FOREIGN DIRECT INVESTMENT AND INNOVATIONS OF SMALL AND MEDIUM-SIZED ENTERPRISES IN VIETNAM: THE ROLE OF INSTITUTIONS

Submitted by

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In fulfilment of the requirements for the degree of

Doctor of Philosophy (Management and Commerce)

College of Business, Law and Governance

James Cook University

September 2024

Acknowledgements

I would like to express my deepest gratitude to those who have supported and guided me throughout my PhD journey.

First and foremost, I am profoundly thankful to my supervisory panel, Associate Professor Sizhong Sun and Associate Professor Riccardo Welters, whose invaluable guidance, patience, and encouragement have been pivotal in shaping this thesis. Your solid expertise, critical insights, constructive feedback and unwavering support have immensely contributed to my academic development.

I sincerely thank Associate Professor Taha Chaiechi, the Chair, and Associate Professor Hossein Ghodosi, the Independent Academic, for their detailed feedback and support through important milestones in my PhD journey.

To the staff of the College of Business, Law and Governance (CBLG), particularly Chris Payne, whose administrative assistance has been invaluable throughout this journey.

I am grateful for the financial support provided by James Cook University (JCU) through the JCU Research Training Program Scholarship and the Graduate Research School's Minimum Resource Funds. This support has been essential in enabling me to focus on my research.

I would also like to acknowledge the anonymous reviewers of my research output, the participants at the Australian Conference of Economists (Brisbane, July 2023), and the discussants at the PhD Summer Institute in International Trade and Industrial Organisation conference (Christchurch, New Zealand, March 2024) for their valuable feedback and discussions.

My heartfelt thanks go to my fellow PhD friends, Someek Basu and Sean Kelly, for the emotional support and enriching economic knowledge exchanges. Your companionship has been a source of strength and motivation.

To my family, parents, and friends back home in Vietnam, your unconditional love and support have been my anchor throughout this journey.

Lastly, I sincerely thank my mentor, Doctor Hiep Luu at Vietnam National University - University of Economics and Business, whose inspiration and encouragement led me to embark on this PhD journey. Your belief in me has been a driving force behind my pursuit of this academic path.

This thesis would not have been possible without all these individuals' collective support and contributions. Thank you all for being a part of my journey.

Statement of the Contribution of Others

The following statement outlines the contribution of others to the completion of this thesis, including intellectual and financial support.

Nature of support	Contribution	Names, titles, and affiliations of co-contributors
Intellectual support	Thesis supervision	A/prof Sizhong Sun A/prof Riccardo Welters (Supervisory panel, James Cook University – JCU)
	Feedback on methodology, analysis and result interpretation	Anonymous reviewers of journal articles and participants at conferences and seminars
Financial support	Tuition fee and monthly stipend	JCU Research Training Program Scholarship
	Minimum Resource Funds	Graduate Research School College of Business, Law and Governance (2020-2024) (JCU)

Abstract

This thesis investigates how the quality of the local institutional environment moderates the impact of foreign direct investment (FDI) on the innovation performance of domestic small and medium-sized enterprises (SMEs) in Vietnam in terms of research and development (R&D) investment, product innovation and process innovation. Existing studies have delved into the relationship between FDI and domestic firms' innovative activities, with some finding positive effects while others find negative or insignificant effects. However, these studies frequently ignore the influence of institutions. Conceptually, institutions play an important role in affecting the strategies and behaviours of foreign-invested firms in the host market. Subsequently, institutions can affect how FDI impacts domestic firms' innovation activities, where domestic SMEs seem particularly relevant due to their greater vulnerability towards institutional deficiencies. This thesis fills the gap in the existing literature by exploring the role of institutions as a moderator in the FDI-domestic innovation nexus.

For this purpose, I estimate three sets of econometric models using a panel dataset of 2,690 manufacturing SMEs in 2011, 2013 and 2015. The Small and Medium-sized Enterprise Survey (SME survey), provided by the United Nations University World Institute for Development Economics Research (UNU-WIDER), is the main data source. Data on SMEs are combined with FDI data extracted from the Enterprise Survey of the General Statistics Office (GSO) of Vietnam and data on provincial institutional quality from the Provincial Competitiveness Index (PCI) constructed by the Vietnam Chamber of Commerce and Industry (VCCI). In estimations, I address the potential endogeneity problems of both FDI and institutional measures by utilising an instrumental variable (IV) approach.

The estimations show that FDI presence hinders domestic SMEs' innovation activities, probably due to SMEs' low absorptive capacity, large technological gap, lack of economies of scale and low market power. Specifically, FDI presence is associated with a lower probability of domestic SMEs engaging in R&D investment and their amount of R&D expenditure. FDI presence also lowers the probability of product and process innovations as well as the number of new/improved products introduced and new processes adopted by domestic SMEs.

However, institutions positively moderate these relationships. That is, better institutions mitigate the negative impacts of FDI on various innovative activities of domestic SMEs. When the quality of local institutions improves beyond a threshold level, FDI exerts positive spillovers that encourage the innovation performance of domestic SMEs. The positive moderating effect of institutions can occur by promoting the incentive and ability of foreign investors to create technological spillovers, which will mitigate FDI crowding-out effects, enhance domestic SMEs' absorptive capacity, and facilitate interaction and knowledge sharing in the local business environment.

Additional analyses reveal that the moderating effect of institutions is less pronounced for FDI originating from developing countries/countries with lower institutional quality than developed countries/countries with higher institutional quality. This result suggests that multinational enterprises (MNEs) in the former group may be more susceptible to institutional impacts due to their unfamiliarity with institutional obstacles in the host economy. I also distinguish different institutional components and find that seven out of nine institutional sub-indices have significant moderating effects, of which the control of corruption is the most important factor in promoting FDI spillovers, while the effects of business support and labour training policies are negligible.

The findings of this thesis assist researchers who explore the relationship between FDI and innovations of domestic firms by highlighting the importance of incorporating institutions as a moderating factor in the analysis. Policy implications are also drawn for emerging countries to capitalize on FDI positive spillovers, that is, to implement institutions enhancing measures simultaneously with FDI-attracting policies. In the context of Vietnam, the estimated thresholds on institutional quality help identify provinces that should be prioritized in institutional reform, especially those receiving large proportions of FDI from developed countries or countries with high institutional quality. Developed countries allocating foreign aid to emerging countries should also focus on improving the recipient's institutional quality in addition to facilitating FDI inflows. As for domestic firms seeking to promote their innovation performance in the face of increased foreign competition, the strategies could be to enhance their absorptive capacity to foreign technologies and advocate for institutional reforms within their local environment.

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Chapter 1: Introduction

1.1 Background and Motivations

Inward foreign direct investment (FDI) plays an important role in the host economy by contributing to its capital stock and technological advancement (Sun & Anwar, 2017). As an external source of capital and the conduit of knowledge and technologies, FDI can foster economic growth (Alfaro et al., 2004). Such an FDI impact is prominent in developing economies where, due to the lack of scientific knowledge and the resources to engage in cutting-edged R&D, the innovation regimes primarily rely on adopting existing knowledge and technology (Vujanović et al., 2022). FDI has surpassed remittances, portfolio investments, and official development assistance to become the most resilient and vital source of external finance for developing economies (Piemonté et al., 2019). According to UNCTAD (2019), FDI made up an average proportion of 39% of the total external finance for developing economies during 2013 – 2017. From 2010 to the pre-COVID-19 era, FDI flows to developing countries have been much more stable than those to developed countries, with an average of USD 674 billion (UNCTAD, 2020). Despite a recent decrease in global FDI due to gloomy prospects for international investment, FDI flows to developing economies increased by 4% in 2022 and accounted for 70% of the global FDI flows, of which the majority are concentrated in a few large emerging countries (UNCTAD, 2023). Thus, FDI and its implications for developing and emerging countries are the topics of paramount attention.

Against this backdrop, researchers have examined the impacts of FDI on different behavioural aspects of domestic firms. For example, since the work of Caves (1974), a large body of literature has examined productivity spillovers of FDI (see, e.g., Blalock & Gertler, 2009; Liang, 2017; Moralles & Moreno, 2020). Other research investigates how FDI affects domestic firms' export performance (Anwar & Nguyen, 2011a; Sun, 2009) and wages (Muñoz-Bullón & Sánchez-Bueno, 2013; Nguyen et al., 2019). In addition, a strong emphasis has been placed on the impacts of FDI presence on the innovation performance of domestic firms, to which this thesis is related.

Conceptually, FDI inflows may promote innovation of domestic firms through four main channels: (*i*) demonstration effects, (*ii*) worker mobility, (*iii*) competition effects, and (*iv*) forward/backward linkages (Blomström & Kokko, 1998; Cheung & Ping, 2004). The first channel involves domestic firms observing and imitating the advanced products and technologies presented by FDI firms. In the second channel, foreign firms hire and train domestic workers who may later contribute to the human capital of domestic firms. The third channel is in operation when intensified market competition following foreign entry stimulates domestic firms to innovate as a survival strategy. However, an increase in competition can also crowd out domestic firms. Foreign entrants with competitive advantages may steal market share, compete for scarce resources, raise input prices, or substitute local suppliers with imports in the domestic market (Jin et al., 2019; Liu & Buck, 2007). The crowding-out effects of increased competition may outweigh any positive effects of increased competition on the innovation of domestic firms, i.e., the overall competition effect need not be positive. The last channel refers to the transfer of technological knowledge and managerial expertise through customer/supplier relations between foreign and domestic firms.

Empirical research on the innovation spillovers of FDI can be classified into two major strands based on the choice of innovation indicators. The first strand of literature focuses on innovation input using R&D investment as a measure of the innovation effort of domestic firms (Chuang & Lin, 1999b; Huang & Zhang, 2020; Stiebale & Reize, 2011). The second strand utilises innovation output as the outcome variable, such as patents (Antonietti et al., 2015; Ascani & Gagliardi, 2015; Cheung & Ping, 2004; Hu & Jefferson, 2009) and measures of product innovation and process innovation (García et al., 2013; Girma, Gong, et al., 2008; Sun & Du, 2010). These studies yield mixed findings.

Attempts have been made to introduce heterogeneity to the relationship between FDI and innovation performance of domestic firms. Prior empirical studies emphasise the role of firm agglomeration or clustering in technological transfer. These studies adopt spatial econometric techniques to demonstrate that technological spillovers can decline with distance (Huang &

Zhang, 2020; Wang & Wu, 2016). The justification is that geographic proximity among firms can foster knowledge sharing through skilled labour mobility, specialize the local markets for labour and intermediate goods, reduce communication costs, and enhance trust relations, interactions and linkages in both horizontal and vertical directions.

In addition, FDI heterogeneity, including modes of entry, ownership structures, origins, and purposes, might have diverse effects on domestic innovation performance. Liu and Zou (2008) distinguish between the two modes of entry: greenfield investment and cross-border M&As. Javorcik and Spatareanu (2008) and Ito et al. (2012) take into account FDI ownership structures, that is, whether the MNEs establish a joint venture or wholly own subsidiary in the local market. Hong et al. (2019) show that FDI from developed countries is a more promising source of advanced technology than FDI from emerging countries, which often come with asset-seeking purposes rather than contributing to local technological advancement. Other studies also account for the type of activity MNEs engage in, such as R&D versus production activities (Cheung, 2010; Ito et al., 2012; Liu & Buck, 2007; Qu & Wei, 2017).

Finally, a significant body of literature highlights the role of firm-specific absorptive capability in determining the effectiveness of FDI technological spillovers. Absorptive capability can influence the extent to which domestic firms are able to recognise, adopt, assimilate and apply the advanced technology and managerial practices of their foreign counterparts to create internal value (Glass & Saggi, 1998). Studies using the level of in-house R&D activities, skilled labour and financial access as indicators of firm-specific absorptive capability find a positive moderating effect of such measurements on the relationship between FDI and the innovation performance of incumbent firms (Girma, Gong, et al., 2008; Liu & Buck, 2007).

This thesis focuses on an alternative, less established argument in the literature, exploring the effect of FDI on the innovation performance of domestic firms through the moderating effect of institutional settings. Institutional settings are the set of rules governing the behaviours of individuals and organisations (North, 1990). These rules can be formal (with codified laws, regulations and contracts) or informal (such as customs, values, social norms, ethics and

ideologies that are tacit and socially embedded). Developed institutions enhance the effectiveness of a market mechanism to relieve firms from undue costs or risks during market transactions, whereas low-quality institutions impede or even undermine markets (Meyer & Sinani, 2009; North, 1990). Extant literature has suggested that host country institutions are immobile factors contributing to the locational advantages of FDI, i.e., the ability of multinational enterprises (MNEs) to exploit local resources to their advantage (Meyer & Nguyen, 2005; Mudambi & Navarra, 2002). Institutions are of concern to MNEs upon making investments, thereby influencing their locational choice (Du et al., 2008; Godinez & Liu, 2015). In addition, institutions can affect various MNEs' decisions, including entry modes, human resources, alliance formation, and export strategies (Brouthers & Brouthers, 2000; He et al., 2013; Xu & Shenkar, 2002). By shaping the strategies of foreign-invested firms in the local market, institutions can influence their incentives and abilities to generate technological spillovers (Wang et al., 2013; Yi et al., 2015). Therefore, the FDI technological spillovers to domestic firms may be contingent upon the level of institutional development. Despite this conceptual link and governments' ability to influence the institutional setting (particularly formal institutions), to the best of my knowledge, surprisingly little attention has been paid to assessing the role of institutions in moderating FDI's impacts on the innovation performance of domestic firms.

This thesis fills the gap by examining institutions as a moderating factor in the relationship between FDI and the innovation performance of domestic small and medium-sized enterprises (SMEs). I focus on SMEs because they are generally more vulnerable to institutional constraints than large firms, which may lead to more significant institutional moderating effects. SMEs often lack market power, resources, and political connections to deal with regulatory burdens or exchange for public favours (LiPuma et al., 2013; Schiffer & Weder, 2001). In this way, institutions can determine the levels of resources and transaction costs of SMEs and, subsequently, influence their absorptive capacity for FDI spillovers more so than large firms. By restricting the sample to SMEs, it is possible to capture a more pronounced institutional moderating effect.

An institution-based analysis is of particular relevance to emerging countries since their institutional arrangements are different and generally of lower quality than those in more developed countries, from where FDI often originates. In addition, emerging countries often experience significant institutional changes over time and have heterogeneous institutional conditions across subnational regions (Xiao & Park, 2018). These institutional disparities likely contribute to the variation in regional FDI spillovers within a country.

Vietnam is a suitable setting to investigate the research question empirically. Vietnam is among the fastest-growing emerging economies, where FDI inflows have increased continuously and are considered a key contributing factor to growth (Anwar & Nguyen, 2013). In addition, Vietnam features considerable variation in institutional development across provinces, enabling the estimation of institutional quality (Yi et al., 2015). Research on FDI technological spillovers in Vietnam has focused on the effect of MNEs on domestic firms' productivity (Le & Pomfret, 2011; Ni et al., 2017; Thang et al., 2016). The investigation of FDI impacts on the innovation of domestic firms has received much less attention. Hoang et al. (2021) and Phi et al. (2024) discuss, given FDI firms' superior ability to innovate, the implication of FDI inflows on the technological development of domestic Vietnamese firms, but do not explicitly test for technological spillovers from the former to the latter. Notably, to the best of my knowledge, how institutional quality moderates the impact of FDI on the innovation of domestic firms in Vietnam has never been considered. Therefore, exploring the research question in the context of Vietnam would be imperative for the country and other similar economies to draw insightful FDI-related policies.

1.2 Aims and Objectives

This thesis aims to examine the moderating effect of institutions on the relationship between FDI presence and innovation performance of domestic SMEs in the context of Vietnam, conceptually, theoretically and empirically. To achieve this overall goal, the following objectives are established:

(*i*) To construct a conceptual model to explain how institutions moderate the impacts of FDI presence on innovation performance, including R&D investment, product innovation and process innovation of domestic firms.

(*ii*) To empirically examine how institutions moderate the effect of FDI presence on the R&D investment of domestic firms, using a panel dataset of SMEs in Vietnam in 2011, 2013 and 2015. In addition, to examine how such an institutional moderating effect is contingent upon FDI origin, specifically FDI inflows from institutionally developed countries and those from less institutionally developed countries.

(*iii*) To empirically examine how institutions moderate the impacts of FDI presence on domestic firms' product and process innovations, using a panel dataset of SMEs in Vietnam in 2011, 2013 and 2015. In addition, to examine how such an institutional moderating effect is contingent upon FDI origins and different dimensions of institutional quality.

(*iv*) To address the problems associated with modelling count data by developing a theoretical model featuring firm heterogeneity. The model illustrates the channels through which FDI presence and institutions affect the expected number of new/improved products introduced by domestic firms.

(*v*) Guided by the aforementioned theoretical model, this thesis empirically estimates the moderating effect of institutions on the relationship between FDI and the number of new/improved products of domestic firms via each theory-informed channel.

1.3 Methodology and Data

To achieve the aims and objectives set out in the previous subsection, I follow several research procedures, summarised below, where the details can be found in later chapters.

The analysis begins with conceptualizing the channels through which FDI presence affects the innovation of domestic firms, taking into account the characteristics of SMEs. More importantly, the conceptual model incorporates institutions as the moderating factor that influences the relationship between FDI and the innovation of domestic firms. Hypotheses

regarding how the institutional moderating effects may vary depending on FDI origins, particularly the level of institutional and economic development of the home countries, are also discussed.

Next, the thesis proceeds with an empirical investigation of the proposed hypotheses by specifying and estimating the econometric models. Various measures of innovation performance of domestic firms, at both extensive and intensive margins, are employed as the dependent variables to ensure a comprehensive assessment. Accordingly, both innovation input in terms of R&D activities and innovation output indicated by product and process innovations are incorporated in the analysis. R&D activities are measured by whether a firm conducts R&D investment (extensive margin) and the amount of R&D expenditure (intensive margin). Regarding product and process innovations, the set of dependent variables comprises whether a firm introduces new products (extensive margin), whether a firm adopts new processes/technologies (extensive margin), the number of new/improved products (intensive margin), and the number of new processes/technologies (intensive margin).

In the econometric models, I control for factors potentially influencing domestic SMEs' innovation. The selection of control variables is based on prior literature on the determinants of innovation performance of domestic firms, especially SMEs. The focus is on institutional quality, FDI presence, and their interaction term as the estimated parameters can be interpreted to quantify the moderating effect of institutions on innovation spillovers from FDI. FDI presence in an industry is proxied by the level of horizontal FDI and later, as a robustness check, an FDI index that captures all the dimensions of FDI, including horizontal FDI, forward FDI and backward FDI.

The econometric models and estimation methods are chosen based on the type of dependent variables. The thesis addresses potential endogeneity problems that may arise from FDI and institution measures using the instrumental variable (IV) approach. A battery of diagnostic tests is performed to confirm the validity of the constructed IVs. For binary outcomes, the thesis employs probit models and IV-probit models, which assume that the functional form of the

dependence on the explanatory variables is a standard normal cumulative distribution function. In addition, a linear probability model is also examined where the parameters are estimated by instrumental variable two-stage least squares estimator (IV-2SLS). Regarding the continuous measure of R&D expenditure, two-step generalized method of moments with excluded instrumental variables (IV-GMM) is adopted.

