a	+
								Olley & Pakes	n.s		+
Damijan et al. (2003)	Ten transition countries	1994-1999	Panel	Firm	8,000 firms	Gross output	Output share	GMM	+ in 4 countries others n.s	+ 3 countries, others n.s	in 3 countries others n.s
Javorcik (2004)	Lithuania	1996-2000	Panel	Firm	2,500 firms	Total factor productivity	Equity share	OLS	n.s	- & n.s	+
								Olley & Pakes	n.s	- & n.s	+

Harris and Robinson (2004)	UK	1974-1995	Panel	Firm	5,324 firms	Real gross output	Capital stock share	GMM	mixed	Mixed	Mixed
Ivarsson and Alvstam (2005)	Brazil, China, India, Mexico	2001-2002	Case study	Firm	389 firms						+
Thangavelu & Pattnayak (2006)	India	1989-2000	Panel	Firm	200 firms	Total factor productivity	Equity share	OLS	+	n.a	_
								FE	+		_
								Olley & Pakes	+		_
								Levinsohn & Petrin	+		_
Bwalya (2006)	Zambian	1993-1995	Panel	Firm	125 firms	Output	Employment share	OLS	_	n.a	n.s
								FE	_		_
								GMM	_		+
Hale and Long (2007)	China	2000	CS	Firm	1,500 firms	Value added	Employment share	2SLS	n.s	n.s	n.s
								GMM	n.s	n.s	n.s
Halpern and Murako¨zy (2007)	Hungary	1996-2003	Panel	Firm	2,987 firms	Total factor productivity	Sales share	FE	n.s	+	
								Levinsohn & Petrin	n.s	+	
Liu (2008)	China	1995-1999	Panel	Firm	17,675 firms	Total factor productivity	Equity share weighted by output share	Olley & Pakes	- Short run + Long run	_	_
Javorick and Spatareanu (2008)	Romania	1998-2003	Panel	Firm	13,129 firms	Total factor productivity	Output share	OLS	_	n.a	+
								Translog	_		+

								Levinsohn & Petrin	−		+
Wang and Zhao (2008)	China	2000-2002	Panel	Firm	486 firms	Value added	Capital stock share	OLS	+	+	
								FE	+	+	
								RE	+	+	
Lin et al (2009)	China	1998-2005	Panel	Industry		Total factor productivity	Equity share	Levinsohn & Petrin	- and n.s	+	+
Barbosa and Eiris (2009)	Portugal	1994-1999	Panel	Firm	1,970 firms	Output	Equity share	GMM	n.s	n.s	
Jude (2013)	Romania	1999-2007	Panel	Firm	1,856 firms	Total factor productivity	Capital stock share weighted by the sales share	LP	n.s	-	+
Tran Ngoc Ca (2002)	Vietnam	2000	Case study	Firm	10 firms					+	
Nguyen Thi Tue Anh, et al (2006)	Vietnam	2001	CS	Firm	9,590 firms	Value added per employee	Employment share	OLS	+		
Giroud (2007)	Vietnam & Malaysia	2002	Survey	Firm	49 firms						+
Le Thanh Thuy (2007)	Vietnam	1995-1999 2000-2002	Panel	Industry	n.a	Gross output/total employees	Employment share	FE	+ (1995-1999) -(2000-2002)		
								RE	+ (1995-1999) -(2000-2002)		
Pham Xuan Kien (2008)	Vietnam	2005	CS	Firm	441 firms	Value added per employee	Revenue share	OLS	+		
Nguyen Ngoc Anh et al' (2008)	Vietnam	2000-2005	Panel	Firm	n.a	Real output	Output share Employment share	OLS	(-) manufacturing (+) services	(-) manufacturing & services	(+) manufacturing (-) services
								FE	(-) manufacturing (+) services	(+) manufacturing (-) services	(+) manufacturing n.s services