Finally, significant effort has been put into modelling the count measures of product innovation as a stand-alone contribution of this thesis. First, I adopt the GMM technique to estimate Poisson models, assuming that the number of new products or processes/technologies follow Poisson distributions with equal mean and variance. Although the Poisson model is widely used and is appropriate for non-negative integer count values, there is a lack of robust theoretical justification for the approach. Furthermore, data on new/improved products exhibit the problem of excessive zero-reporting, which may come from two distinct data-generating processes: (*i*) firms having no innovative initiatives and (*ii*) those who innovate but fail to produce a new product. To address these concerns, I developed a theoretical model of a two-stage game to illustrate domestic firms' optimal decision on the number of new/improved products introduced in a given period and estimate the parameters in each stage using the GMM estimator.

The empirical analyses employ a panel dataset comprising 2,690 SMEs in Vietnam during the three-year period in 2011, 2013 and 2015. The data are compiled from three distinct sources. The first data source comes from the biennial Small and Medium-sized Enterprise surveys provided by the United Nations University World Institute for Development Economics Research (UNU-WIDER). The surveys provide essential details on Vietnam SMEs' identity, production and technology, sale structure, inputs, finance, employment, owners/managers' characteristics, and operational strategies, especially innovative activities. Secondly, data on FDI are extracted from the Enterprise Survey of the General Statistics Office (GSO) of Vietnam, which gathers accounting information of all formally registered enterprises in the country. Thirdly, data on provincial institutional quality come from the Provincial Competitiveness Index (PCI) constructed by the Vietnam Chamber of Commerce and Industry (VCCI). The first and second

data sources are merged based on the four-digit Vietnam Standard Industrial Classification (VSIC) provided by the GSO. The institutional measures from the third data source are incorporated using provincial codes. The data screening and cleaning process includes checking for missing and non-credible values, correcting for outliers, matching data from different sources, and constructing panel data based on a unique firm identifier. The thesis uses the statistical software package Stata 17 and R and R Studio for data management, visualization and econometric analyses.

1.4 Contributions

Firstly, the most significant contribution of this thesis involves incorporating institutions as a moderating factor in the relationship between FDI presence and the innovation performance of domestic firms. Therefore, the thesis contributes to the literature examining the impact of host country institutions on FDI spillovers in the local economy. Recent studies have shown how institutional factors, such as marketization (Yi et al., 2015), the ease of doing business (Krammer, 2015), rule of law (Zhang, 2019), and control of corruption (Gorodnichenko et al., 2014), moderate FDI spillovers to the productivity of domestic firms. However, to the best of my knowledge, no study has explicitly tested the moderating effect for innovation, which is a knowledge gap because although improved productivity might be the result of innovation activities, productivity measures cannot directly reflect a firm's effort to innovate (Salomon & Shaver, 2005). Even though productivity can be linked to innovation, as domestic firms benefiting from productivity spillovers tend to exhibit greater innovative capacity, it is crucial to note that productivity alone does not guarantee innovation. Several other factors promoting a firm's ability to innovate are generated by FDI but are not directly tied to productivity. These factors include FDI-induced market demand for new products, access to technologies and knowledge for product development or process enhancement, and the strategic imperative for firms to regain their monopolistic position through innovation, thereby circumventing foreign competition. By considering domestic innovation as the dependent variable, this thesis advances the literature on the moderating role of institutions in FDI spillovers.

Secondly, this thesis contributes to the literature investigating the impact of FDI on the innovation performance of domestic firms by focusing on SMEs as the recipients of FDI spillovers. Previous studies focus on large firms and offer little evidence on how FDI may influence the innovation capacity of indigenous SMEs. Arguably, SMEs possess distinct characteristics from large firms that may affect their innovation ability under the influence of FDI entry. On the one hand, the flexible structure, quick decision-making process, and willingness to take risks of SMEs are advantageous for adopting and implementing new ideas (Hossain & Kauranen, 2016). On the other hand, SMEs often lack financial resources, skilled labour, managerial expertise, technical experts, technological assets, and technical information (Madrid-Guijarro et al., 2009; Xie et al., 2010), which may explain the low absorptive capability of SMEs to FDI technological spillovers.

In addition, SMEs are more vulnerable to institutional threats than large firms since they lack market power, resources and political connections to endure the cost of bureaucratic obstacles or to exchange for public favours (LiPuma et al., 2013; Schiffer & Weder, 2001). SMEs are often poorly equipped to deal with regulation burdens and have to sacrifice a larger proportion of resources for administrative procedures than large firms (OECD, 2018). Institutional weaknesses are considered a major hindrance to the innovation performance of SMEs in emerging countries (Pachouri & Sharma, 2016; Zhu et al., 2012). Therefore, examining SMEs will help identify the institutional impact on innovation spillovers of FDI in the domestic market.

Thirdly, by achieving the (*iv*) and (*v*) objectives, this thesis contributes to the literature investigating the impact of FDI on domestic firms' product innovation, theoretically and empirically. Prior studies mainly use the share of new product sales, which serves as an intensive margin, to measure the scope of product innovation. Other studies follow a binary approach by using a dummy variable indicating the status of with and without product innovation as the dependent variable, which serves as an extensive margin. Another important dimension of innovation is the frequency, which is the number of new products domestic firms introduce. However, the impact of FDI presence on the frequency of product innovation remains

understudied. To the best of my knowledge, only two studies empirically investigate the relation between the impact of FDI inflows and the number of new products, namely García et al. (2013) and Jin et al. (2019). Therefore, this thesis contributes by adding to the scant literature on the frequency of product innovation and FDI spillovers.

Furthermore, both studies employ a negative binomial regression model to estimate the number of new products. However, other than the dependent variable being a count measure, it is not clear why the number of new products shall be negatively binomially distributed. The negative binomial distribution allows for the number of new products to be infinite. Nevertheless, given resource scarcity, firms' optimal number of experimental trials to develop new products is finite. Consequently, the number of new products (successful experimental trials) is also finite. The theoretical modelling will show that the number of new products is instead binomially distributed.

Finally, when a firm reports zero new/improved products in the survey data, it is because either the firm has no intention to innovate, or innovates but fails to create improved/new products, similar to the number of patents examined by Hu and Jefferson (2009). That is, the zero values come from two distinct data-generating processes. Hence, it is likely that the proportion of observations with zero values in the sample is higher than predicted by the negative binomial distribution, resulting in biased estimations (Ito et al., 2012). The estimations enable these two types of firms to be identified separately, making this another important contribution of this thesis.

1.5 Structure of the Thesis

The remainder of this thesis is structured as follows: Chapter 2 provides a comprehensive review of existing literature on the impacts of FDI on the innovation performance of domestic firms and the relevance of institutions as the moderating factors in the relationship, thereby highlighting research gaps and the significance of the proposed research questions. Chapter 3 provides background information on the current development trend of the institutional environment in Vietnam, the expansion and significance of FDI inflows in the economy, and the characteristics of domestic SMEs. Chapter 4 presents the conceptual framework and research

method used in the thesis. The conceptual framework illustrates the relationships among the variables of interest, from which I develop testable hypotheses corresponding to objective (*i*) of the thesis. Chapter 5 describes the data used in the empirical estimations, encompassing data sources, the construction of panel data, summary statistics and preliminary analysis. Chapter 6 presents the empirical results of the moderating effects of institutions on FDI spillovers to R&D investment of domestic SMEs, which fulfils objective (*ii*) of the thesis. Also focusing on the moderating role of institutions on FDI spillovers, Chapter 7 reports the empirical results for product and process innovations of domestic SMEs to achieve objective (*iii*) of the thesis. Chapter 8 realizes objectives (*iv*) and (*v*) by presenting the estimation results of the two-stage model, as described in Chapter 4, regarding how FDI and the institutional moderating role affect the number of new/improved products introduced by domestic SMEs. Finally, Chapter 9 concludes the thesis by summarising key findings, providing implications for local firms and policymakers, and limitations and avenues for future research.

Chapter 2: Literature Review on FDI and Innovations of Domestic Firms

2.1 Introduction

This chapter provides a comprehensive review of the literature on the impacts of FDI on innovations of domestic firms and the role of institutions as a moderating factor in this relationship. It begins with the discussion in Section 2.2 of relevant concepts of R&D investment, product innovation, process innovation, marketing innovation and organisational innovation. Section 2.3 discusses various channels of FDI technological spillovers to domestic firms, comprising the demonstration effect, labour mobility, competition effects and customer-supplier relations. Section 2.4 summarises the emergence of research on FDI spillover and domestic innovation performance. It highlights the mixed findings in three strands of studies employing different measures of innovation, including patent data, R&D investment, and product and process innovations. Following this, Section 2.5 discusses subsequent studies aiming to address the heterogeneity in the FDI-domestic innovation relationship by considering the directions of FDI spillovers (horizontal versus vertical effects), the spatial effect of FDI spillovers, the heterogeneity of FDI flows, and the moderating role of domestic firms' absorptive capacity.

A separate section, Section 2.6, is devoted to reviewing studies on FDI spillovers in the context of Vietnam. Section 2.7 identifies the knowledge gap in existing literature, featuring the lack of research on SMEs, the research gap in the context of Vietnam, and the negligence of the institutional moderating effect on FDI spillovers to the innovation of domestic firms. Section 2.8 concludes the chapter.

2.2 Innovation Concepts

R&D is a key innovation input that contributes to firms' competitiveness and innovation success. The Frascati Manual of OECD (2015) provides a standard definition of research and development (R&D), that is "R&D comprise creative and systematic work undertaken in order to increase the stock of knowledge - including knowledge of humankind, culture and society - and to devise new applications of available knowledge". This definition emphasises the systematic nature of R&D and its dual focus on knowledge creation and application. According to the manual, R&D encompasses three components, namely basic research, applied research, and experimental development. To be considered as R&D investments, the activities need to generate new insights based on original ideas or hypotheses, often with uncertain results regarding time and resource requirements. These activities are planned, budgeted, and aim to produce outputs that can either be shared freely or commercialised. Therefore, R&D is characterised by five key criteria: it must be novel, creative, uncertain in outcome, systematic, and transferable or reproducible. Different from its previous version, the manual classifies R&D as capital investments instead of expenditures in national accounts, recognising the creation of a knowledge-based capital stock.

Regarding innovation outputs, the Oslo Manual compiled by (OECD, 2005) defines innovation as resulting from firms' ability to generate new knowledge and apply it to new products, product varieties, processes, organisational designs, and marketing, thereby implying the following four types:

Product innovation is defined as "the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses" (OECD, 2005). The substantial improvements in goods or services may stem from technical specifications, components, materials, embedded software, user friendliness or other functional features (Martínez-Alonso et al., 2019). Product innovation helps firms sustain competitive advantages by gaining first-mover position, meeting customer needs, increasing demand, and achieving higher profit margins (Kotler & Keller, 2006; O'Regan et al., 2006). Challenges like evolving customer

preferences, shorter product life cycles, and intensified global competition may hinder the implementation of product innovation (Gunday et al., 2011).

Process innovation refers to "the implementation of a new or significantly improved production or delivery method" through substantial changes in techniques, equipment, or software (OECD, 2005). While product innovation is mainly driven by market and customer, process innovation is more internally oriented, aiming to enhance firm efficiency and reduce the costs of production and delivery (Hervas-Oliver et al., 2014). As a result, implementing process innovation allow firms to gain cost advantages over competitors, optimize resource allocation, boost labour productivity, and increase profit margins, hence a critical source of competitive advantage (Chang et al., 2015; Diéguez-Soto et al., 2018). However, the benefits of process innovation may take longer time to manifest due to its reliance on complementary assets and cost-cutting nature (Gunday et al., 2011).

Marketing innovation refers to "the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing" to better meet customer needs, open new markets, or reposition products to increase sales (OECD, 2005). Rooted in the four Ps of marketing (product, price, promotion, and place), it overlaps with product innovation and focuses on enhancing market segmentation and service delivery. Firms typically aim to boost sales, exploit economies of scale, segment markets, and offer value-added products to increase customer willingness to pay (Tavassoli & Karlsson, 2015). Empirical evidence highlights the role of marketing innovation in building and maintaining competitive advantages, particularly through cost reduction and differentiation (Naidoo, 2010).

Finally, organisational innovation involves "the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations" (OECD, 2005). Organisational innovation enhances firm performance by reducing administrative and transaction costs, improving workplace satisfaction and productivity, accessing non-tradable assets, and lowering supply costs. Examples include creating knowledge-sharing databases, employee training programs, and supplier development initiatives, all aimed at renewing

organisational routines, fostering collaboration, and promoting innovation (Gunday et al., 2011). In some research, the differentiation between process innovation and organisational innovation are not always clear-cut and organisational innovation may be considered as a part of the technological process innovation plan (Hervas-Oliver et al., 2014).

Based on data availability, this thesis examines R&D investments as innovation input and product and process innovations as innovation outputs, while leaving marketing and organisational innovations for future research.

2.3 Channels of FDI Impacts on Innovation of Domestic Firms

Existing literature has identified two types of FDI spillovers: horizontal and vertical. The horizontal effect occurs between foreign-invested enterprises and indigenous firms operating in the same industries, mainly through the demonstration effect, labour movement and increased market competition.

First, MNEs can benefit domestic firms by introducing superior advanced technologies and management techniques, which local firms may adopt through demonstration and imitation. The demonstration effect occurs when domestic firms observe, imitate and even reverse engineer the products and advanced technologies from their foreign counterparts, leading to higher innovative capability of the former (Aldrich Howard & Ruef, 2006; Nguyen et al., 2020; Qu & Wei, 2017). Since there may exist discrepancies in factors of production, consumers' tastes and market-size between the country origins of MNEs and the host economy (Katrak, 1985), domestic firms may undertake some adaptive R&D to ensure the newly devised products and technologies could suit the local conditions and then be applicable to commercial ends (Kathuria, 2008). Technology from MNEs with certain public good qualities can create positive externalities, thereby enhancing local firms' technological capabilities and incentives to invest in R&D (Jongwanich & Kohpaiboon, 2015). The demonstration effect may also hold significance for domestic firms' product innovation, because new products introduced by foreign firms can educate local consumers and stimulate demand in related industries (Kim & Li, 2014). Additionally, given the

successful launch of these new products in foreign markets, the FDI presence can guide domestic firms in their innovation path, alleviating perceived risks associated with developing similar products (Cheung & Ping, 2004).

The horizontal spillover may also manifest through labour movement, with local workers obtaining tacit knowledge of superior technologies and managerial practices from FDI firms through work experience, learning and interaction (Liu & Zou, 2008). These skilled workers will later constitute the human resources of domestic entrants (Smarzynska, 2002) or they can become entrepreneurs in the same or related industries (Ayyagari & Kosová, 2010). The transfer of R&D personnel then promotes innovation in domestic firms. Labour mobility may exert a strong influence on process innovation, as firms often require tacit knowledge to effectively adopt new technologies – a knowledge transfer facilitated by the movement of human capital.

Finally, market competition intensified by the entry of MNEs could pose a threat to domestic firms, forcing them to innovate and escape competition (Aghion et al., 2009). In response to foreign entry, local firms launch R&D projects, which in turn can give them competitive advantages (Rammer et al., 2009b). The competition effect may impact both product and process innovation depending on the response strategy of domestic firms. If the objective is to regain monopolistic power, there is a greater incentive to introduce new products. Alternatively, if the aim is to compete by lowering production costs, the focus may shift towards adopting new processes or technologies for enhanced efficiency.

Regarding the vertical spillover effect, the technological spillover can occur through forward linkages since MNEs in the upstream industries might provide high-quality inputs for the innovation process of local firms in addition to technical assistance and training programs (Liang, 2017; Lin et al., 2009). In terms of backward linkages, MNEs have incentives to enhance the quality of input from local suppliers by providing technical assistance and training programs, information, financial support, and organisational and managerial externalities (Giroud, 2007; Le & Pomfret, 2011; Nguyen & Nguyen, 2008). The high requirements on the quality of intermediate inputs and delivery time of foreign buyers can encourage local suppliers to improve their

production efficiency, delivery and sale process to compete for foreign customers (Huynh et al., 2019). The close linkages and interaction might also facilitate labour movement and knowledge sharing between MNEs and local buyers (Le & Pomfret, 2011).

2.4 Research on FDI Spillovers and Domestic Innovation Performance

Extant research on international knowledge spillovers frequently focuses on investigating the impact of FDI on total factor productivity or labour productivity of domestic firms (Blalock & Gertler, 2009; Liang, 2017; Lin et al., 2009; Smarzynska, 2002). Those positive externalities findings suggest that the enhanced innovative capacity of indigenous firms is one of the transmission channels of FDI spillovers to productivity in the local market. In this regard, enhanced productivity is often used as a proxy for process innovation. This measurement was later challenged by researchers in the field, arguing that various factors contribute to productivity enhancement other than innovation, while it is also uncertain that improved productivity would eventually result in innovation (García et al., 2013; Ito et al., 2012). They suggested that firms' efforts to develop new products or patents can be a more direct measurement of innovation performance (MacGarvie, 2006; Salomon & Shaver, 2005). Subsequently, empirical research using innovation, rather than productivity, as an assessment of FDI spillovers in the host economy has emerged over the past decade, marking a shift from aggregate production function studies to knowledge production functions (Mancusi, 2008).

2.4.1 Mixed Findings in Studies Using R&D Investment

Research on the relationship between FDI and R&D investment of domestic firms remains scant and inconclusive. Anwar and Sun (2014) suggest that China's manufacturing firms increase R&D spending in response to foreign entry owning to the positive FDI spillovers on their productivity and, hence, their capacity to invest in R&D. Khachoo et al. (2018) find that horizontal FDI and backward FDI encourage R&D activity of Indian manufacturing firms, which significantly contributes to innovation output. This impact is substantially stronger for firms residing near the best practice frontier, suggesting that the extent to which domestic firms benefit

from FDI technological spillovers depends on their predetermined technical capability. Huang and Zhang (2020) also concur that FDI inflows generate positive technological spillovers that scale up innovation input measured by the R&D intensity of domestic Chinese firms.

In contrast, Chuang and Lin (1999a) find a statistically non-significant effect of FDI on the R&D intensity of Taiwan's manufacturing firms, arguing that FDI may be a substitute for domestic R&D activity. Kathuria (2008) shows that FDI reduces the probability of domestic Indian firms investing in R&D, confirming the substitution effect of FDI as domestic firms may rely on the purchase or license of technologies from foreign firms rather than pursuing risky and costly R&D. Stiebale and Reize (2011) find that foreign acquisitions adversely affect the R&D activities of the local target firms. This effect occurs because MNEs often try eliminating duplicate R&D in the new establishment by relocating R&D programs at home while tightening R&D budgets to mitigate organisational complexity. However, the study does not provide implications for FDI impacts on other non-acquired firms.

2.4.2 Mixed Findings in Studies Using Product and Process Innovations

Researchers on innovation generally agree that innovation outputs measured by the introduction of new products or new production processes can be better indicators of innovation performance (Cheung & Ping, 2004; Wang & Kafouros, 2009). Thus, a body of research has emerged to assess how FDI spillovers affect the capability of domestic firms to develop new products or production processes. These studies, yet again, are far from reaching a consensus. The most common approach is measuring innovation performance by the share of new product sales in total sales at the firm or industry level. Using this indicator as the dependent variable in the innovation function, Cheung (2010) finds that the intensity of R&D activities by foreign-invested enterprises enhances the efficiency of domestic firms' R&D and subsequently promotes product innovation of domestic firms in China's high-technology industries. Huang and Zhang (2020) corroborate this finding and further suggest that the level of FDI in a given industry within a confined geographical boundary increases the number of product innovations. The study of Vahter (2010), using a firm-level panel dataset in the Estonia manufacturing sector, confirms a

positive relationship between the FDI entry rate and the probability of domestic firms engaging in process innovation. Crescenzi et al. (2015) employ a broad measure of innovation and suggest that the presence of MNEs in the UK market fosters all aspects of domestic innovation in terms of product innovation, process innovation, organisational innovation and participation in innovation projects. The positive externalities from MNEs are stronger for domestic firms focusing on regional and national markets than for those engaging in international markets since the latter are less likely to establish relationships with local affiliates of MNEs, which limits the opportunities for knowledge diffusion.