								RE	(-) manufacturing (+) services	(-) manufacturin g & services	(+) manufacturing (-) services
Nguyen Phi Lan (2008)	Vietnam	2000-2005	Panel	Firm	n.a	Output	Output share	2SLS	+	–	+
Hoang Van Thanh & Pham Thien Hoang (2010)	Vietnam	2003-2007	Panel	Firm	28,096 firms	Value added	Employment share	FE	+		
								RE	+		
Le and Pomfret (2011)	Vietnam	2000-2006	Panel	Firm	8,601 firms	Gross output/total employees	Employment share	OLS	–	+	+
Tran Toan Thang (2011)	Vietnam	2001-2005	Panel	Firm	27,206 firms	Total factor productivity	Capital stock share weighted by employment share	Levinsohn & Petrin	–	–	+
Anwar & Nguyen (2014)	Vietnam	2000-2005	Panel	Firm	n.a	Total factor productivity	Output share	2SLS	+	-	+
Bin Ni et al, (2014)	Vietnam	2002-2011	Panel	Firm	604,365 firms	Total factor productivity	Output share	OLS	–		+
								Stochastic Frontier Analysis	–	n.a	+
								Levinsohn & Petrin	–		+

Source: Author's summary

N.B: Reviewed papers in the above table are organized in 3 groups. Papers for direct effects and horizontal spillover (except Vietnam case) are presented first, followed by those in second group for both horizontal and vertical spillovers (except Vietnam case). The last group constitutes 12 papers that review the research on the case of Vietnam. All papers in 3 groups are arranged by year ascending in each group.

Table A4: Direct effects of FDI on productivity in Vietnam (2001-2010) with quadratic specification and 10% threshold for FDI firms

Dep. variable: Ln real value added	OLS	FE	SYS GMM
Ln lagged real value added	.336***	-.047***	.147***
	(.003)	(.004)	(.052)
Ln fixed asset	.193***	.145***	.186***
	(.002)	(.003)	(.034)
Ln employment	.559***	.593***	.764***
	(.003)	(.006)	(.053)
FDI_firm_adjusted	.019***	.004	-.024
	(.001)	(.004)	(.048)
FDI_firm_adjusted_square	-.0001***	-.00003	.0003
	(.00001)	(.000035)	(.0004)
Constant	2.36***	4.41***	3.14***
	(.019)	(.072)	(.186)
Firm/year observations	7,483	7,483	7,483
Firms	2,586	2,586	2,586
Adjusted R-squared	0.88	0.435	.907
Instrument			50
Hansen test			[0.420]
AR(1)			[0.000]
AR(2)			[0.913]

Notes:
All firms are with a minimum threshold of 10% for FDI intensity. All industry and time dummies are included but not reported to save space.
Standard Errors are in parenthesis; p-values in brackets.
GMM regression uses robust standard errors and treats the lagged real turnover measure, fixed asset and FDI intensity at firm level as endogenous. The values reported for the Hansen test is the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first-and second-order auto-correlated disturbances in the first differences equations.

*,** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table A5. 1: Crowding-in/Crowding-out effects of FDI in Vietnam (2001-2010) with 10% threshold for FDI firms

Dep. variable: Ln real turnover	OLS	FE	SYS GMM
Ln real turnover			
L1	.717***	.149***	.679 ***
	(.004)	(.005)	(.125)
L2	.202***	.010***	.155 *
	(.004)	(.004)	(.088)
FDI_firm_adjusted	.002***	.00087	.047 ***
	(.00019)	(.001)	(.010)
FDI_industry _adjusted	-.0002	-.0026***	.080 ***
	(.00039)	(.0003)	(.014)
FDI_firm_adjusted* FDI_industry_adjusted	.000015***	.000015**	-.0012 ***
	(4.45e-06)	(6.65e-06)	(.00031)
Constant	.808***	6.64***	-.771*
	(.016)	(.091)	(.409)
Firm/year observations	18,541	18,541	18,541
Firms	4,499	4,499	4,499
Adjusted R-squared	0.788	0.039	0.907
Instrument			41
Hansen test			[0.616]
AR(1)			[0.000]
AR(2)			[0.803]

Notes:
All firms are with a minimum threshold of 10% for FDI intensity. All industry and time dummies are included but not reported to save space.
Standard Errors are in parenthesis; p-values in brackets.
One-step GMM regression uses robust standard errors and treats the lagged real turnover measure and all other independent variables as endogenous. The value reported for the Hansen test is the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first-and second-order auto-correlated disturbances in the first differences equations.
*,** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table A5. 2: Crowding-in/Crowding-out effects of FDI in Vietnam (2001-2010) with quadratic specification and 10% threshold for FDI firms

Dep. variable: Ln real turnover	OLS	FE	SYS GMM
Ln real turnover			
L1	.719*** (.004)	.151*** (.005)	.619*** (.037)
L2	.200*** (.003)	.011*** (.003)	.110*** (.033)
FDI_firm_adjusted	.0046*** (.0007)	.0005 (.002)	.028*** (.005)
FDI_firm_adjusted_square	-.000026*** (7.01e-06)	-.00001 (.00002)	-.00014** (.00007)
FDI_industry_adjusted	-.001* (.0006)	-.0039*** (.00063)	.0411*** (.0151)
FDI_firm_adjusted* FDI_industry_adjusted	.00001*** (4.63e-06)	.00005*** (.00001)	-.00027*** .0001)
Constant	.82*** (.020)	6.72*** (.095)	1.09*** (.363)
Firm/year observations	18,541	18,541	18,541
Firms	4,499	4,499	4,499
Adjusted R-squared	0.788	0.039	.908
Instrument Hansen test			43 [0.220]
AR(1)			[0.000]
AR(2)			[0.396]

Notes:
All firms are with a minimum threshold of 10% for FDI intensity. All industry and time dummies are included but not reported to save space.
Standard Errors are in parenthesis; p-values in brackets.
One-step GMM regression uses robust standard errors and treats the lagged real turnover measure and all other independent variables as endogenous. The value reported for the Hansen test is the p-values for the null hypothesis of instrument validity. The values reported for AR(1) and AR(2) are the p-values for first-and second-order auto-correlated disturbances in the first differences equations.
*,** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table A6. 1: Spillover effects of FDI in Vietnam (2001-2010) with 2 lags

Dep. variable: Ln real value added output	**All firms**	**Domestic firms**	**Foreign firms**
Ln real value added output			
L1	.136**	.077*	.313***
	(.065)	(.043)	(.076)
L2	.169***	.154***	.159***
	(.010)	(.009)	(.043)
Ln fixed asset	.094***	.157***	.038**
	(.032)	(.027)	(.019)
Ln employment	.703***	.742***	.399***
	(.078)	(.049)	(.075)
FDI_ firm	.003*	-	-.010*
	(.002)		(.005)
Horizontal	-.047***	-.046***	-.006
	(.012)	(.014)	(.004)
L. Horizontal	-.007***	-.003**	-.002
	(.002)	(.001)	(.003)
L2. Horizontal	-.008***	-.003*	.001
	(.001)	(.002)	(.002)
Backward	.085*	.035	.004
	(.049)	(.023)	(.010)
L. Backward	.008***	.005***	-.004
	(.003)	(.001)	(.006)
L2. Backward	-.002	-.005***	.001
	(.003)	(.001)	(.004)
Forward	-.033**	-.033	.004
	(.016)	(.025)	(.017)
L. Forward	-.004	.001	-.012
	(.005)	(.008)	(.014)
L2. Forward	-.026***	-.037***	.007
	(.007)	(.006)	(.006)
Constant	4.10***	4.34***	4.48***
	(.513)	(.582)	(.726)
Lincom (Horizontal	-.062***	-.053***	-.007
+L. Horizontal+L2. Horizontal)	(.016)	(.017)	(.005)
Lincom (Backward	.092*	.035	.001
+L. Backward+L2. Backward)	(.055)	(.025)	(.014)
Lincom (Forward	-.063**	-.069*	-.0001
+L. Forward+L2.Forward)	(.024)	(.037)	(.016)
VIF	7.63	7.77	8.64
Correlation predicted & actual dependent variables	0.9337	0.9050	0.8914
Firm-year observations	55,528	50,535	4,993
Firms	27,129	25,209	1,932

Adjusted R-squared	.928	.917	.956
Instrument	54	61	180
Sargan/Hansen test	[0.207]	[0.157]	[0.496]
AR(1)	[0.000]	[0.000]	[0.000]
AR(2)	[0.173]	[0.000]	[0.358]
AR(3)		[0.121]	