On the other hand, FDI has been suggested to exert an insignificant or even deleterious effect on the innovation performance of domestic firms under certain circumstances. According to Sun and Du (2010), the presence of foreign-invested firms in a sector, while fostering intra-sector patent grants, exerts no significant spillover effect on new product sales. The study proposes that domestic enterprises may be unable to transfer the positive technological spillovers from FDI to commercial ends for economic gain. Stiebale and Reize (2011) also fail to find a significant effect of FDI via merger and acquisition (M&A) on product and process innovations of domestic target firms. In addition, negative externalities from FDI are found for those who fail to implement in-house R&D activities and suffer limited access to finance (Girma, Gong, et al., 2008). García et al. (2013) find a negative impact of FDI on product innovation in Spain at both industry and firm levels. They argue that foreign entrants into the country act as asset-seeking FDI that shifts innovation activities from the foreign affiliates to the parent firms back in the home country, leading to limited opportunities for technological transfer. Lengyel and Leydesdorff (2015) identify the diverse effects of FDI on innovation across regions, with a negative effect in the relatively lagging regions.

2.5 Factors affecting the relationship between FDI and domestic innovation

2.5.1 Horizontal and Vertical Effects

A number of empirical studies on the FDI-domestic innovation nexus distinguish horizontal and vertical dimensions of the spillovers. The horizontal spillovers of FDI, also known as the intra-industrial effect, refer to the transfer of advanced technology and managerial practice through demonstration effects, labour mobility, and the pressure to escape competition (Aghion et al., 2009; Blalock & Gertler, 2009; Cheung & Ping, 2004). FDI vertical spillovers, also known as the inter-industrial effect, occur through supplier-customer relations since high-quality technological inputs, technical assistance, and training programs can be offered by upstream MNEs to local buyers (forward linkages) or by downstream MNEs to local suppliers (backward linkages).

The study of Ito et al. (2012) shows a positive effect of both R&D activities and production of foreign firms on patent applications of domestic firms in the same industry, while the effect of FDI in upward and downward industries is insignificant. The justification is that technologies from FDI in other industries may be irrelevant for domestic firms to imitate and innovate. Khachoo and Sharma (2016) support the positive FDI spillovers on innovation via horizontal and backward linkages but fail to find a robust statistically significant forward effect from FDI in upstream sectors. Chen et al. (2022) reach a similar conclusion while extending that to patent quality, a measurement based on patent citations, the generality and originality indexes. The study also finds that the positive effect of horizontal FDI on the innovation of domestic firms is more pronounced for radical innovation, that is, invention patent applications as opposed to utility models or design patents. Such an effect happens via intensified market competition, which pressures domestic firms to opt for technology upgrades. In addition, backward FDI spillovers operate through the channel of knowledge transfer as evident by domestic firms citing patent citations possessed by foreign firms in the downstream industries.

Vujanović et al. (2022) examine FDI spillovers at different stages of the innovation process, including the innovation decision, innovation input, innovation output and innovation-induced labour productivity, distinguishing knowledge-use and knowledge-generating regimes. Using data from Serbia – an emerging European economy, the paper finds that positive FDI spillovers

are greater for knowledge-use firms than knowledge-generating ones. Horizontal FDI is more beneficial in the earlier phases of innovation, such that the FDI impact on innovation spending is positive, but that on sales from innovation is negative, probably due to intensified market competition and domestic firms' poor marketing and commercial skills. Forward FDI spurs domestic innovation through the purchase of machinery and equipment/ improved quality or new types of inputs. Backward FDI exerts negative innovation spillovers as foreign firms may source inputs globally rather than locally.

2.5.2 The Spatial Effect of FDI Spillovers

Recent empirical works strongly emphasise the role of firm agglomeration or clustering in technological transfer and have started incorporating such spatial dimensions into examining FDI spillovers on innovation. Arguably, while technological spillover can decline with distance (Simmie, 2004), the geographic proximity among firms can foster knowledge sharing by facilitating skilled labour mobility (Fan & Scott, 2003), specialising the local markets for labour and intermediate goods (Driffield, 2006; Driffield & Girma, 2003), reducing communication cost (Thang et al., 2016), enhancing the trust relation (Fu et al., 2013), and spurring interactions and linkages in both horizontal and vertical directions (Wolfe & Gertler, 2004). While previous studies often adopt province as the geographical boundary to identify the regional impact of FDI (Ascani & Gagliardi, 2015; Fu, 2008; Zhang & Rogers, 2009), Wang and Wu (2016) narrow the scope to the county level and find that FDI exerts stronger positive spillovers on domestic innovation if domestic firms intensively and actively innovate in a cluster. Huang and Zhang (2020) employ a firm-level spatial dynamic panel regression model and 100 km distance between domestic firms and their foreign counterparts as the geographical boundary and confirm positive spatial spillovers of FDI on product innovation of domestic firms. Lin et al. (2021) utilise the introduction of high-speed railways in China as an exogenous foreign technology shock and confirm a positive impact on the patent activities of domestic firms located near the direct receivers of the technology.

2.5.3 Heterogeneity in FDI Flows

In addition, one may argue that FDI is not a homogeneous stock of capital, and the variation in its modes of entry, ownership structures, origins and purposes might lead to diverse effects on domestic innovation performance. First, FDI entering a market may either take the form of greenfield investment or cross-border M&As that are distinct in nature. While greenfield investments require setting up new production plans in the host economy, cross-border M&As involve taking over or merging an existing domestic firm's assets, capital and liabilities (UNCTAD, 2009). Liu and Zou (2008) distinguish between the two modes of entry and find that while both intra-industrial and inter-industrial positive spillovers from greenfield investment exist, the spillovers of M&As are only significant through inter-industrial linkages. This result suggests that M&A entry may heighten market competition and discourage domestic firms in the same high-tech sector from innovating. In contrast, Damioli and Marin (2024) find that greenfield FDI flows to China dampen regional innovation, driven mainly by the reduction in patent output of less experienced inventors. As greenfield subsidiaries attract the best local talent, new inventors may miss out on collaboration with more experienced ones, which hints at the crowding-out effect of FDI in the labour market. FDI taking place via M&A generally has no significant effect on regional innovation, except for a slight increase in the patent output of experienced inventors shortly after entry. Tan et al. (2023) provide support for a negative or insignificant effect of greenfield FDI on the innovation quality of domestic Chinese firms as opposed to a positive one found in M&A entry, suggesting that due to the high cost of greenfield investments, MNEs implement measures to prevent knowledge leakage by keeping their R&D centres at home and adopting intellectual property protection.

Second, MNEs can establish a joint venture or a wholly-owned subsidiary in the local market. While a joint venture can capitalize on the existing well-established linkages of the domestic partner to facilitate technological transfer (Javorcik & Spatareanu, 2008), one may argue that technological-enriched FDI often takes the form of a wholly-owned subsidiary over which MNEs exert better control (Wang & Wu, 2016). Ito et al. (2012) distinguish between the two FDI

ownership structures and find that the positive spillovers from joint ventures are not always significant compared to wholly-owned firms.

Third, the heterogeneity in FDI origin might also influence its spillover impact on innovation. Although FDI from developed countries is a promising source of advanced technology for the host economy, FDI from emerging countries often comes with an asset-seeking purpose to exploit the local advantage rather than contribute to local technological advancement (Hong et al., 2019). Ito et al. (2012) point out that FDI originating from Hong Kong, Macau, and Taiwan (HMT-origin FDI) generally contributes less to the innovation performance of Chinese mainland firms compared to FDI originating from countries outside China, arguing that HMT-origin foreign-invested enterprises mainly exploit the country's cheap labour to serve the export market, leading to limited opportunities for local technological transfer.

Fourth, some studies also account for the type of activity engaged by MNEs in the local market with the expectation that MNEs' R&D activities can facilitate knowledge sharing to assist innovation of domestic firms, thereby being more beneficial than their production activities, which might otherwise discourage innovation efforts through crowding-out effects (Cheung, 2010; Ito et al., 2012; Liu & Buck, 2007; Qu & Wei, 2017). Chen and Zhou (2023) corroborate this finding by showing that FDI innovation activity in a region measured by the sales of new products encourages innovative entrepreneurship entry and growth through opportunity recognition and human capital development of the entrepreneurs.

2.5.4 The Moderating Role of Firm Absorptive Capacity

Finally, a large strand of literature highlights the role of firm-specific absorptive capability in determining the effectiveness of FDI technological spillovers. Absorptive capability can influence the extent to which firms are able to recognise, adopt, assimilate and apply the advanced technology and managerial practices of their foreign counterparts to create internal values (Glass & Saggi, 1998). The majority of studies, using the level of in-house R&D activities, skilled labour and financial access as indicators of firm-specific absorptive capability for technological

advancement, find a positive moderating effect of such measurements on the relationship between FDI and the innovation performance of incumbent firms (Girma, Gong, et al., 2008; Liu & Buck, 2007). Jiang et al. (2022) emphasise the role of regional absorptive capacity, indicated by educational level, infrastructure development and the share of state-owned capital, in enhancing positive FDI spillovers on both patent quantity and quality.

In addition, the technological gap between incumbent firms and the best practices in the industries might also determine their absorptive capability for FDI-led innovation. According to Aghion et al. (2009) and Khachoo et al. (2018), firms close to the technological frontier innovate more under the influence of FDI entry than those located further behind. Firms that are closer to the frontier are more efficient, undertake more R&D and have higher incentives to innovate to escape competition raised by the presence of foreign firms (Khachoo & Sharma, 2016; Khachoo et al., 2018). On the other hand, raising the technological frontier by FDI entry can reduce the expected rents and payoffs of innovation for relatively laggard local firms, leaving them with little hope of surviving the competition by innovation and, hence, lower incentive to innovate (Aghion et al., 2005; Aghion et al., 2001).

2.6 FDI Spillovers to Vietnamese Enterprises

Research on FDI technological spillovers in Vietnam has been devoted to the examination of how the presence of MNEs affects domestic firms' production scale (Nguyen & Nguyen, 2008), trade and export activities (Anwar & Nguyen, 2011a, 2011b; Nguyen & Sun, 2012), labour productivity (Le & Pomfret, 2011; Trinh & Doan, 2018) and most recently, total factor productivity (Huynh et al., 2019; Nguyen et al., 2020; Ni & Kato, 2020; Ni et al., 2017; Thang et al., 2016).

A large body of studies employs firm-level data from the annual Vietnam Enterprise Survey (VES) provided by the General Statistics Office to examine the effect of FDI through both horizontal and vertical channels. These studies largely confirm that horizontal FDI entry in the same industry creates the "market stealing effect" that crowds out domestic firms, and Vietnamese

firms are incapable of competing with technologically advanced foreign entrants, resulting in negative spillovers on productivity (Huynh et al., 2019; Nguyen et al., 2020; Ni & Kato, 2020; Ni et al., 2017; Thang et al., 2016). Concerning vertical direction, MNEs might be unwilling to transfer technology and know-how to the local buyers while raising input prices for the downstream industries, leading to insignificant forward spillovers from FDI. The effect is negative for local firms purchasing inputs from MNEs due to high sunk costs and asymmetric bargaining powers (Newman et al., 2015). On the other hand, it has been emphasised that backward linkages are probably the most prominent channels of FDI spillovers as MNEs have large incentives to enhance the productivity of local suppliers by providing technical assistance and training programs, information, financial support, organisational and managerial externalities (Giroud, 2007; Le & Pomfret, 2011; Nguyen & Nguyen, 2008). The high requirements on the quality of intermediate inputs and delivery time of foreign buyers can encourage local suppliers to improve their production efficiency, delivery and sale process so that they can compete for foreign customers (Huynh et al., 2019). The close linkages and interaction might facilitate labour movement and knowledge sharing between MNEs and local buyers (Le & Pomfret, 2011). Newman et al. (2015) further show that FDI generates greater demand for domestic intermediates and local firms to compete for foreign customers, thereby benefiting domestic firms in upstream industries even without direct customer-supplier relations.

Attempts have been made to analyse the various mechanisms and factors affecting the degree of horizontal and vertical spillovers in FDI, with a focus on heterogeneity in FDI, industry, and domestic firms. Accounting for the influence of FDI ownership structure, Truong et al. (2015) suggest that wholly-owned foreign MNEs consistently impose negative spillovers while joint ventures often exert positive ones, arguing that weak interactions between domestic firms and wholly-owned foreign subsidiaries may inhibit knowledge transfer in some industries. The study of Le and Pomfret (2011) suggests that the ownership structure of foreign entrants determines the extent of both horizontal and backward spillovers. Specifically, the negative horizontal spillovers on local firm productivity only occur for fully-owned FDI, not for partially-owned FDI, while the

positive vertical spillovers are significant for both types of FDI ownership. The explanation is that fully-owned foreign investors are more likely to receive sophisticated technology from their home parents, but have a relatively higher motivation to prevent knowledge leakage to local firms. This might increase market competition, leading to a negative crowding-out effect on local firms in the same industry. Conversely, fully-owned foreign buyers are more capable of providing technical assistance and knowledge transfer to local suppliers, leading to a greater positive effect via backward linkages of fully-owned FDI compared to that of partially-owned FDI.

Ni et al. (2017) consider the origin of foreign investors in determining horizontal and vertical technological spillovers. The study shows a negative horizontal effect of FDI on domestic firms' total factor productivity (TFP) while confirming positive vertical spillovers via both backward and forward linkages. However, these effects are only significant for FDI originating from Asian countries as opposed to European and American regions. Among Asian countries, foreign investors from the Association of Southeast Asian Nations (ASEAN) countries can rely on the trade agreement with Vietnam and import inputs from their home countries rather than sourcing locally, which diminishes the vertical linkages and results in insignificant vertical spillover effect of FDI from ASEAN countries to Vietnamese firms. Chinese and Taiwanese MNEs, which purchase a large proportion of inputs from Vietnamese suppliers to minimize production costs, create strong positive vertical spillovers. In contrast, Japanese and Korean MNEs do not generate significant vertical spillovers since the sophistication and high standard of their products require them to seek inputs from their familiar international suppliers but not local Vietnamese firms that still provide relatively low-quality products.

Nguyen and Nguyen (2008) examine the impact of FDI spillovers on the production scale of domestic firms by distinguishing between manufacturing and service sectors, suggesting that different channels of spillovers matter for different sectors. The study supports positive backward spillovers for firms located in the manufacturing sector and positive horizontal spillovers for those in the service sector. Some studies (Ni et al., 2017) argue that the level of technology in a given

industry can influence productivity spillovers by showing that backward spillovers are positive only in low-technology industries as opposed to medium and high technologies industries.

Regarding firm characteristics, the absorptive capacity of indigenous firms measured by the level of human capital, technological gap and financial development has been repeatedly examined as the factors moderating the relationship between FDI spillovers and firm productivity (Anwar & Nguyen, 2014; Huynh et al., 2019; Nguyen et al., 2020). Although different factors are important for different spillover channels, previous studies generally agree that the higher absorptive capacity of local firms is essential for them to learn and adopt technology and knowledge from their foreign counterparts while staying competitive in the local market. Accordingly, firms with a higher level of human capital, lower technology gap and fewer financial constraints can better leverage the positive spillovers to their advantage and lessen the negative crowding-out effect from FDI.

As for other firm-specific characteristics, Le and Pomfret (2011) propose that the negative horizontal impact of FDI is only significant for private, small, low-technological, domestically oriented and non-R&D firms who have a low absorptive capacity and face higher competition pressure from FDI presence in the local market. Thang et al. (2016) investigate the role of firm location relative to the foreign entrants in facilitating productivity spillovers from FDI and find that FDI presence in neighbouring provinces enhances the TFP of domestic firms via both horizontal and vertical (backward and forward) channels. These spatial spillover effects diminish as the distance from foreign firms increases, suggesting that low communication costs and specialized local markets for labour and intermediate goods within a cluster can promote inter-firm knowledge sharing. In addition, inter-firm interaction strengthens the positive FDI spillovers via backward linkages while mitigating the negative effect of horizontal and forward FDI.

However, research in Vietnam has not yielded consistent results concerning the impacts of FDI through different channels. As opposed to many studies supporting the negative spillover of FDI horizontal effect, Anwar and Nguyen (2014) find that such an effect is uncertain and varies across different regions. Thang et al. (2016) find the effect to be positive for domestic firms in

the same province. Newman et al. (2015) suggest insignificant horizontal spillovers. As for vertical spillovers, although FDI has been repeatedly shown to exert positive spillovers via backward linkages, the role of the forward linkage channel is more controversial. While some studies assert negative spillovers from FDI in upstream industries to domestic buyers (Huynh et al., 2019; Nguyen & Nguyen, 2008; Nguyen et al., 2020), others provide evidence for a positive forward relationship (Ni et al., 2017; Thang et al., 2016).

2.7 Research Gaps

2.7.1 Research Gap in FDI Spillovers on SMEs

The impact of FDI spillovers on the innovation performance of SMEs remains less explored. Arguably, SMEs possess distinct characteristics from large firms that may affect their innovation ability under the influence of FDI entry. On the one hand, the flexible structure, quick decision-making process, and willingness to take risks of SMEs are advantageous for adopting and implementing new ideas (Hossain & Kauranen, 2016). Since SMEs often lack the critical tools and resources to carry out their in-house R&D, they often rely heavily on external sources of innovation inputs (Hadjimanolis, 1999; Narula, 2004). In this regard, technological advances and knowledge sharing facilitated by FDI may be important sources of technology, managerial practice, and labour skills that assist SMEs in their innovation process. Especially in emerging countries, where SMEs face additional barriers from the inferior technological and policy infrastructure (Demirbas et al., 2011), FDI entry will enhance the overall innovation capacity of the economy and subsequently benefit SMEs' innovation. For SMEs that also face difficulties in commercialising their R&D activities, FDI with strong manufacturing capacities, marketing channels and global contacts may facilitate this process and promote their effort to introduce new products (Lee et al., 2010).

On the other hand, FDI might exert a deleterious effect on the innovation performance of SMEs. Various barriers to innovation by SMEs have been identified, for example, the lack of financial resources, skilled labour, managerial expertise, technical experts, technological assets,

and technical information (Madrid-Guijarro et al., 2009; Xie et al., 2010). These internal demerits result in the low absorptive capability of SMEs for FDI technological spillovers, suggesting that SMEs might fail to detect, adopt, assimilate, and apply the advanced technology from foreign entrants to generate innovation outputs. In addition, SMEs might be more vulnerable to competition pressure raised by the presence of MNEs in the local market compared to larger firms.

In the specific context of Vietnam, this is a major research gap since SMEs play an important role in the Vietnamese economy, contributing around 40% of labour hiring, 40% of the total GDP, 30% of the public budget, and 33% of industrial outputs (Nam & Bao Tram, 2021). The Vietnamese government has given preferential treatment to SMEs' innovation activities, including incentives such as low tax rates, fast-tracking of business registration, government funding and subsidies. Therefore, it is crucial for the government to understand its role in providing support and creating a favourable business environment to further facilitate the development of SMEs, especially under increased competition from FDI entry.

2.7.2 Research Gap in Vietnam

Research on FDI technological spillovers in Vietnam has not yet examined the effect of FDI on the ability of domestic firms to innovate. As discussed above, although improved productivity might result from innovation activities, productivity measures cannot directly reflect the firms' effort to launch new products or production processes. This research gap might be owing to the unavailability of data on innovation from the commonly used GSO enterprise survey and the negligence of innovation as a focal economic objective in the previous research.

In the early 2000s, the transition of the Vietnamese economy featured a privatization and liberalization process. Although socio-economic reform was initiated in 1986,[1] it was not until 1999 that the *Enterprise Law* was enacted, which established a legal framework for the operation of the private sector, recognizing the freedom to conduct commercial activities in different forms of ownership. The subsequent introduction of *Investment Law* in 2005 provided a more detailed legal framework for foreign investment, followed by the accession of Vietnam into WTO in 2007, opening a period of active global integration. Thus, in the 2001-2010 period, the main economic objective has been to overcome the stagnation and inefficiency left by the once long-existing centrally planned regime. Accordingly, the first and foremost development priority was to boost economic growth, encourage industrialization and export, and develop basic infrastructure and amenities to catch up with other more developed countries in the region.[2] Therefore, the economic strategy in this period emphasises productivity enhancement rather than technological development and innovation. However, innovation has recently emerged as a focal development objective.

Over the past decade, since the country has successfully created the foundation for industrialization and modernization, the national economic strategy put forward technology development as the key driving force of the country's fast and sustainable development process.[3] Government policies have, therefore, focused on promoting and supporting technology adoption

[1] Under the reform, Vietnam has transformed from a centrally-planned economy to a market economy which encourages privatization and liberalization.

[2] Socio-economics development Strategy for 2001-2010, the Central Committee of the Communist Party VIII tenure, 9th National Party Congress.

[3] Socio-economics development Strategy for 2011-2020, the Central Committee of the Communist Party X tenure, 11th National Party Congress.

and innovation of enterprises in all economic sectors and encouraging them to master key technologies and produce technology-intensive products. At the same time, Vietnam, with its many government incentives, such as favourable corporate income tax, import and export tax incentives, and easy land access, became an appealing destination for FDI inflows, leading to a surge in FDI inflows.[4] Thus, whether FDI inflows promote or crowd out domestic innovation and what the government should do to facilitate positive technology spillovers from FDI would hold important policy implications for Vietnam.

2.7.3 Research Gap in Institutions and FDI Spillovers

How institutions affect the transmission of FDI spillovers in a local market has been understudied in the literature. Given that institutions influence the performance and strategies of foreign-invested firms, it is reasonable to expect that this could influence the effectiveness of technological diffusion to domestic firms following the FDI entry. Supporting institutions can reduce transaction costs by reducing uncertainty and establishing a stable structure to facilitate interactions (Meyer, 2001). High-quality institutions also ensure the partial enforcement of laws and regulations, which increases trust within business environments to facilitate arm-length transactions and complicated economic activities, including innovation (Anokhin & Schulze, 2009).

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[4] According to the data provided by the General Statistics Office of Vietnam, over the ten-year period from 2005 to 2015, the number of FDI projected tripled from 970 projects in 2005 to 3.147 projects in 2015. The quantity of yearly registered FDI surged by more than 250% from 6.840 million USD in 2005 to 24.155 in 2015, which continued to increase steadily, reaching 36.368,6 million USD in 2018. The highest growth rate in registered FDI was observed in 2008, with the figure raising by roughly 235% in just one year from 21.348,8 million USD in 2007 to the peak of 71.726,8 million USD in 2008.

Studies on institutions and FDI spillovers remain scarce and exhibit several limitations. First, although a tenuous stream of research has looked at how the productivity spillovers of FDI to domestic firms are contingent upon locally-specific institutions (Du et al., 2011; Farole & Winkler, 2012; Gorodnichenko et al., 2014; Krammer, 2015; Wang et al., 2013; Xiao & Park, 2018; Yi et al., 2015; Zhang, 2019), to the best of my knowledge, no significant attempt to date has been made to explicitly investigate the institutional contingency of FDI spillover on domestic innovation performance. Whilst there is overlap between the conceptual frameworks that link FDI spillovers to productivity and innovation (i.e., domestic firms that benefit from productivity spillovers are also more capable of innovating), productivity does not necessarily lead to innovation. That is, there are other factors affecting firms' capability to innovate, such as the demand for new products, the availability of technologies and knowledge to generate new products or adopt new processes, and the need for firms to gain monopolistic power (to avoid competition) through innovation. These factors are FDI-induced but not directly related to productivity. Therefore, it is important to test for innovation explicitly.

Second, most studies use China as a country setting for the investigation. Although China is the largest emerging market in the world and receives the largest amount of inward FDI, it is hardly representative of all emerging countries due to its specific institutional idiosyncrasies. The Chinese government has long been implementing the *"quid pro quo"* policy that requires foreign firms to transfer technology to China in exchange for market access (Holmes et al., 2013). Accordingly, improving institutions may reduce the government's ability to force disclosure of technology and know-how from FDI, thereby impeding productivity spillovers through demonstration and technological transfer. Since such a phenomenon is unique to China and unlikely to be observed in other emerging countries with lower market capacity and government bargaining power, focusing on China can induce bias in the estimation of institutional impacts on FDI spillovers. Thus, one should be cautious when generalizing the results obtained from China for institutional impacts in emerging markets as a whole. It has been suggested that research on other emerging markets is essential to explain the institutional mechanism of FDI spillovers (Xiao

& Park, 2018), such as the interesting context of Vietnam, which also features significant variations in institutional arrangements across subnational regions (Yi et al., 2015).

Finally, it is still unclear how FDI spillovers to innovation may vary depending on the heterogeneity of FDI given their origins. Prior studies suggest that the experience of MNEs at home determines their vulnerability to the institutional environment in the host economy, thus institutional gap between home and destination countries matters (Cuervo-Cazurra, 2006b; Godinez & Liu, 2015). In addition, the home country's development level may also influence MNEs' globalisation strategies and the capability to generate technological spillovers in the host economy (Buckley et al., 2015; Cuervo-Cazurra & Genc, 2008a). There is little knowledge of how institutions affect FDI spillovers in different directions, including horizontal, backward, and forward spillovers. To the best of my knowledge, the only study on this matter is Zhang (2019), who suggests that improving local rule of law enhances backward and forward spillovers to local firms. It is crucial to consider not just horizontal FDI but also vertical FDI. Moreover, previous studies fail to consider the diverse aspects of institutions, such as marketization, entry cost, bureaucratic transparency, government effectiveness, corruption, business support policies, and their potential different impacts on FDI spillovers. Regarding domestic firms, their heterogeneity, particularly absorptive capacity and the technological intensity level of the industry, may influence the institutional moderating effect. This requires a more in-depth and comprehensive analysis of institutions and FDI spillover mechanisms.

2.8 Summary

In summary, the recent literature on FDI innovation spillovers to domestic firms provides fiercely contrasting findings. Some studies confirm positive spillovers of FDI on domestic innovation (Antonietti et al., 2015; Ascani & Gagliardi, 2015; Cheung, 2010; Crescenzi et al., 2015; Huang & Zhang, 2020; Vahter, 2010), while other studies support the insignificant (Ito et al., 2012; Sun & Du, 2010) or even negative impacts (García et al., 2013; Girma, Görg, & Pisu, 2008; Qu & Wei, 2017; Zhang & Rogers, 2009).

Consequently, institutions that shape the rules of the game for both FDI and domestic firms, have increasingly received attention as moderating factors on FDI spillovers. Existing literature has focused on how institutions affect FDI spillovers to domestic firms' productivity, not firms' innovation. Some studies support the enhancing effect on FDI productivity spillovers of a number of institutional factors, including IPR protection (Yi et al., 2015), marketization (Wang et al., 2013; Yi et al., 2015), the ease of doing business (Krammer, 2015), rule of law (Zhang, 2019), control of corruption (Gorodnichenko et al., 2014), and tax incentives given to foreign firms (Du et al., 2011). In contrast, high governance quality, economic freedom, and low government interference exert adverse moderating effects (Krammer, 2015; Zhang, 2019).

The existing literature exhibits several research gaps. First, previous studies focus on large firms and offer little evidence on how FDI may influence the innovation capacity of indigenous SMEs. Second, previous studies fail to provide a comprehensive analysis involving various innovation activities by domestic firms, ranging from innovation inputs (R&D investment, patent investment) to innovation outputs (product innovation and process innovation). Third, research has examined how institutions moderate the effect of FDI spillovers on domestic firms' productivity, not innovation. These studies are mostly confined to China, which hardly represents emerging countries due to its institutional idiosyncrasies. Finally, it is still unclear how institutional impacts on FDI spillovers may vary depending on the heterogeneity in FDI origin, the direction of FDI spillovers, domestic firms' absorptive capacity and different institutional components.

Chapter 3: Institutions, FDI and SMEs in Vietnam

3.1 Introduction

This chapter aims to accentuate the relevance and importance of exploring the research question in Vietnam by providing an overview of the country's institutional background, FDI inflows and SMEs. Section 3.2 delineates the institutional reforms in Vietnam, focusing on the country's transition process, key milestones, and the trajectory of its institutional development. By comparing the country's institutional quality to world standards, the section reveals the improvement of Vietnam's institutions and underdeveloped status. The institutional strengths and weaknesses in Vietnam are also discussed, with an emphasis on the institutional variation across space and time.

Section 3.3 describes the significance of FDI to Vietnam's economy in terms of the amount of capital inflows, the number of projects, and the output. The section explains the attractiveness of Vietnam to foreign investors by discussing FDI policies, economic conditions, and geographical characteristics. Data analysis on the distribution of FDI in different sectors underscores the domination of FDI in manufacturing. Taking a closer look at the heterogeneity of FDI presence in different 2-digit manufacturing industries, the analysis shows that FDI is a major contributor to Vietnam's manufacturing industries with high levels of technological intensity. In addition, the distribution of FDI inflows across provinces and regions is also analyzed, which shows regional patterns in FDI inflows.

Section 3.4 demonstrates the development of SMEs in Vietnam, highlighting their overall contribution to the economy in terms of firm count, employment, GDP and exports. SME's supporting policies and their effectiveness are also discussed. By comparing productivity and profitability between SMEs and large firms, key challenges of SMEs are identified, which hint at SMEs' struggle in the face of increased foreign competition and technological advancement. Finally, Section 3.5 summarises the chapter.

3.2 Institutional Background

Vietnam has undergone a transition from a centrally planned economy to a market economy since the major economic reform, known as *Doi Moi*, in 1986. The milestones were marked by the enactment of the *Enterprise Law* in 1999 and the *Law on Investment* in 2005 to establish the legal framework for privatization. Consequently, the institutional environment has evolved to accommodate the liberalization, privatization, and internationalization process. The unprecedented institutional reform in Vietnam happens step-by-step with a lot of reservation and probation; that is, a national initiative is often implemented in a pilot group of selected provinces and goes through post-intervention assessments before being applied nationwide (Rand & Tarp, 2020). Thus, institutional reform is a gradual hold-and-see process happening at different speeds throughout the country (Tran, 2019).

In addition, during the reform, the central government set out the overall direction, while practical steps were delegated to provincial governments, such as budget spending, action plans and development strategies. As a result, active decentralization of fiscal, administrative and political power has endowed provincial governments with considerable discretion in implementing laws and policies. Most government-business interactions now occur at the provincial level, such as business registration, inspections, government procurement and land permission (Bai et al., 2019). These contribute to substantial variation in institutional quality across provinces, making Vietnam a rich context for empirically examining the relationship between institutions and FDI spillovers. Figure 3.1 depicts the provincial competitiveness index (PCI)[5] for 63 provinces in Vietnam in 2022. PCI is a well-established measure of institutional quality in Vietnam and has been widely used in research (see, e.g., Bai et al., 2019; Nguyen &

[5] More details about the index and the data source can be found in *Subsection 5.2. Data sources*.

Van Dijk, 2012; Tran, 2019). The index ranges from 1 to 10, with higher scores indicating higher institutional quality. As can be seen from Figure 3.1, the PCI score varies among provinces, indicating heterogeneity in the level of institutional development.

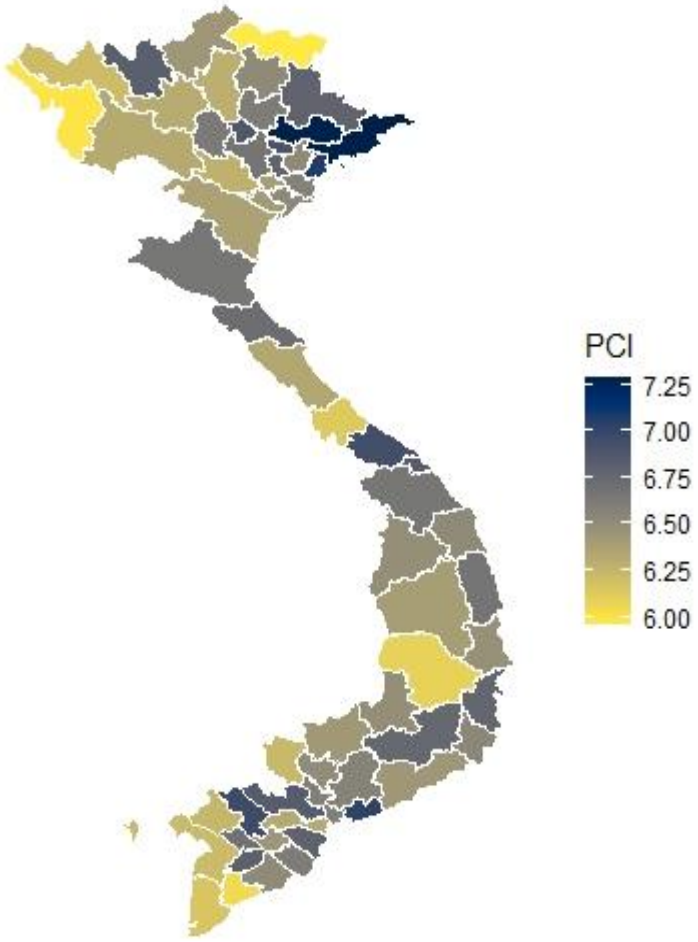

Figure 3.1. Map of mainland Vietnam - Vietnam Provincial Competitiveness Index (PCI) in 2022.
Data source: Vietnam Chamber of Commerce and Industry

More than three decades after the reform, the overall institutional quality in Vietnam remains relatively low, ranked 130th out of 208 countries worldwide according to the Worldwide Governance Indicators (WGI) provided by the World Bank in 2022. The WGI collect survey data on the perception of governance from a diverse group of stakeholders worldwide. The data feature six governance aspects, comprising voice and accountability, political stability and absence of violence/terrorism, governance effectiveness, regulatory quality, rule of law, and control of

corruption. The aggregated WGI score for each country in a given year is calculated by taking the average of all six indicators. Figure 3.2 illustrates the development trajectory of WGI scores for Vietnam compared to the world average and world median from 1996-2022. A conspicuous improvement in the country's overall level of institutional development is observed, which helps the country gradually close the gap with the rest of the world. However, Vietnam remains below the world standard, and there is no immediate evidence that this situation will be altered.

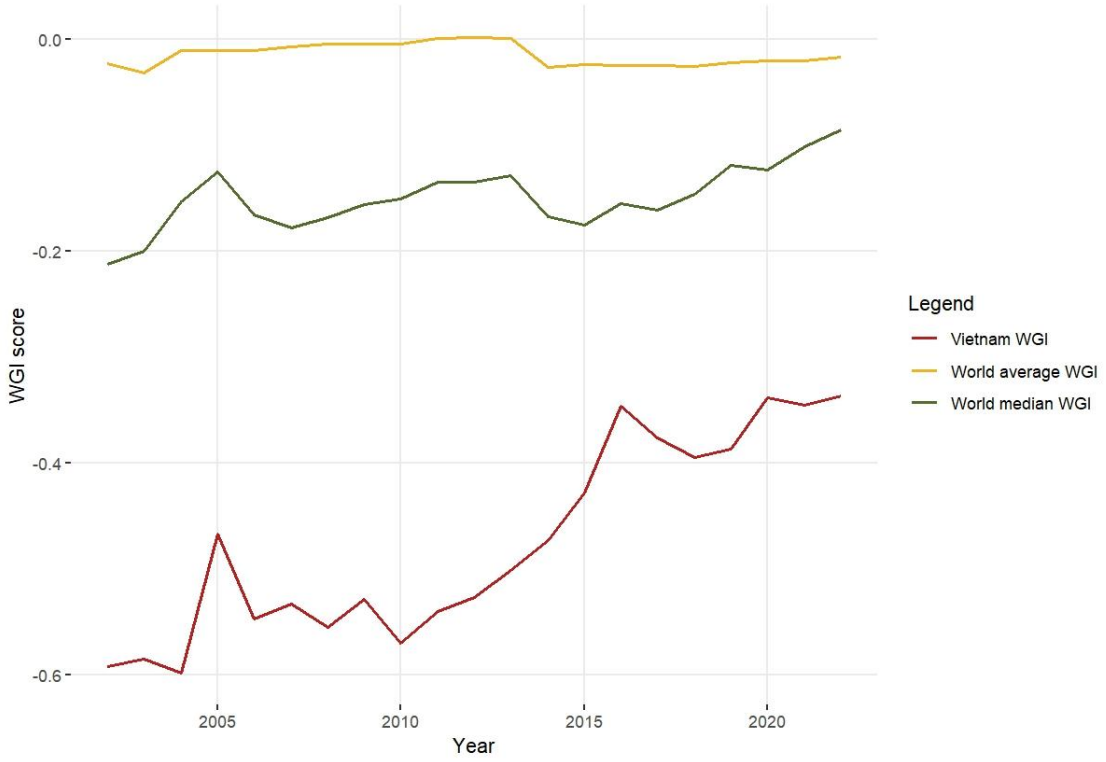

Figure 3.2. Institutional development of Vietnam in comparison to the world average
Data source: The World Governance Indicators

In a recent report on Vietnam's Provincial Competitiveness Index, Malesky et al. (2020) conclude that despite laudable achievements in terms of political stability, low expropriation risks and reduced policy uncertainties, several aspects, including corruption, transparency, public service delivery and regulatory quality, still manifest as institutional bottlenecks for doing business in Vietnam. Figure 3.3 demonstrates the heterogeneity in the development of nine institutional factors in Vietnam by 2022, including entry cost, time cost, land access, transparency, control of corruption, proactivity, business support service, labour training policy, and rule of

law.[6] As can be seen from Figure 3.3, although the government has done well in keeping entry costs low for business establishments, there is plenty of room to improve on other factors, especially the control of corruption and the proactivity of local governments in addressing firms' problems.

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[6] Higher scores indicate higher institutional quality. *Subsection 5.2.3. Institutional Data* provides full definitions and scaling of these indices.