Notes: All industry and time dummies are included but not reported to save space.
Standard Errors are in parenthesis; p-values in brackets.
GMM regression uses robust standard errors and treats the lagged real value added output measure, labor, capital, FDI intensity at firm level, horizontal spillovers, backward spillovers, forward spillovers as endogenous. The value reported for the Sargan/Hansen test is the p-values for the null hypothesis of instrument validity.
The values reported for AR(1), AR(2) and AR(3) are the p-values for first-and second-order auto-correlated disturbances in the first differences equations.*,** and *** denote significance at the 10%, 5% and 1% level, respectively

Table A6. 2: Spillover effects of FDI in Vietnam (2001-2010) by economic region with 2 lags

Dep. variable: Ln real value added output	Red River Delta	Northern Midlands & Mountain areas	North Central & South Central Coast	Central Highlands	South East	Mekong River Delta
Ln real value added output						
L1	.096***	.355***	.136***	.146*	.734***	.113***
	(.037)	(.072)	(.029)	(.078)	(.179)	(.041)
L2	.083***	.075*	.107***	.197***	-.142*	.071*
	(.029)	(.041)	(.022)	(.065)	(.077)	(.038)
Ln fixed asset	.110***	.098**	.075*	.243***	.112***	.130**
	(.049)	(.040)	(.043)	(.073)	(.039)	(.059)
Ln employment	.860***	.429**	.815***	.652***	.260*	.695***
	(.047)	(.174)	(.051)	(.088)	(.151)	(.065)
FDI_ firm	.016***	.005	.009**	.022***	.007***	.013***
	(.005)	(.003)	(.004)	(.005)	(.002)	(.003)
Horizontal	-.059***	.022*	-.006	.015	-.022	-.073
	(.012)	(.012)	(.009)	(.022)	(.026)	(.049)
L.Horizontal	-.011***	-.002	.001	-.003	-.003	.046*
	(.002)	(.001)	(.001)	(.018)	(.011)	(.026)
L2. Horizontal	-.002	.011	.0005	-.0003	-.004	.006
	(.003)	(.007)	(.001)	(.007)	(.005)	(.028)
Backward	.076*	-.065	-.023	-.021	-.255*	-.039
	(.045)	(.041)	(.022)	(.042)	(.139)	(.047)
L. Backward	.010	-.004	.0003	-.006	.050	-.052
	(.022)	(.023)	(.015)	(.025)	(.047)	(.048)
L2. Backward	.011	-.0003	.005	.017	.022	-.004
	(.007)	(.013)	(.013)	(.021)	(.031)	(.037)
Forward	.012***	-.077	-.049	-.067	-.287	.132***
	(.054)	(.104)	(.037)	(.128)	(.224)	(.124)
L.Forward	-.112***	.061	.037**	.123*	.217	.155*
	(.038)	(.052)	(.017)	(.065)	(.163)	(.093)
L2. Forward	-.024	.035	.066**	.060	.085	-.136
	(.024)	(.055)	(.028)	(.091)	(.096)	(.129)

	4.44***	2.37**	2.18***		3.89***	
Constant	(.826)	(1.10)	(.666)	.905	(1.04)	4.27***
				(.949)		(1.63)
Lincom	-.073***	0.220*	-.004		-.030	
(Horizontal+L.Horizontal)	(.015)	(.016)	(.011)	.011	(.021)	-.020
Lincom	.098**	-.070	-.017	(.015)	-.182	(.025)
(Backward+L.Backward)	(.046)	(.056)	(.024)	-.010	(.116)	-.096
Lincom	-.124*	.019	.054	(.027)	.015	(.068)
(Forward+L.Forward)	(.066)	(.057)	(.047)	.116*	(.070)	.151
VIF	9.41	17.85	11.69	(.065)	7.82	(.102)
Correlation predicted &	0.7607	0.9209	0.8152	15.09	0.8897	12.02
actual dependent variables				0.9079		0.8135
Firm-year observations	8,949	1,490	3,172	461	37,081	4,201
Firms	5,885	941	1,932	294	15,854	2,140
Adjusted R-squared	.958	.981	.961	.943	.916	.918
Instrument	77	65	90	43	55	75
Sargan/Hansen test	[0.205]	[0.871]	[0.358]	[0.779]	[0.211]	[0.227]
AR(1)	[0.000]	[0.000]	[0.000]	[0.037]	[0.002]	[0.000]
AR(2)	[0.874]	[0.220]	[0.575]	[0.238]	[0.652]	[0.000]
AR(3)						[0.772]

Notes: All industry and time dummies are included but not reported to save space. Standard Errors are in parenthesis; p-values in brackets.
GMM regression uses robust standard errors and treats the lagged real value added output measure, labor, capital, FDI intensity at firm level, horizontal spillovers, backward spillovers, forward spillovers as endogenous. The value reported for the Sargan/Hansen test is the p-values for the null hypothesis of instrument validity. The values reported for AR(1), AR(2) and AR(3) are the p-values for first-and second-order auto-correlated disturbances in the first differences equations.*,** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table A6. 3: Spillover effects of FDI & Firm size in Vietnam (2001-2010) with 2 lags

Dep. variable: Ln real value added output	**Small firms**	**Medium & Large firms**
Ln real value added output		
L1	.394***	.296***
	(.058)	(.096)
L2	.191***	.154***
	(.039)	(.055)
Ln fixed asset	.151**	.100***
	(.065)	(.023)
Ln employment	.328**	.234**
	(.130)	(.100)
FDI_ firm	.009*	.004***
	(.005)	(.001)
Horizontal	-.028	.007
	(.053)	(.006)
L. Horizontal	-.001	-.019***
	(.005)	(.005)
L2. Horizontal	.006	.003
	(.006)	(.003)
Backward	.308**	-.010
	(.154)	(.010)
L. Backward	-.087	.0007
	(.088)	(.007)
L2. Backward	-.040	-.012**
	(.043)	(.006)
Forward	.153	.028*
	(.160)	(.015)
L. Forward	-.024	-.010
	(.082)	(.008)
L2. Forward	-.027	-.009
	(.053)	(.006)
Constant	-.576	4.37***
	(3.65)	(.475)
Lincom (Horizontal+L.Horizontal	-.023	-.008*
+ L2. Horizontal)	(.064)	(.005)
Lincom (Backward+L.Backward	.180**	-.022*
+L2. Backward)	(.078)	(.011)
Lincom (Forward+L.Forward	.101	.008
+L2. Forward)	(.178)	(.018)
VIF	8.22	8.71
Correlation predicted & actual dependent variables	0.8940	0.9344
Firm-year observations	39,017	16,511
Firms	21,548	6,907

Adjusted R-squared	.805	.953
Instrument	53	97
Sargan/Hansen test	[0.608]	[0.166]
AR(1)	[0.009]	[0.000]
AR(2)	[0.334]	[0.458]

Notes: All industry and time dummies are included but not reported to save space.
Standard Errors are in parenthesis; p-values in brackets.
GMM regression uses robust standard errors and treats the lagged real value added output measure, labor, capital, FDI intensity at firm level, horizontal spillovers, backward spillovers, forward spillovers as endogenous. The value reported for the Sargan/Hansen test is the p-values for the null hypothesis of instrument validity.
The values reported for AR(1) and AR(2) are the p-values for first-and second-order auto-correlated disturbances in the first differences equations.*,** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table A6. 4: Spillover effects of FDI and Firm's R&D status in Vietnam (2001-2010) with 2 lags