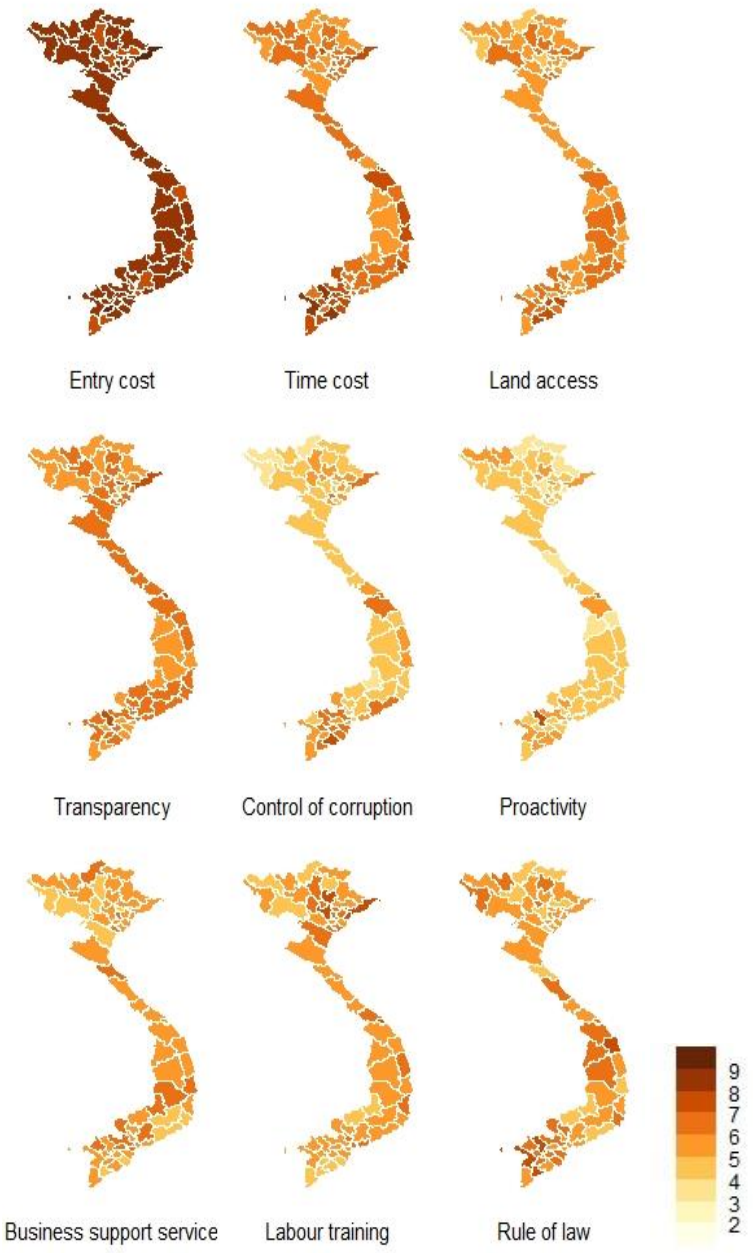

Figure 3.3. Institutional quality sub-indices across provinces in Vietnam in 2022

Data source: Vietnam Chamber of Commerce and Industry

3.3 FDI in Vietnam

Under *Doi Moi*, Vietnam started to attract foreign capital with the promulgation of the *Law on FDI* in 1987, which was later amended in 1990, 1992, 1996 and 2000, thereby establishing a legal framework for the entry and operation of foreign-invested enterprises. Accordingly, many government incentives have been granted to foreign investors, including favourable corporate income tax, exemption and reduction of import and export taxes, easy land access and site

clearance, and investment guarantee measures.[7] The enactment of the *Law on Investment* in 2005 and its later revision in 2014 continue to remove administrative barriers to FDI and discrimination between foreign firms and domestic firms (Huynh et al., 2019). Recently, the government's determination to attract FDI has been documented in Resolution No. 16/2021/QH15 on the socio-economic development plan for 2021-2025 of the National Assembly on 27th July 2021. The proposed target is (*i*) to strengthen the linkages between the domestic economic sector and the foreign-invested sector and (*ii*) to develop policy incentives to attract international investors to large, important projects and to encourage strategic investors and multinational corporations to set up headquarters and innovation and R&D centres in Vietnam. From the foreign investors' perspectives, the key drivers behind FDI inflows include low labour costs, abundant labour

[7] The various incentives and favours given to FDI include:

(1) Tax incentives on the income of foreign investors: Newly established firms are entitled to tax exemption for the first 2 years and 50% reduction for the next 2 years. Firms investing in sectors, industries, and economic regions eligible for investment incentives will enjoy lower tax rates than other projects. In the 2001-2010 period, the State reduced the tax burden by reducing tax rates, simplifying the tax system, and eliminating tax on transferring profits abroad. The tax policy of this period has contributed to remove discrimination between economic sectors, domestic enterprises and FDI enterprises.

(2) Tax incentives on import and export for FDI firms: Since 1991, the country import tax policy has allowed import tax exemption for goods that constitute fixed assets of FDI enterprises, and raw materials imported to process for foreign parties. In the period 1995-2000, the government continued to reform import and export tax to prioritize the import of machinery, equipment, materials and raw materials for production (most import taxes are 0%) rather than consumer goods; to give priority to the export of processed goods (0% tax rate) over goods in the form of raw materials. As of September 2019, Vietnam has participated in negotiating and implementing 17 free trade agreements, allowing FDI firms to receive favourable tax rates on the import of inputs and export of processed goods.

(3) Incentives on land use: the government has introduced regulations on exemption and reduction of land use fees, land rent, water surface rent to improve the investment climate for FDI firms.

supply, a large domestic market, proximity to key regions, convenient shipping routes and a rapidly growing network of Free Trade Agreements (Vichyanond, 2021).

After the economic reform, Vietnam adopted a series of liberalised trade policies that transformed its economy and created a conducive environment for FDI. The government reduced trade barriers, eliminated quotas, and gradually reduced tariffs, aligning with its commitments under international agreements such as the ASEAN Free Trade Area (AFTA) and its accession to the WTO in 2007. These policies fostered greater market openness, encouraged export-oriented growth, and attracted multinational corporations seeking cost-effective production bases. Recent new generation trade agreements, including the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) in January 2019 and the EU-Vietnam Free Trade Agreement (EVFTA) in August 2020, have further enhanced Vietnam's appeal as an FDI destination. Empirical research confirms that trade openness is a significant driver of FDI inflows to Vietnam, especially export-oriented FDI as the foreign firms can tap into larger markets around the world with favourable trade conditions (Lien, 2021). However, challenges such as institutional reforms, trade competitiveness, heavy dependence on traditional markets or market diversification, and access to international standards and practices remain critical for the country to gain long-term benefits from trade agreements (Phuong, 2020).

Developing special economic zones (SEZs) is another notable government policy playing a pivotal role in attracting FDI. Special economic zones refer to both industrial and economic zones.[8] An industrial zone is an area with defined geographical boundaries, specialising in the production of industrial goods and providing services for industrial production. Different types of industrial zones include export processing zones, auxiliary industrial parks, and eco-industrial

[8] The definitions are provided in government decree No.82/2018/NĐ-CP on 22nd May 2028.

parks. Economic zones, including coastal economic zones and border gate economic zones, are areas with defined geographical boundaries, consisting of many functional areas, established to achieve the goals of attracting investment, expediting socio-economic development, and ensuring national defence and security.

SEZs in Vietnam facilitate FDI penetration by offering a favourable business environment characterised by tax incentives, streamlined administrative procedures, and modern infrastructure. These zones, such as the Dung Quat Economic Zone and the Chu Lai Open Economic Zone, are strategically located to leverage Vietnam's proximity to major global trade routes. A survey by Tien and Nuong (2020) shows that most FDI firms in SEZs are relieved from obstacles in government administrative management, tax office management, customs office management, electricity and water services, transportation infrastructure, credit services supply, and supportive government policies. The study also finds that districts with a larger number of SEZs attract more FDI inflows. While SEZs have succeeded in mobilising investment capital for economic development, challenges such as weak linkages among FDI firms in SEZs and local firms, inadequate waterway and seaport transport systems, lack of skilled labour and social services, and security concerns, require careful policy considerations to ensure attraction to FDI (Dzung et al., 2017).

Figure 3.4 shows yearly registered FDI inflows in Vietnam from 2005 to 2022. Yearly registered FDI inflows surged by more than 250% from 6,840 million USD in 2005 to 24,155 in 2015, which continued to increase steadily, reaching 38,951.7 million USD in 2019 (see Figure 3). From 2005 to 2015, the endpoint of the data sample used in the main analysis, the average growth rate of FDI inflows is approximately 13.4% per annum. The average annual FDI growth rate during 2005-2022 is 8.9%. The highest growth rate was observed in 2008, one year after the accession of Vietnam to the World Trade Organisation (WTO).

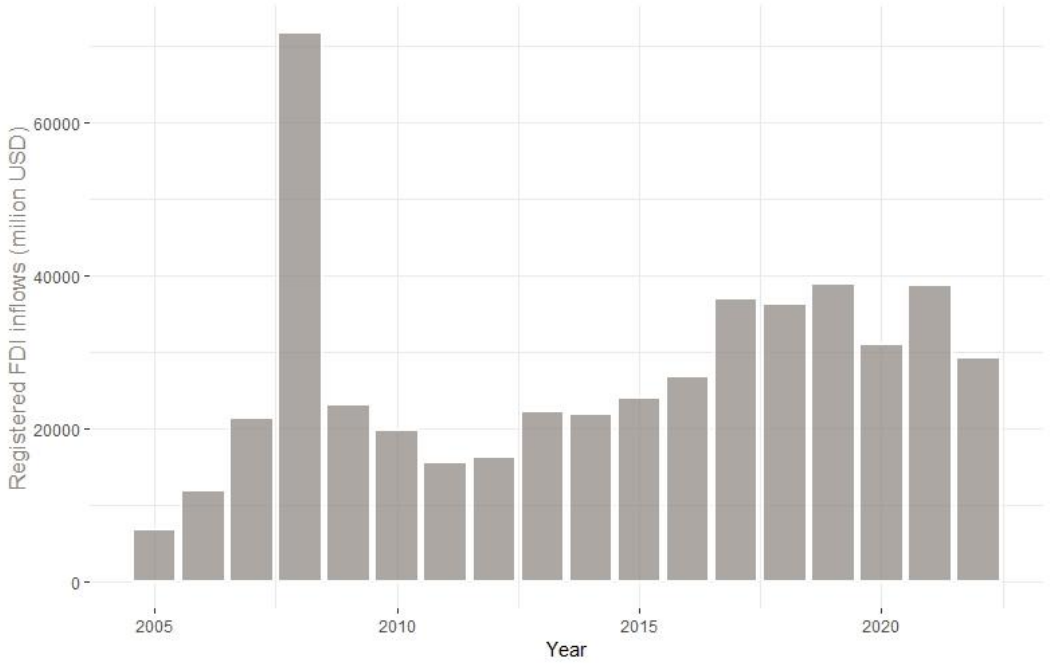

Figure 3.4. Registered FDI inflows in Vietnam 2005-2022.

Data source: General Statistics Office of Vietnam (GSO Vietnam)

Three decades after the economic reform in 1986, the country is now among the top 20 destinations for FDI inflows in the world (UNCTAD, 2021). Figure 3.5 depicts the growth in sales revenue from FDI during 2005-2016. FDI sale revenue grew steadily from 481 trillion VND in 2015 to 4,660 trillion VND in 2016, with an average growth rate of 28.7% per annum. The orange curve shows the share of FDI revenue to the total revenue of all officially registered businesses in Vietnam, which implies the contribution of FDI to the overall output. The output share declined between 2007-2009 during the global financial crisis but then picked up quickly after that, reaching a peak of 26% in 2010. From 2011, the growth in FDI output share stabilized as the figure increased steadily to reach a new high of roughly 30% in 2016. Thus, FDI is playing an increasingly important role in Vietnam's economy.

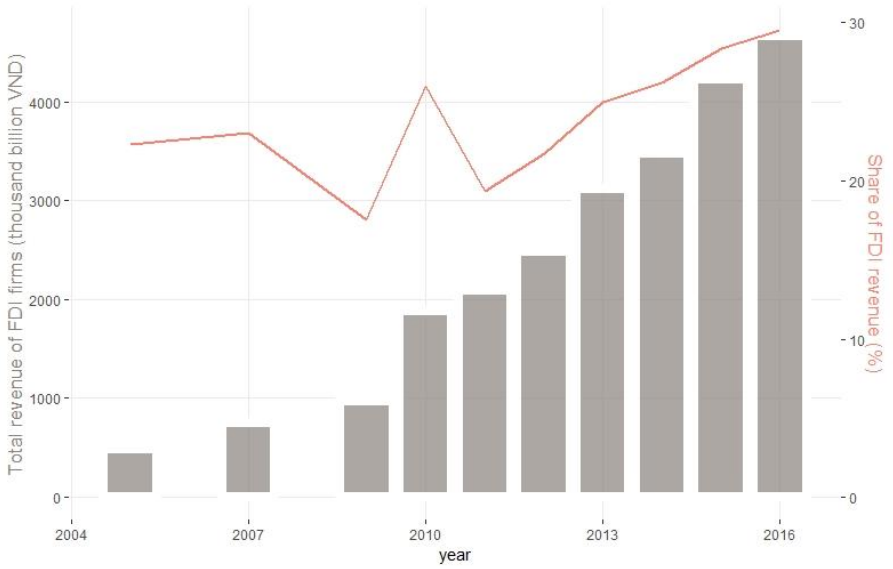

Figure 3.5. FDI generated revenue and its share in Vietnam's economy.

Data source: GSO Vietnam

FDI in Vietnam comes from more than 70 countries and territories. Figure 3.6 describes the spatial distribution of registered FDI flows to Vietnam in 2022. The figure shows that the majority of FDI in Vietnam comes from East Asia, followed by some Southeast Asia countries and the US. Looking at the cumulative numbers, Figure 3.7 lists the cumulative amount of FDI registered capital of the top 10 FDI partners. Accordingly, South Korea, Singapore, Japan, and Taiwan are the largest foreign investors, accounting for about 60% of cumulative registered FDI from viable projects in 2022.[9] The cumulative number of FDI registered projects of the top 10 FDI partners is

[9] Later in the analysis, FDI's home countries are classified into developing countries/countries with high institutional quality and developed countries/countries with low institutional quality to examine how the moderating effect of institutions may be contingent upon FDI origins. It is possible that the data may not reflect the true origin of FDI, as some MNEs may locate their production or operations to tax heaven countries before investing abroad to benefit from low tax liabilities. Since it is very hard to trace back the true FDI origins given the current data, I follow the FDI literature and proceed with the classification which still gives us a rough idea of the FDI origin. The results (in *Subsection 6.5.1* and *Subsection 7.4.1*) should, therefore, be interpreted with that in mind.

presented in Figure 3.8. The ranking almost overlaps what is shown in Figure 3.7, except that China joins the top 3 in place of Singapore.

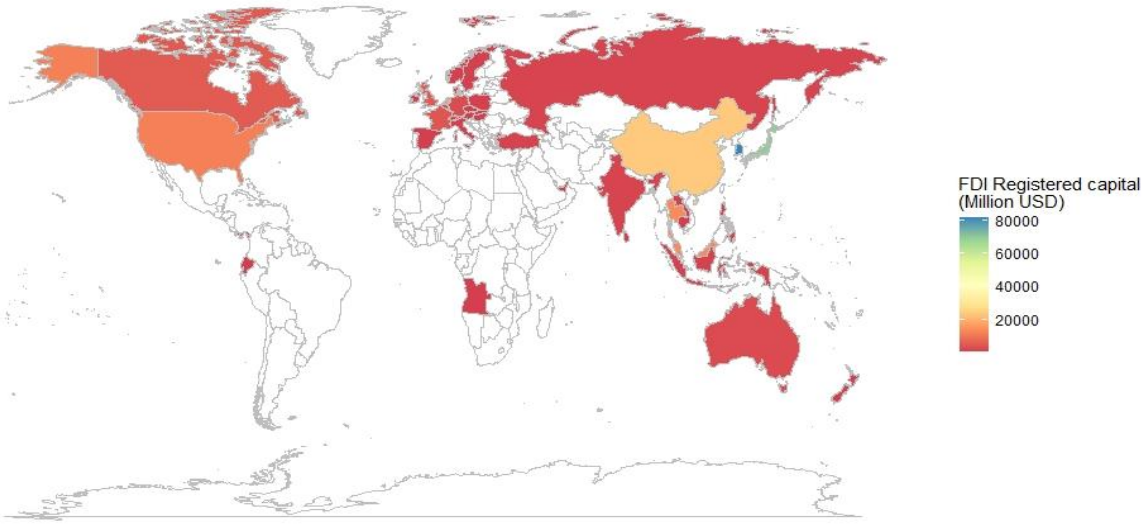

Figure 3.6. FDI origin in Vietnam in 2022.

Data source: GSO Vietnam

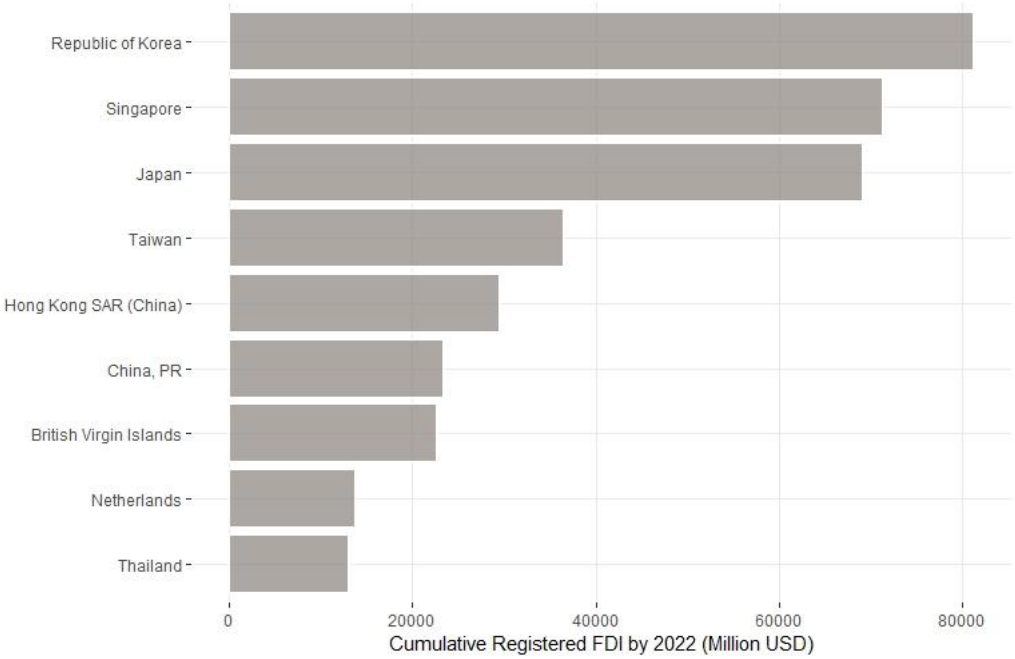

Figure 3.7. Top 10 foreign investors in Vietnam regarding cumulative FDI inflows by 2022

Data source: GSO Vietnam

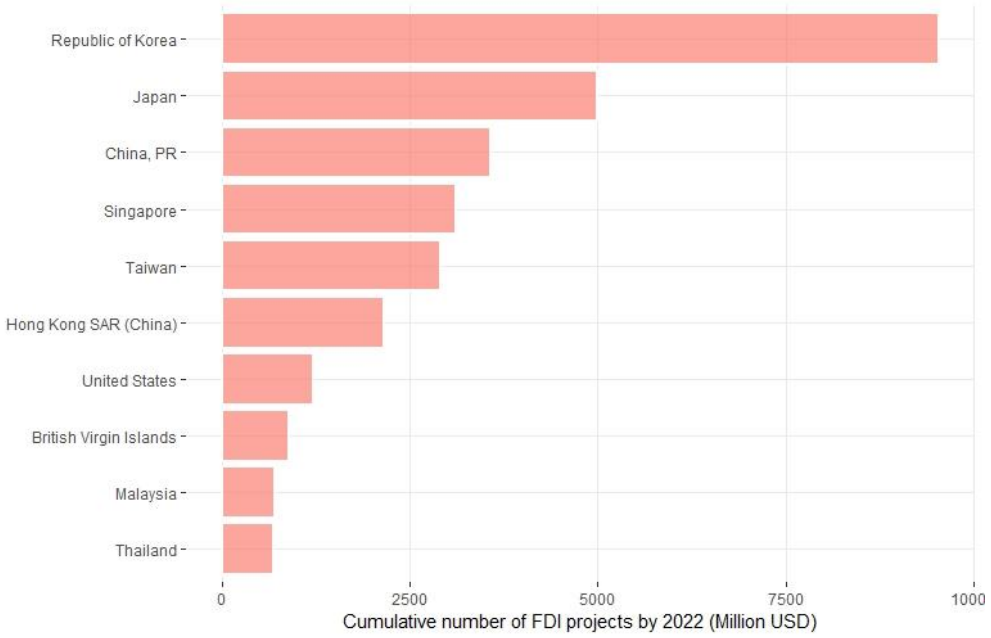

Figure 3.8. Top 10 foreign investors in Vietnam regarding the cumulative number of FDI projects by 2022

Data source: GSO Vietnam

It is important to look at the distribution of FDI inflow by industries, which is demonstrated in Figure 3.9. Specifically, the pie chart shows the proportions of cumulative FDI projects by 2022 in Vietnam. As can be seen, manufacturing attracts the largest proportion of FDI projects, at 44%. FDI from service sectors, comprising wholesale and retail, professional scientific and technical activities, and information and communication, accounts for a more modest proportion at 35%. The domination of FDI in manufacturing industries becomes more conspicuous when considering the amount of capital. The shares of accumulated FDI registered capital by industries in Vietnam in 2022 are presented in Figure 3.10. The amount of accumulated FDI registered capital in manufacturing is 261.432 million USD, accounting for 59% of the total FDI inflows in all industries.

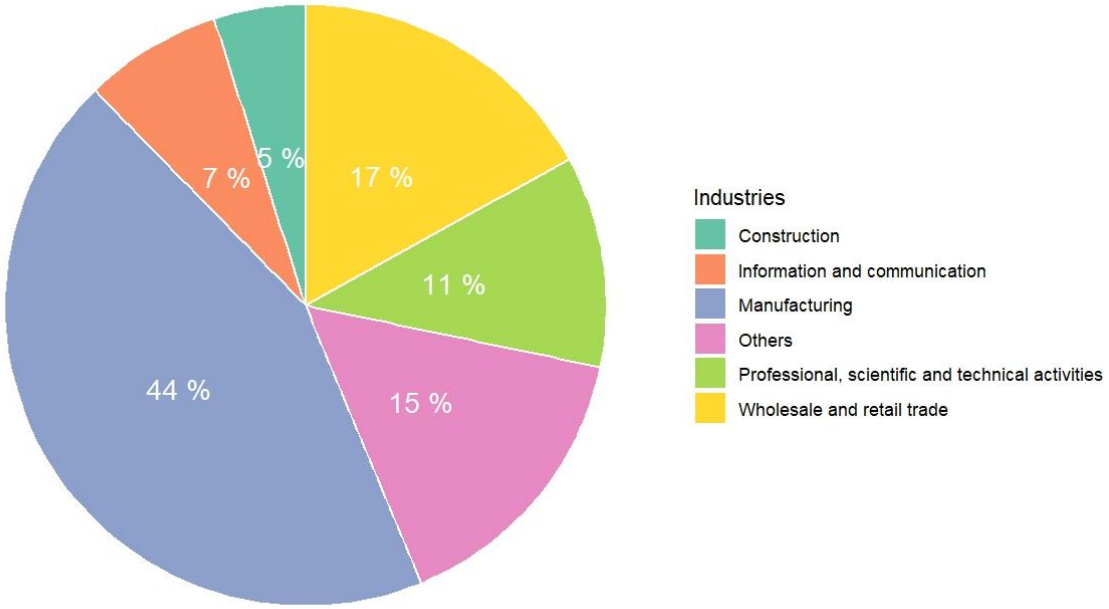

Figure 3.9. Number of accumulated FDI projects in Vietnam by 2022, shares by industry.

Data source: GSO

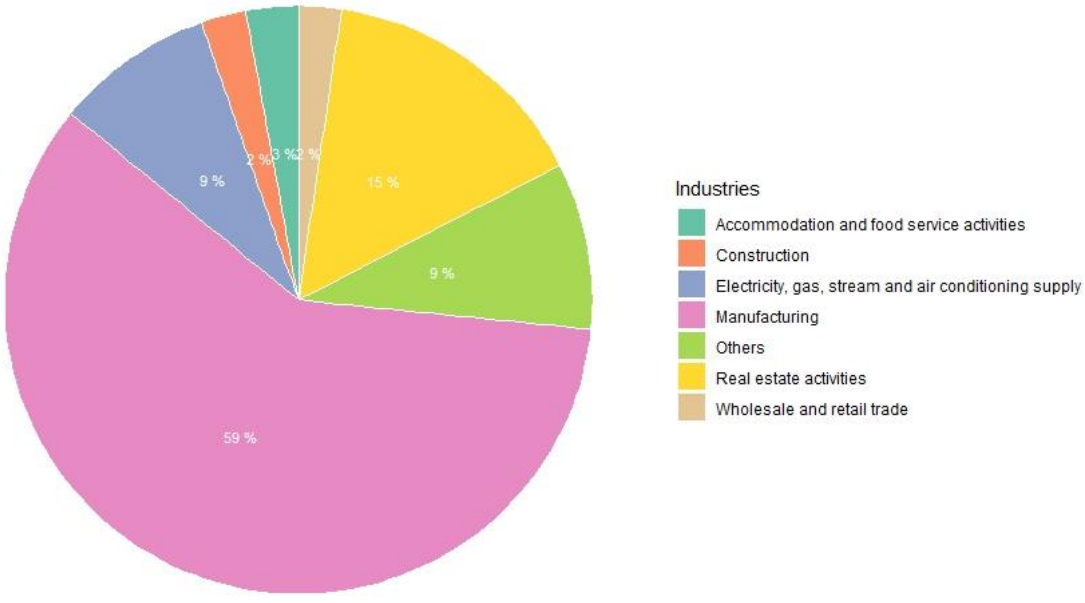

Figure 3.10. Accumulated FDI registered capital in Vietnam by 2022, shares by industry.

Data source: GSO

Looking closely at FDI presence in manufacturing industries,

Table 3.1 reports the amounts of output generated by FDI firms and their output shares in each 2-digit manufacturing industry in 2016.[10] The first two columns in Table 3.1 list all 2-digit manufacturing industries based on the 2017 Vietnam Standard Industry Classification (2017). As shown in the third column, FDI firms in Computer, electronic and optical products generated the largest output, making up 40.4% of all FDI output in manufacturing. The rest of the industries account for modest shares, of which the bigger ones include Food products, at 7%; Leather and related products, at 6.6%; Motor vehicles, trailers and semitrailers, at 4.6%.

FDI output shares tell us about the presence of FDI firms in each industry. FDI plays a dominant role in Computer, electronic and optical products and Leather and related products, accounting for over 80% of the total industries' output. Sectors where the majority of output comes from FDI firms include Motor vehicles, trailers and semitrailers; Machinery and equipment; Textiles; Electrical equipment; Wearing apparel; Furniture; and Chemicals and chemical products. Most of the aforementioned industries are in the medium- and high-tech sectors,[11] implying that FDI is the major contributor to the industries with higher levels of technological intensity in Vietnam.

[10] The latest micro data on FDI firms that are accessible is in 2016.

[11] The classification of low-tech, medium-tech and high-tech industries is provided in Table A2 of the Appendix.

Table 3.1. FDI presence in 2-digit manufacturing industries in 2016

2-digit code	Industries	FDI output (Trillion VND)	FDI output share
10	Food products	268.00	0.271
11	Beverages	58.20	0.428
12	Tobacco product	8.36	0.236
13	Textiles	164.00	0.662
14	Wearing apparel	159.00	0.540
15	Leather and related products	251.00	0.855
16	Wood and products of wood and cork, except furniture	15.00	0.148
17	Paper and paper products	48.90	0.384
18	Printing and reproduction of recorded media	7.50	0.173
19	Coke and refined petroleum products	6.76	0.074
20	Chemicals and chemical products	141.00	0.534
21	Pharmaceuticals, medicinal chemical and botanical products	14.20	0.223
22	Rubber and plastic products	132.00	0.472
23	Non-metallic mineral products	65.70	0.236
24	Basic metals	119.00	0.393
25	Fabricated metal products, except machinery and equipment	121.00	0.386
26	Computer, electronic and optical products	1540.00	0.990
27	Electrical equipment	135.00	0.617
28	Machinery and equipment	51.10	0.672
29	Motor vehicles, trailers and semitrailers	174.00	0.696
30	Other transport equipment	179.00	0.818
31	Furniture	88.50	0.537
32	Other manufacturing	56.50	0.802
33	Repair and installation of machinery and equipment	4.89	0.200

Note. *Data source: GSO Vietnam*

Regarding the geographical distribution of FDI, Figure 3.11 presents a map chart of accumulated FDI registered capital by region and province in Vietnam in 2022.[12] Specifically, the left graph displays the distribution of FDI inflows across six regions in the country, including Northern Midlands and Mountains, Red River Delta, North and Central Coast, Central Highlands, South East and Mekong River Delta, while the right one breaks that down to provincial level. The two graphs illustrate that FDI inflows vary across provinces and exhibit a regional pattern. To complement the map chart, Table 3.2 reports the number of FDI projects and the amount of FDI registered capital for each region. South East attracts the largest FDI inflows, accounting for 40.6% of the national figure. In the region, FDI concentrates in Ho Chi Minh City – the largest city in Vietnam, Binh Duong, Dong Nai and Ba Ria - Vung Tau. The second largest FDI destination is Red River Delta, which attracts 30.3% of the national FDI inflows, where the majority of FDI flows into Ha Noi, Hai Phong, and Bac Ninh. These provinces are advantageous in attracting FDI owing to their population density (especially Ho Chi Minh City and Ha Noi), large industrial zones, and commercial ports.

[12] Vietnam consists of 63 provinces, which are the major administrative units at the local levels. These provinces are grouped into 6 regions, including Northen Midlands and Mountains, Red River Delta, North and Central Coast, Central Highlands, South East and Mekong River Delta based on similarities in geographical and social-economic characteristics.

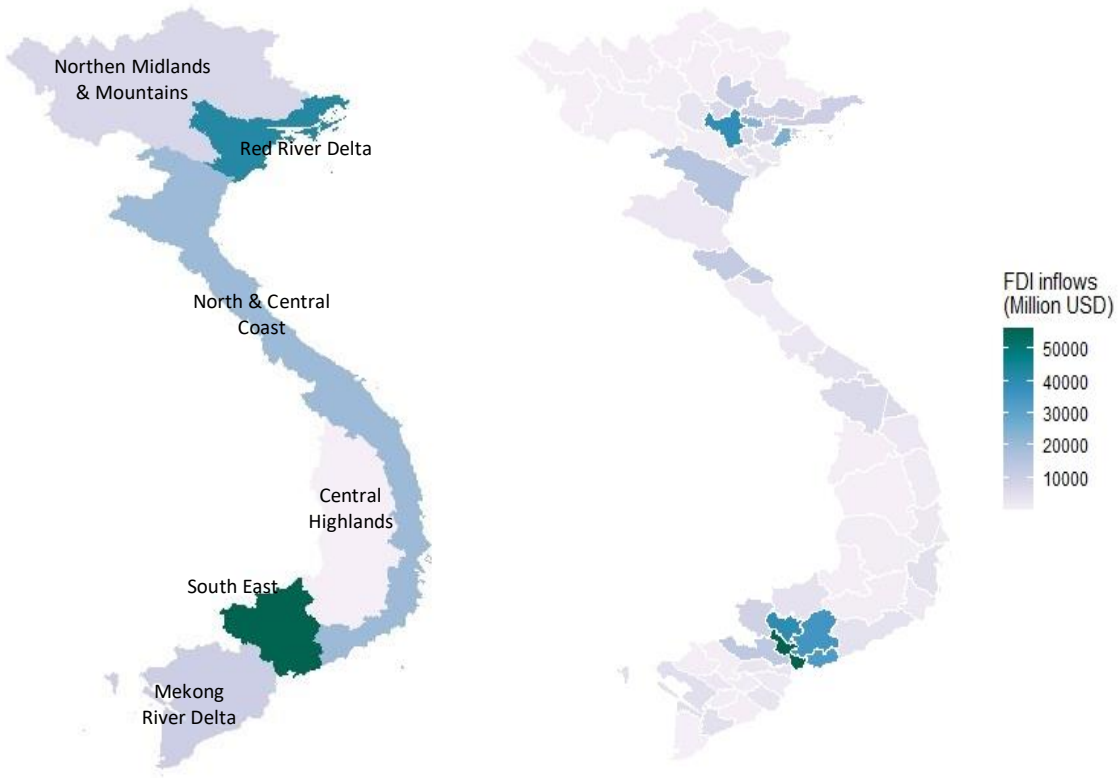

Figure 3.11. Cumulative FDI registered capital in Vietnam by region and province in 2022.

Data source: GSO

Table 3.2. FDI inflows by regions in 2022

Regions	Number of projects	Total registered capital (million USD)
Northern Midlands and Mountains	1,223.00	25,408.37
Red River Delta	12,217.00	132,841.54
North and Central Coast	2,266.00	65,149.16
Central Highlands	166.00	1,811.24
South East	18,547.00	177,752.89
Mekong River Delta	1,876.00	34,803.20

Source: GSO Vietnam

3.4 SMEs in Vietnam

The liberalization and privatization processes in Vietnam have resulted in a rapid growth of the country's private sector, most of which are SMEs, accounting for 97% of the total number of enterprises. SMEs play an important role in Vietnam's economy, contributing to approximately 40% of labour hiring, 40% of the total GDP, 30% of the public budget, and 33% of industrial

outputs (Nam & Bao Tram, 2021). In addition, 88% of the country's exporters are SMEs, producing half of the export volume (OECD, 2021).

The government issued decrees to support SME development in 2001,[13] 2009,[14] and most recently, the *Law on Supporting SMEs,* which took effect in early 2018. These policies provide preferential treatment for SMEs on various aspects, including finance and credit support, tax incentives, simplified accounting regimes, reduced land rents, technology support, human resources development through training courses, information and consulting services, and market promotion. Although well-intended, these measures are not effective in practice, with limited SMEs' access to support, probably due to complicated administrative procedures in applying for support and the incapability of provincial governments to implement these policies (OECD, 2021). Vietnamese SMEs perform poorly in innovation as R&D investment is limited, and most innovations are incremental by making slight modifications to existing products (OECD, 2021). While Vietnam has succeeded in attracting FDI, SMEs often fail to form linkages with MNEs and benefit from FDI spillovers due to technical inefficiencies, inadequate labour skills, and insufficient managerial expertise (Asya et al., 2017).

Based on firm size, there are four categories: micro firms having up to 10 employees, small firms with from 11 up to 50 employees, medium firms with from 51 up to 300 employees and large firms with more than 300 employees (CIEM et al., 2015). The first three categories constitute the group of SMEs. Figure 3.12 demonstrates the average shares of the number of enterprises, employment, and revenue by firm size during the five-year period of 2016-2020. Regarding the number of enterprises, SMEs made up the vast majority of the firm count in Vietnam, at 97.3%, and the rest, 2.3%, were large firms. Within the group of SMEs, micro-

[13] Decree No.90/2001/ND-CP on 23 November 2011.
[14] Decree No.56/2009/ND-CP on 30 June 2009.

enterprises accounted for the largest proportion at 66% of the total number of enterprises, followed by small enterprises at 27.8% and medium enterprises at merely 3.5%. The number of micro-enterprises during 2016-2020 grew the fastest, with an increase of 70.1% compared to the average figure in 2011-2015. The number of small enterprises and medium enterprises increased by 42.2% and 54.6%, respectively, during the two periods. The growth rate of the number of large firms in 2016-2020 compared to the previous period of 2011-2015 was the most modest, at 40.2%.

During 2016-2020, large firms, even with a low count, were the most prominent employment creators, accounting for 62.5% of national employment. SMEs hired 37.5% of the labour force, among which employment in micro-enterprises constituted 9.8%, and the employment shares of small enterprises and medium enterprises were 18.4% and 9.3%, respectively. According to the Ministry of Planning and Investment (2022), between 2016 and 2020, micro-enterprises generated 1.5 million jobs on a yearly average, an increase of 46.8% compared to the previous period of 2011-2015. Small enterprises hired 2.6 million workers, with an increase of 11.4%, and medium enterprises hired 1.4 million workers, with an increase of 14.2%. Large firms created the largest number of jobs at 9.1 million, an increase of 29.6% compared to the previous period of 2011-2015. Thus, between 2011-2015, micro-enterprises witnessed the largest employment growth rate, contributing to the rapid expansion of the SME sector.

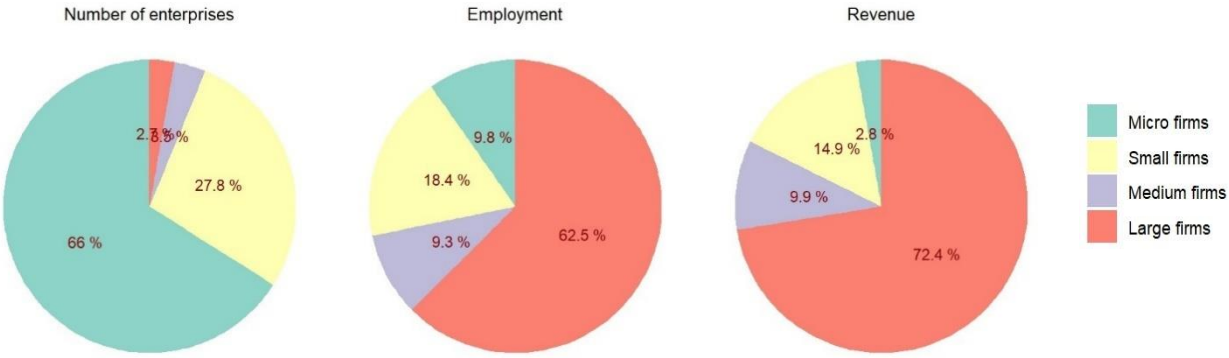

Figure 3.12. Shares of the number of enterprises, employment, and revenue by firm size, average during 2016-2020.

Data source: Ministry of Planning and Investment (2022)

The revenues generated by SMEs were modest compared to large firms and were not proportional to their employment. During 2016-2020, on average, SMEs made up only 27.6% of total output, which was smaller than their employment share of 37.5%. Large firms contributed 72.4% of the total output. As documented by the Ministry of Planning and Investment (2022), on a yearly average during 2016-2020, large firms generated 16.7 quadrillion Vietnamese Dong (VND) of revenue, a remarkable increase of 95.9% compared to 2011-2015. Medium firms generated an average of 2.3 quadrillion VND of revenue per year, also a considerable growth of 94.2% from the previous period. The annual average revenue of small enterprises was 3.4 quadrillion VND, and that of micro enterprises was 651 trillion VND. The increases in revenue of small enterprises and micro enterprises were roughly the same at approximately 50%, which was much more modest compared to the revenue growth rates of large and medium firms.

Based on the figures for firm count, employment, and revenue, one can conclude that the presence of SMEs in Vietnam's economy is significant. SMEs have been proliferating in terms of the number of entities and employment, which is at a faster pace than their large counterpart. SMEs' employment share is greater than their output share, implying lower labour productivity than large firms. Among SMEs, micro-enterprises account for the majority of entities. Micro-enterprises had the fastest employment growth but the lowest revenue growth, suggesting a decline in labour productivity.