Dep. variable: Ln real value added output	Active R&D	Non-active R&D
Ln real value added output		
L1	.485***	.249*
	(.133)	(.140)
L2	.091*	.146**
	(.048)	(.018)
Ln fixed asset	.046*	.222***
	(.025)	(.085)
Ln employment	.289**	.448**
	(.117)	(.218)
FDI_ firm	.005***	.006**
	(.001)	(.002)
Horizontal	-.023	.053
	(.025)	(.038)
L. Horizontal	.001	-.004
	(.010)	(.006)
L2. Horizontal	-.003	.00002
	(.007)	(.006)
Backward	.042	.431***
	(.040)	(.146)
L. Backward	-.021	.016**
	(.029)	(.007)
L2. Backward	-.013	-.011
	(.020)	(.011)
Forward	-.107*	.399**
	(.059)	(.199)
L. Forward	.088*	-.079
	(.049)	(.097)
L2. Forward	.028	-.079
	(.035)	(.069)
Constant	3.26***	-6.17***
	(.934)	(2.79)
Lincom (Horizontal+L.Horizontal	-.025	.049
+ L2. Horizontal)	(.033)	(.047)
Lincom (Backward+L.Backward	.008	.437***
+L2. Backward)	(.069)	(.142)
Lincom (Forward+L.Forward	.009	.24**
+L2. Forward)	(.054)	(.102)
VIF	8.72	9.00
Correlation predicted & actual dependent variables	0.9264	0.7335
Firm-year observations	14,487	41,041

Firms	4,575	22,554
Adjusted R-squared	.968	.898
Instrument	56	52
Sargan/Hansen test	[0.569]	[0.272]
AR(1)	[0.000]	[0.000]
AR(2)	[0.159]	[0.376]

Notes: All industry and time dummies are included but not reported to save space.

Standard Errors are in parenthesis; p-values in brackets.

GMM regression uses robust standard errors and treats the lagged real value added output measure, labor, capital, FDI intensity at firm level, horizontal spillovers, backward spillovers, forward spillovers as endogenous. The value reported for the Sargan/Hansen test is the p-values for the null hypothesis of instrument validity.

The values reported for AR(1) and AR(2) are the p-values for first-and second-order auto-correlated disturbances in the first differences equations.*,** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table A6. 5: Spillover effects of FDI & Industry concentration in Vietnam (2001-2010) with 2 lags

Dep. variable: Ln real value added output	Bottom 25% level of concentration	Top 25% level of concentration
Ln real value added output		
L1	.159***	.236***
	(.059)	(.063)
L2	.009	.042
	(.049)	(.049)
Ln fixed asset	.157**	.175***
	(.067)	(.037)
Ln employment	.800***	.688***
	(.117)	(.044)
FDI_ firm	.007***	.013***
	(.002)	(.003)
Horizontal	-.024***	-.011***
	(.007)	(.003)
L. Horizontal	.034**	-.001*
	(.009)	(.0007)
L2. Horizontal	.015**	-.001
	(.005)	(.0007)
Backward	-	-.005
		(.004)
L. Backward	-.023	-.004
	(.019)	(.002)
L2. Backward	.002	-.0001
	(.011)	(.002)
Forward	-.090	.075***
	(.035)	(.011)
L. Forward	.222	-.029***
	(.049)	(.008)
L2. Forward	.119*	-.0003
	(.062)	(.004)
Constant	.102	3.06***
	(1.17)	(.180)
Lincom (Horizontal+L.Horizontal	.025**	-.013***
+ L2. Horizontal)	(.011)	(.004)
Lincom (Backward+L.Backward	-.020	-.009*
+L2. Backward)	(.027)	(.005)
Lincom (Forward+L.Forward	.250***	.045***
+L2. Forward)	(.083)	(.010)
VIF	12.13	5.51
Correlation predicted & actual dependent variables	0.8231	0.9342
Firm-year observations	11,955	14,493

Firms	7,976	8,259
Adjusted R-squared	.865	.955
Instrument	33	84
Sargan/Hansen test	[0.734]	[0.114]
AR(1)	[0.000]	[0.000]
AR(2)	[0.136]	[0.222]

Notes: All industry and time dummies are included but not reported to save space.
Standard Errors are in parenthesis; p-values in brackets.
GMM regression uses robust standard errors and treats the lagged real value added output measure, labor, capital, FDI intensity at firm level, horizontal spillovers, backward spillovers, forward spillovers as endogenous. The value reported for the Sargan/Hansen test is the p-values for the null hypothesis of instrument validity.
The values reported for AR(1) and AR(2) are the p-values for first-and second-order auto-correlated disturbances in the first differences equations.*,** and *** denote significance at the 10%, 5% and 1% level, respectively.