Profitability is an important indicator of firm performance. Figure 3.13 demonstrates the percentages of profitable firms by firm size in Vietnam from 2017 to 2020. Large firms outperformed all SMEs during the period but experienced a reduction in the percentage of profitable firms from 79.8% in 2017 to 74.4% in 2020. Medium firms had the largest proportion of profitable firms among the group of SMEs, at 76.3% in 2017, which then declined slightly to 73.4% in 2020. Throughout the period, small enterprises performed slightly worse, with 63.2% of profitable firms in 2017, which remained stable. Small enterprises had the lowest percentage of profitable firms, which reduced from 34.8% in 2017 to 28.6% in 2020.

According to the Ministry of Planning and Investment (2022), on a yearly average during 2016-2020, large firms made a profit before tax of 882.4 trillion VND, which increased by 92.2% compared to 2011-2015. The yearly average profit of medium enterprises was 30.2 trillion VND, a considerable increase of 88.9% compared to the previous period. On the contrary, both small and micro enterprises made losses of 122 trillion VND and 46.9 trillion VND, respectively, during 2016-2020.

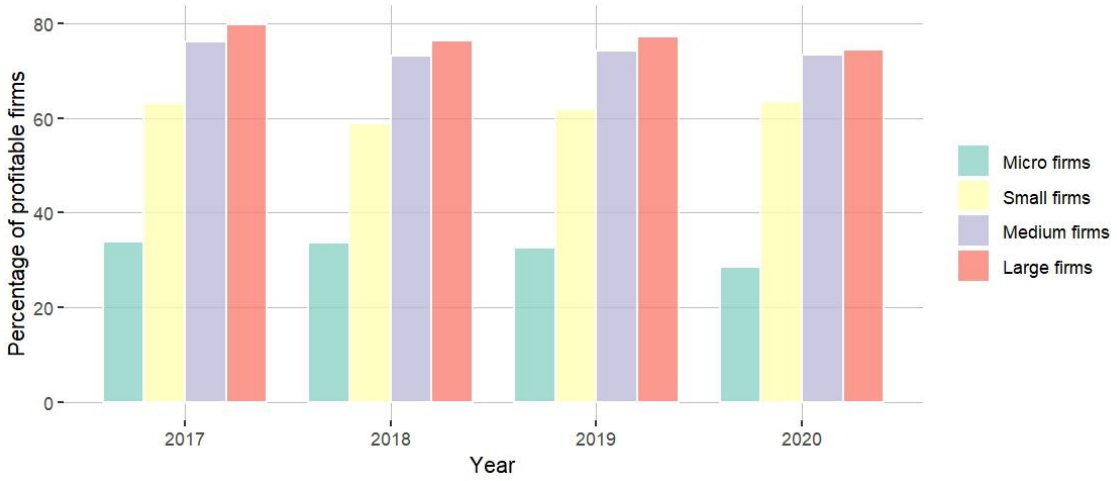

Figure 3.13. Percentage of profitable firms by firm size in Vietnam from 2017-2020

Data source: Ministry of Planning and Investment (2022)

Figure 3.14 presents the return on assets (ROA) by firm size in Vietnam from 2017 to 2020. Large firms were the most profitable throughout the period, with a ROA of 3.5 in 2017, but that figure continuously fell to 3.1 in 2020. Medium enterprises were less profitable than their large counterparts, and their ROA decreased slightly from 1.5 to 1 between 2017 and 2020. On the

other hand, small enterprises and micro enterprises both experienced losses, indicated by negative ROA. ROA of small enterprises mostly settled at -0.1 during the period. The performance of micro-enterprises was the worst but showed modest improvement as their ROA rose from -1.7 in 2017 to -0.7 in 2020.

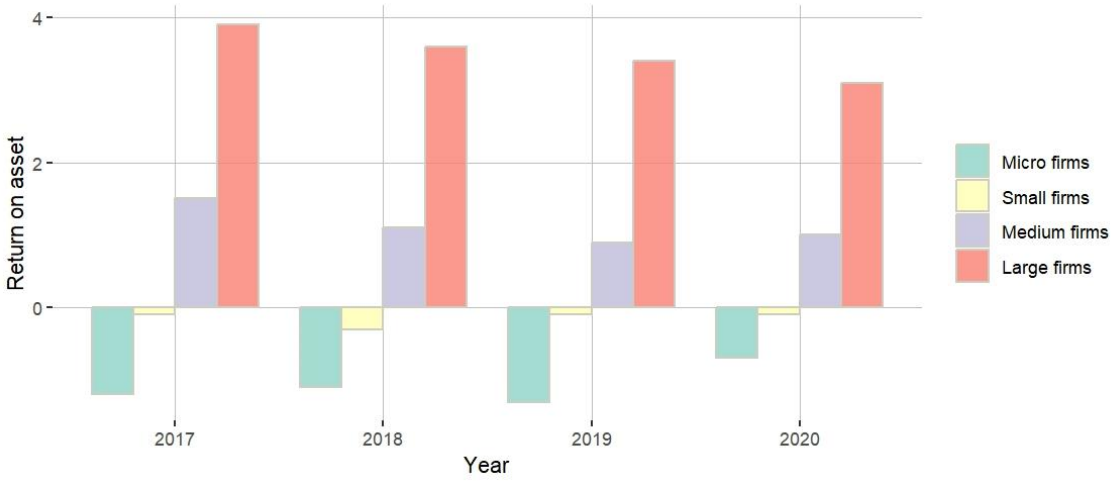

Figure 3.14. ROA by firm size in Vietnam from 2017-2020.
Data source: Ministry of Planning and Investment (2022)

3.5 Summary

In summary, institutions, FDI inflows and SMEs have evolved together to shape the transition dynamic of Vietnam following the major economic reform (*'Doi Moi'*) in 1986. During the institutional transformation from a centrally planned economy to a market economy, the enactment of key laws comprising the *Enterprises Law* and the *Law on Investment* laid the legal framework for privatization and liberalization. Consequently, the institutional environment has been rendered more conducive to the development of the private sector owing to political stability, improved policy certainty, low expropriation risks and low entry costs for new businesses. Despite the progress, persistent challenges in institutional aspects such as corruption, lack of transparency, regulatory quality, public service delivery and policy implementation capability impede business operations and hinder Vietnam's global integration. Institutional quality measured by the Worldwide Governance Indicators shows improvement, but Vietnam still lags behind global standards. Notably, the country's institutional evolution has been marked by cautious experimentation and decentralization. This process results in significant variation in

institutional quality across provinces and time, making Vietnam a rich context for exploring institutional impacts.

The attraction of Vietnam to foreign investors is evident in the country's robust FDI inflows, which are supported by favourable government policies and economic incentives. Since the major economic reform, Vietnam has emerged as a top destination for FDI, mainly from East Asian partners, including South Korea, Japan, and Taiwan. FDI plays an increasingly important role in the national economy, recently accounting for almost a third of total output. The manufacturing sector attracts a prominent share of FDI inflows, significantly contributing to medium- and high-tech industries. This suggests that FDI has been pivotal for technological advancement in Vietnam. Moreover, FDI presence exhibits heterogeneity across provinces while following a conspicuous regional pattern. South East and Red River Delta, with the presence of major cities and geographical advantages, obtain the largest FDI inflows.

The institutional transition also manifests via the rapid expansion of the domestic private sector, where SMEs account for the vast majority of entities and exert nontrivial contribution to employment, output and exports. Government policies supporting the development of SMEs have been introduced, but they suffer from administrative inefficiencies and implementation incapability. As a result, SMEs continued encountering problems such as limited access to support schemes, low levels of innovation, and inadequate linkages with foreign firms. In addition, SMEs' productivity and profitability are generally low compared to large firms and vary across size categories. Specifically, SMEs' output share is smaller than their labour share, implying lower labour productivity than large firms. Micro and small enterprises experience low levels of revenue growth and struggle to achieve positive returns as opposed to large firms whose output expands quickly and high profitability is maintained. Medium enterprises performed marginally better than micro and small enterprises with positive profits but performed poorly compared to large firms. Given that the majority of SMEs are of micro and small size, the poor performance of these two groups emphasises the need for government policies to enhance SMEs' competitiveness,

particularly in light of increasing foreign competition and rapid technological advancements brought on by FDI.

In conclusion, Vietnam's economic landscape is shaped by a complex interplay of institutional dynamics, FDI inflows, and SME development. While significant progress has been made since the *Doi Moi* reform, persistent challenges remain characterised by the struggle of SMEs to stay productive and profitable. The increased presence of FDI reinforced by FDI-attracting policies necessitates continuous policy interventions to take advantage of FDI-positive spillovers while mitigating the negative crowding-out effect on domestic firms, especially the group of SMEs.

Chapter 4: Conceptual Framework and Research Method

4.1 Introduction

This chapter presents the conceptual framework and research method used in this thesis. Section 4.2 outlines the conceptual framework consisting of three main hypotheses. The first hypothesis concerns the likely impact of FDI presence on the innovation performance of domestic SMEs, given SMEs' low absorptive capacity. The second hypothesis refers to the mechanisms via which institutions may moderate the nexus between FDI and domestic SMEs' innovation. The third hypothesis relates to the institutional moderating effect being contingent upon FDI origin, that is, the level of institutional and economic development of MNEs' home countries.

Section 4.3 specifies the econometric models. *Subsection 4.3.1* models the impacts of FDI presence and the institutional moderating effect on R&D investment of domestic SMEs. *Subsection 4.3.2* involves modelling FDI impact and the institutional moderating effect on product and process innovations of domestic SMEs. *Subsection 4.3.3* advances the modelling for the intensive margin of product innovation by constructing a theoretical model to explain the channels through which FDI and institutions interact to influence the number of new products/improved products introduced by domestic SMEs. Next, guided by the theoretical model, econometric models are specified to estimate the parameters in each channel.

Section 4.4 presents the estimation strategy by first acknowledging the potential endogeneity issues of the key explanatory variables, including FDI presence, the institutional measure and their interaction term. Next, the instrumental variable (IV) approach to address endogeneity is presented, followed by the discussion of appropriate estimation techniques. In addition, several diagnostic tests are employed to ensure the relevance and validity of the adopted IVs. Finally, Section 4.5 summarises the chapter.

4.2 Conceptual framework

4.2.1 FDI Presence and Innovation of Domestic SMEs

Prior studies focus on large firms and offer little evidence on how FDI may influence the innovation of indigenous SMEs. Arguably, not every domestic firm can reap the same benefit from foreign technologies since the extent of FDI technological spillovers largely depends on their absorptive capacity (Liu & Buck, 2007). Incumbent firms need to possess some related knowledge, familiarity with technology in the field, and a pool of highly skilled workers in order to recognise, decode and assimilate the technologies from their foreign counterparts (Cohen & Levinthal, 1990; Liang, 2017; Lin et al., 2009). In the case of SMEs, they may suffer from various barriers to innovation, such as the lack of financial resources, skilled labour, managerial expertise, technical experts, technological assets, and technical information (Madrid-Guijarro et al., 2009; Xie et al., 2010). These inherent demerits suggest the low absorptive capacity of SMEs to foreign technologies, i.e., SMEs are less capable of improving their innovation capacity under FDI presence.

In addition, foreign competition may only promote the innovation effort of firms already close to the technological frontier, not those lagging (Aghion et al., 2005; Khachoo et al., 2018). Aghion et al. (2005) argue that when firms are far from the technological frontier, market competition will reduce their post-innovation rents as innovation can no longer help them overcome competition. In the model of R&D competition developed by Matsubara (2005), the entry of foreign-invested firms can positively affect the R&D spending of domestic firms only when the domestic firms have a large enough initial marginal cost advantage; otherwise, the effect is negative. This is because domestic firms with already superior technologies may want to invest more in R&D to maintain their monopoly rents, while for the laggards, the returns on R&D are smaller. Since SMEs in developing countries often have lower productivity compared to their

foreign counterparts,[15] it is reasonable to expect that the effect of foreign competition on SMEs' innovation is negligible.

Finally, SMEs may endure adverse crowding-out effects from FDI entry that reduce their resources for engaging in innovative activities. Specifically, horizontal FDI firms might compete with the less efficient domestic counterparts for market share and put downward pressure on prices (Liu & Buck, 2007). The FDI firms' ability to pay higher wages may attract the highly skilled workers available in the labour market, leading to a depletion of potential human resources for domestic firms (Spencer, 2008). Competition may also occur in the financial market when foreign investors use their strong reputations to compete for bank loans (Qu & Wei, 2017). These crowding-out effects are particularly deleterious for SMEs since their lack of economies of scale often exacerbates the financial burden associated with innovation (Cohen & Klepper, 1996a; Rammer et al., 2009b).

The negative FDI crowding-out effects may also manifest via vertical channels when FDI firms use market power to raise input prices for local buyers or to appropriate the expected profits of local suppliers (Newman et al., 2015). This can reduce the profitability of domestic SMEs with lower market power, thereby restraining their financial resource to invest in R&D. In addition, foreign firms in downstream industries can import intermediate inputs and substitute local suppliers in the host economy (Liu & Buck, 2007; Newman et al., 2015). Particularly, MNEs with technology-intensive products prefer suppliers who can meet high standards on quality, cost, and delivery (Ni et al., 2017). Therefore, domestic SMEs with low technical capacity are less likely

[15] In the survey of Vietnamese SMEs employed in this study, more than 80% of SMEs have lower productivity compared to foreign-invested firms in the same industries.

to be chosen as the suppliers of FDI firms and consequently suffer from the crowding-out effect in the supply market.

Therefore, FDI presence can negate domestic SMEs' innovation efforts due to SMEs' low absorptive capacity, substitution effect and negative crowding-out effects. Thus, I hypothesise that:

Hypothesis 1: FDI presence exerts a negative impact on the innovation of domestic SMEs.

4.2.2 Institutions and FDI Innovation Spillovers

Institutions are generally referred to as the sets of rules governing the behaviours of individuals and organisations (Lin & Nugent, 1995; North, 1990). By imposing constraints on which actions are acceptable and supportable given certain circumstances, institutions influence individuals' and organisations' decision-making processes (Ahlstrom & Bruton, 2002; Bruton et al., 2005; Peng & Heath, 1996) and shape how they interact with each other (Aldrich & Fiol, 1994). Economists generally classify institutions into two components, namely formal and informal institutions (Williamson, 2000). Formal institutions consist of explicitly expressed rules and regulations that are formally accepted, often in the form of writing (Tonoyan et al., 2010). These rules include, for example, the constitution, government laws, the legal framework and its enforcement, property rights, and economic contracts (Lin & Nugent, 1995; Meyer et al., 2009). The informal component of institutions, on the other hand, is tacit and often unwritten, but deeply embedded in the functioning of a society. It consists of traditions, customs, shared values, social norms, ethics, ideologies and other unwritten codes of conduct (Baumol, 1996; Denzau & North, 2000; North, 1990), which evolve over time, passing from one generation to the next through diverse informal channels, such as observation, word of mouth and oral teaching (Tonoyan et al., 2010).

Economists have widely recognised institutions as a critical factor in explaining economic development and the disparities in economic performance across countries (Peng, 2000). Since institutions constitute the "*rules of the game*" in a market economy, imposing constraints on the

behaviours of economic agents while creating a structure for their interactions; institutions can either facilitate or impede market functioning (Meyer, 2001). Williamson (1985), North (1990) and Peng (2011) propose the crucial role of institutions in reducing uncertainties and undue transaction costs for firms and individuals, thereby enhancing the effectiveness of the free market mechanism. Meyer et al. (2009) further reinforce this point and define strong institutions as consisting of an effective legal framework and its enforcement, property rights, information systems, and regulatory regimes that support voluntary exchange in a market economy. In contrast, a weak institutional arrangement not only fails to promote market functioning but further dampens market functioning when, for example, corruption and red tape are prevalent.

Institutions can impact FDI technological spillovers in several ways, namely through promoting the foreign investors' incentive and ability to create technological spillovers, mitigating FDI crowding-out effects, enhancing domestic firms' absorptive capacity, and facilitating interaction and knowledge sharing in the local business environment.

First, highly developed institutions may facilitate FDI spillovers in the local market by promoting the foreign investors' incentive and ability to create technological spillovers. FDI firms often consider better institutional environments as a guarantee to efficiently exploit their ownership advantages and maximize profits (Meyer & Nguyen, 2005). They are, therefore, encouraged to bring better technology to the host economy, incorporate more technology-intensive assets and undertake R&D investment and innovation projects locally, leading to a higher possibility of spillovers (Gorodnichenko et al., 2014; Smarzynska, 2002). In addition, institutional development, such as strong law enforcement, transparency, low regulatory burden, adequate government support, equal access to finance, and better control of corruption, can enhance foreign entrants' productivity and innovation capacity (Yi et al., 2015). This effect subsequently enables them to expand their innovative activities in the host economy by setting up R&D centres and pursuing technology-intensive projects, which ultimately generate more positive externalities (Chen et al., 2007; Wang et al., 2013). It is expected that the more

technological spillovers are generated, the higher the chance that SMEs (even though restrained by low absorptive capacity) can absorb some of these to improve their innovation performance.

Second, it has been consistently suggested that FDI entering with the purpose of exploiting local resources and strategic assets, such as cheap labour, preferential trade agreements, or tax incentives is most likely to exert negative crowding-out effects (see, e.g. Hong et al., 2019; Ito et al., 2012). Under more developed institutions, FDI firms are encouraged to pursue the exploitation of their specific advantage rather than relying heavily on a resource-seeking strategy. This reduces the negative crowding-out effects of FDI on domestic SMEs, making FDI presence less detrimental to their innovation resources.

Third, for domestic firms as the recipients of FDI technological spillovers, strong institutions can enhance their absorptive capacity of foreign technologies and reduce transaction costs to facilitate the learning process, value creation, labour movement and the acquisition of human resources (Krammer, 2015; Yi et al., 2015). Strong institutions are particularly important for SMEs since they are more vulnerable to institutional threats than large firms. SMEs often lack market power, resources, and political connections to endure the cost of bureaucratic obstacles or exchange for public favours (LiPuma et al., 2013; Schiffer & Weder, 2001). In addition, they have to sacrifice a larger proportion of resources to administrative procedures compared to large firms (OECD, 2018). Therefore, when the institutional quality is higher, SMEs can reallocate the resources, otherwise spent coping with institutional constraints, to develop technical ability, financial resources and human capital. These internal resources are often considered key components of the firm's absorptive capacity (Anwar & Nguyen, 2014; Nguyen et al., 2020).

Finally, the development of institutions may enhance the effectiveness of spillovers by creating a conducive environment to facilitate coordination, interactions and knowledge sharing between foreign-invested firms and local firms (Yi et al., 2015). Better institutions reduce transaction costs and uncertainties of foreign investors in finding and negotiating with local partners (Meyer, 2001), allowing them to access local networks and complementary resources (Meyer & Nguyen, 2005). This can foster the scope and depth of the foreign entrants' linkages in

the local economy, which enhances the effectiveness of FDI spillovers (Krammer, 2015). In addition, high-quality institutions with stringent enforcement of law and lower corruption can mitigate the risk of opportunistic contracting behaviour whereby one party can break the contract and appropriate the expected profits of the other (Anokhin & Schulze, 2009; Zhang, 2019). This can enhance the productivity and efficiency of supplier-customer relations and subsequently foster FDI spillovers through vertical linkages (Zhang, 2019).

Hypothesis 2: Local institutional development has a positive moderating effect on FDI spillovers to innovation of domestic SMEs.

4.2.3 The Role of FDI Origins

The moderating effect of institutions on FDI spillovers is likely to depend on the institutional quality of the country in which they originated. Low institutional quality in the host relative to the origin economy can create additional costs and risks to FDI (Choi et al., 2016). This occurs as MNEs entering a new market may suffer from the "*liabilities of foreignness"* due to their unfamiliarity with local legal frameworks and the ways of doing business (Krammer, 2015). However, MNEs experiencing poor institutional environments at home may have developed the management skills and knowledge to cope with institutional pressures, leading to lower sensitivity to poor institutional quality (Godinez & Liu, 2015). For example, empirical studies have confirmed that MNEs from countries with developed institutions are deterred more by worse institutions abroad (Aleksynska & Havrylchyk, 2013). Cuervo-Cazurra (2006a) finds that investors who have been exposed to bribery at home may not be hindered by corruption abroad. Wang et al. (2013) posit that the moderating effect of institutions on spillovers of ethnic-linked

FDI[16] is not significant as opposed to non-ethnic-linked FDI due to the familiarity of the former with the local business environment. Therefore, MNEs already encountering low institutional quality at home are more familiar with institutional obstacles in the host economy, thereby less susceptible to institutional impacts. Hence, recognizing Vietnam's poor institutional quality setting (see Chapter 3, Section 3.2), I hypothesise that:

Hypothesis 3a: The moderating effect of local institutions on FDI innovation spillovers is weaker for FDI from countries with low institutional quality than FDI from countries with high institutional quality.

Literature has also distinguished between developed-country and developing-country MNEs in terms of their globalisation strategies and capability to generate technological spillovers in the host economy. Developing-country MNEs often fail to possess cutting-edge technology that can be exploited abroad to create competitive advantages as opposed to those from developed countries (Luo & Tung, 2007). This implies that FDI originating from developing countries often has a lower potential for technological spillovers. Instead, their ownership advantage may stem from the experience of coping with underdeveloped institutions at home (Buckley et al., 2010). Such an ownership advantage can assist developing country MNEs in operating more efficiently in other developing countries (Cuervo-Cazurra & Genc, 2008b). Due to the inherent deficiency in technological endowment and familiarity with the low-quality institutional environment of developing-country MNEs, the institutional impact on their technological spillovers is less salient. Thus, I hypothesise that:

[16] Wang et al. (2013) examine FDI spillovers in China. Ethnic-linked foreign investment is FDI from Hong Kong, Macau and Taiwan, while non-ethnic-linked FDI refers to FDI from elsewhere.

Hypothesis 3b: The institutional impact on FDI innovation spillovers is weaker for FDI originating from developing countries than that from developed ones.

4.2.4 Firm-level determinants of R&D investment and innovation

Firm size

The relationship between firm size and R&D investment is inconclusive, with both positive and negative effects evident in theory and practice. On the one hand, Schumpeterian hypothesis posits that larger firms have greater incentives for R&D and innovation due to economies of scale and the ability to appropriate returns from those activities (Nelson, 1985; Schumpeter, 1934). Larger firms benefit from greater scientific knowledge, management expertise, complementary assets, better access to capital, and some level of monopoly power, allowing them to invest in risky R&D projects with potentially high returns (Afuah, 2020). On the other hand, small firms often exploit niched opportunities to introduce new products, production methods, markets, supply chains, and industry structures (Damanpour & Aravind, 2006). This adaptability enables them to drive innovation in ways that may be less feasible for larger, less agile organisations.

Empirical studies have shown that large firms are often better equipped to capitalise on economies of scale in R&D, resulting in higher R&D intensity (Anwar & Sun, 2014; Shefer & Frenkel, 2005). Larger firms tend to allocate a higher proportion of their R&D expenditures to process innovation, as its returns are more strongly correlated with firm size (Cohen & Klepper, 1996b). Empirical studies with data from British (Pavitt et al., 1987) and U.S. firms (Scherer, 1991) shows a positive relationship between firm size and process R&D expenditure. While some studies corroborate the Schumpeterian hypothesis that larger firms have greater incentives for R&D and innovation (Banerjee & Gupta, 2021), others report inconclusive results, suggesting that R&D intensity decreases for the largest firms (Mansfield, 1980). Several studies find no clear positive relationship between firm size and R&D intensity (Audretsch & Acs, 1991; Griliches, 1980). Empirical work by Tsai and Wang (2005) suggests a U-shaped relationship where both small and large firms are more productive in R&D compared to medium-sized firms.

Firm age

Younger firms, especially small ones, are often more innovative because of their entrepreneurial spirit and ability to quickly adapt to environmental changes (Hausman, 2005). Many young firms are founded on R&D, making innovation central to their business model (Anwar & Sun, 2014). Younger firms tend to exhibit higher efficiency, which correlates positively with R&D intensity (Grilliches, 1995; Majumdar, 1997). Conversely, older firms may become entrenched in traditional practices, lacking the agility and entrepreneurial mindset necessary for breakthrough innovation (Hausman & Fontenot, 1999; Radas & Božić, 2009). They are less inclined to engage in fundamental or high-risk R&D, favouring incremental improvements instead (Czarnitzki & Kraft, 2004).

Arguments in favour of firm age posit that older firms benefit from accumulated experience and greater market power, which enhance their capacity to fund large-scale R&D projects (Thornhill & Amit, 2003). The resource-based view suggests that as firms mature, they acquire financial stability and resources, enabling sustained R&D investments (Banerjee & Gupta, 2021).

Studies such as Lee (2003) and Sasidharan and Kathuria (2011) indicate that younger firms are more R&D intensive. However, Shefer and Frenkel (2005) finds a positive relationship between firm age and R&D activity, particularly for established firms with access to resources. Research by Håkanson and Nobel (1993) and Czarnitzki and Kraft (2004) suggests no strong link between firm age and R&D activity. The relationship between firm age and R&D intensity seems to vary across contexts. Younger firms often lead in innovation due to their entrepreneurial drive and efficiency, while older firms bring stability and resource advantages for sustained R&D.

Profit

According to the Schumpeterian view, profitability enhances R&D intensity by providing firms with retained earnings, a cost-effective funding source for innovation due to lower transaction costs compared to external financing (Grabowski, 1968). Higher profits increase organisational resources, enabling firms to fund projects beyond standard budgets, absorb

failures, and cover the costs of complex or risky innovations (Cohen, 1989). Profitable firms can sustain R&D efforts requiring significant capital and long-term investments, making them better equipped to handle the uncertainties of innovation (Coad & Rao, 2010; Lev & Sougiannis, 1996).

In contrast, less profitable firms or those incurring losses may have greater motivation to invest in R&D as a survival strategy, viewing innovation as a means to regain competitiveness (Antonelli, 1989). While profitability can support R&D, it may not always lead to higher intensity as firms with excess profits might prioritize other investments or face reduced pressure to innovate.

Empirical studies such as Grabowski (1968) and Smyth et al. (1972) highlight the positive impact of profitability on R&D intensity, emphasising the role of internal financial capacity in enabling innovation. Some studies, like Kumar (1987), report an insignificant relationship, suggesting profitability alone may not be a decisive factor in R&D investment. Mixed findings suggest that high profitability does not guarantee high R&D intensity, as firms' strategic priorities and external pressures also play critical roles.

Exports

The relationship between exports and R&D investment is predominantly positive, with firms leveraging international exposure to enhance innovation. Presence in foreign markets exposes firms to larger, more competitive environments, encouraging innovation to maintain competitiveness (Martinez-Ros, 1999; Radas & Božić, 2009). Access to international markets enhances the potential returns on R&D investments due to the expanded market size (Zimmermann, 1987). In addition, competing in international markets enables firms to access advanced technologies and adapt to global standards, that is learning-by-exporting (Banerjee & Gupta, 2021; Girma, Görg, & Hanley, 2008). However, high competition in international markets may discourage innovation, aligning with Schumpeter's hypothesis that intense competition can negatively affect R&D and innovation (Damanpour & Aravind, 2006).

Many studies confirm a positive link between export activities and R&D intensity (Czarnitzki & Kraft, 2004; Sasidharan & Kathuria, 2011; Shefer & Frenkel, 2005). Firms engaging in exports show higher investments in both product and process innovations (Martinez-Ros, 1999).

Human capital and labour skill

Human capital and labour skills play a pivotal role in driving R&D investment and innovation. Theoretical perspectives emphasise that technical knowledge resources, such as a high proportion of technically skilled employees and specialized expertise, foster innovation by enhancing the understanding of technological advancements (Damanpour & Aravind, 2006). The presence of qualified scientists and engineers is considered a key indicator of a firm's technological and scientific capabilities (Huiban & Bouhsina, 1998). Strong leadership from highly educated directors or founders further strengthens a firm's innovative activities by leveraging its knowledge base for product and process development (Hoffman et al., 1998; Radas & Božić, 2009). Modern innovation extends beyond R&D departments, requiring employees across all functions to possess a blend of technical, marketing, and integrative competencies, especially in smaller firms with less-defined roles (Iansiti, 1995; Leiponen, 2005).

Empirical findings confirm the significant contribution of skilled human capital to R&D and innovation. High levels of technical expertise enhance a firm's ability to absorb and utilise external knowledge through spillover effects (Galende & de la Fuente, 2003). Studies show that technical staff with domain expertise increase the likelihood of integrating knowledge to develop new technologies and support R&D activities (Coad & Rao, 2010; Fleming, 2001). Conversely, the absence of necessary skills poses a critical barrier to innovation (Mohnen & Röller, 2005). Firms that prioritize workforce development, knowledge integration, and leadership in their innovation strategies are better positioned to overcome these challenges, fostering sustainable growth and competitive advantage.

Manager's characteristics

Entrepreneur and managerial characteristics significantly influence R&D investment and innovation, especially in small firms where decision-making is often centralised. Theoretical foundations, dating back to Schumpeter's work, highlight the critical role of entrepreneurs in driving innovation (Schumpeter, 1942). Entrepreneurs' skills, background, and strategic decisions are pivotal in shaping the competitive strategies of smaller firms, in contrast to the more complex decision-making processes in larger organisations (Avermaete et al., 2004). Younger entrepreneurs tend to innovate more, driven by their strong motivation and long-term vision for their businesses (Diederen et al., 2003). Additionally, an entrepreneur's educational background is often linked to innovation, as education fosters technical, social, and learning skills crucial for adapting to and developing new ideas (Cohen & Levinthal, 1989; Leiponen, 2000).

Despite these theoretical insights, empirical findings on the relationship between entrepreneurs' educational levels and innovation in small firms are inconclusive. While some studies associate higher education with increased innovation, others find no significant correlation (Diederen et al., 2003; Romijn & Albaladejo, 2002). This disparity is particularly notable in SMEs from developing and transitional economies, where firms often start with low levels of managerial expertise and need to adapt significantly to remain competitive (Radas & Božić, 2009). These findings underscore the nuanced impact of entrepreneurial characteristics on innovation, suggesting that contextual factors, such as economic conditions and firm size, play a crucial role in shaping outcomes.

Competition

The relationship between market structure and innovation has been debated extensively in economic theory. Schumpeter (1942) argued that firms in concentrated markets, such as monopolies or oligopolies, have stronger incentives to innovate because they can more easily appropriate the returns from innovation. In less competitive environments, firms may possess the financial surplus to undertake costly and risky R&D activities. This view suggests that market concentration fosters innovation by providing firms with the resources and stability needed to focus on long-term technological advancements. However, the literature also points out that a

lack of competition could lead to bureaucratic inefficiencies that may hinder innovation (Arrow, 1972). Moreover, Schumpeter's hypothesis applies more to process innovations, as they are internally driven and harder for competitors to replicate.

In contrast, other theories highlight the positive effects of competition on innovation. Arrow (1972) argued that in competitive markets, firms have greater incentives to innovate because the gains from cost-reducing or product-enhancing innovations are higher compared to monopolistic markets. Competition fosters a dynamic environment where firms strive to acquire and utilise knowledge productively to gain a competitive edge. This perspective views competition as a catalyst for innovation, particularly in industries where new products can be patented or kept secret. Firms operating in competitive markets are compelled to innovate to differentiate themselves and meet evolving consumer demands, creating a virtuous cycle of innovation and market competition.

Empirical evidence on the relationship between competition, market structure, and innovation is mixed. While some studies find no significant relationship (Czarnitzki & Kraft, 2004; Veugelers & Houte, 1990), others report nonlinear effects, such as an inverted U-shaped relationship where moderate competition maximizes innovation (Jefferson et al., 2006). Banerjee and Gupta (2021) highlight this duality, noting that the impact of competition on R&D depends on the balance between the financial resources available in less competitive markets and the innovative pressures in more competitive ones. These findings suggest that the optimal market structure for fostering innovation may vary across industries and contexts, emphasising the complexity of this relationship.

4.2.5 Summary of Conceptual Framework

In the above sections, I derive predictions for the moderating impact of local institutions on innovation spillovers from FDI and how this relationship differs based on the level of institutional development of home countries. Figure 4.1 graphically summarises these proposed relationships.

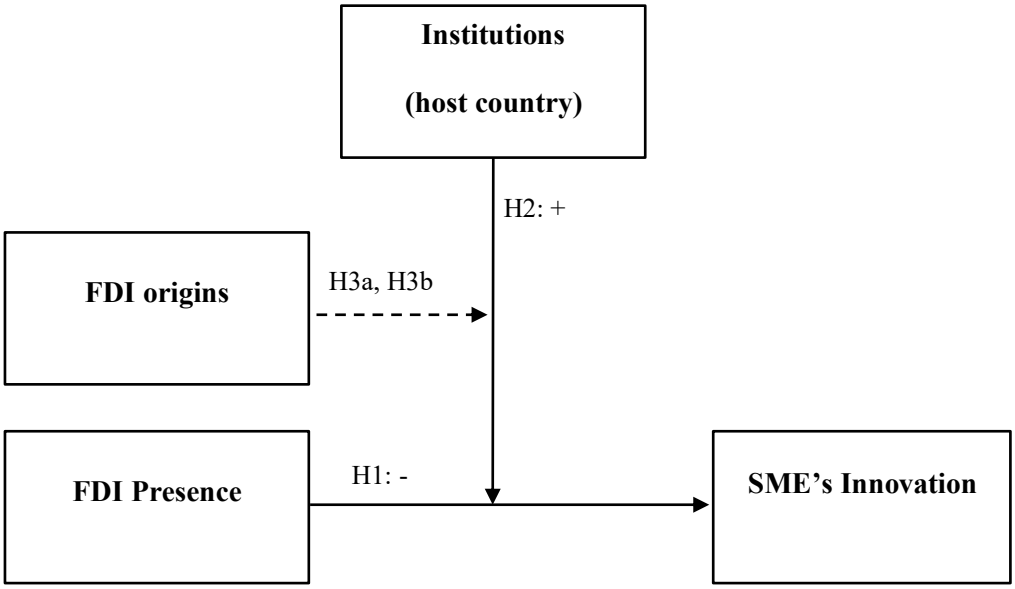

Figure 4.1. Conceptual framework.

Hypothesis 1: FDI presence exerts a negative impact on innovation of domestic SMEs.

Hypothesis 2: Local institutional development has a positive moderating effect that mitigates the negative impact of FDI on innovation of domestic SMEs.

Hypothesis 3a: The moderating effect of local institutions on FDI innovation spillovers is weaker for FDI from countries with low rather than high institutional quality.

Hypothesis 3b: The institutional impact on FDI innovation spillovers is weaker for FDI originating from developing countries than that from developed ones.

4.3 Model Specifications

4.3.1 FDI, Institutions and R&D Investment of Domestic SMEs

This subsection models the impacts of FDI presence and the institutional moderating effect on R&D investment of domestic SMEs. In the survey used as data input for this research, firms were asked if they had made any R&D investment since the last survey and if the answer was yes, they would be asked about the amount of the investment. The survey questions reflect the two stages in the decision-making process of a SME regarding R&D investment, that is to decide whether to engage in the investment or not, and once the firm has decided to do so, it will decide on the actual amount. Hence, two dependent variables and two corresponding estimations emerge naturally. The first variable is a dummy variable taking the value of one if a firm engaged in R&D investment used to estimate the probability of making the investment. The second one is R&D expenditure used to estimate the intensive margin of the investment.

Motivated by the conceptual links discussed in *Subsection 4.2* and the two-stage decision making process of a SME, the following models are employed to investigate the moderating effect of institutions on the relationship between FDI and R&D investment of domestic SMEs:

$$Pr\left(RDD_{ijdt} = 1 \middle| RDD_{ijdt-1}, FDI_{jdt}, INST_{kt}, X_{ijdt}, dregion_d, dyear_t, dindustry_j\right) = \Phi\left(\eta_0 + \eta_1 FDI_{jdt} + \eta_2 INST_{kt} + \eta_3 FDI_{jdt} \times INST_{kt} + \eta_4 RDD_{ijdt-1} + \eta_5 dregion_d + \eta_6 dyear_t + \eta_7 dindustry_j + \eta' X_{ijdt}\right) \quad (1)$$

$$RDE_{ijdt} = \vartheta_0 + \vartheta_1 FDI_{jdt} + \vartheta_2 INST_{kt} + \vartheta_3 FDI_{jdt} \times INST_{kt} + \vartheta_4 RDD_{ijdt-1} + \vartheta_5 dregion_d + \vartheta_6 dyear_t + \vartheta_7 dindustry_j + \vartheta' X_{ijdt} + \varepsilon_{ijdt} \quad (2)$$

where *i*, *j*, *k*, *d*, and *t* denote firm, 4-digit industry, province, economic region, and year, respectively; RDD is a dummy variable taking the value of 1 if the firm engages in R&D investment, and 0 otherwise; RDE represents real R&D expenditure in natural logarithm form; FDI_{jdt} is FDI presence in industry *j* in region *d* and year *t*; $INST_{kt}$ represents institutional quality in province *k* in year *t*; X_{ijdt} is the vector of control variables that capture firm-specific and

industry-specific characteristics; regional dummies ($dregion_d$) and industry dummies ($dindustry_j$) are employed to account for regional-specific and industry-specific characteristics that are stable over time, while year dummies ($dyear_t$) capture common macro shocks; ε_{ijdt} is the error term.

FDI presence[17] (FDI_{jdt}) is measured by the output share of foreign firms in the 4-digit industry *j* in region *d* at time *t*. $INST_{kt}$ measures the institutional quality of province *k* at time *t*. To examine the moderating role of institutions, FDI_{jdt} is interacted with $INST_{kt}$. In Equations (1) and (2), RDD_{ijdt-1} is included to control the effect of the fixed cost of R&D investment. As such, the 2009 SME survey round is used to obtain RDD_{ijdt-1} in 2011 for the purpose of minimising data loss.

4.3.2 FDI, Institutions and Product and Process Innovations of Domestic SMEs

This subsection involves modelling FDI impact and the institutional moderating effect on product and process innovations of domestic SMEs. In the survey, firms were asked if they had introduced any new product groups (new production processes) since the last survey and if yes, how many. The survey questions reflect the two stages in the decision-making process of a SME regarding new product innovation (process innovation), that is to decide whether to innovate or not, and once the firm has decided to do so, it will decide on the scale of the innovation. Hence, two dependent variables and two corresponding estimations emerge naturally. The first variable is a dummy variable taking the value of one if a firm introduces new products/processes used to

[17] The presence of FDI in a given industry is proxied by horizontal FDI, which is the output share of foreign firms in the same industry. Later in the additional analysis, vertical FDI is also considered. A composite FDI index that captures FDI from both horizontal and vertical directions is constructed using principal component analysis and Equations (1) and (2) are re-estimated accordingly.

estimate the probability of product/process innovation. The second one is the number of new products/processes used to estimate the intensive margin of the innovation.

To estimate how institutions moderate the impact of FDI on the probability of product and process innovations by domestic SMEs, the following probit model is specified:

$$Pr\left(INNOD_{ijdt} = 1 \middle| INNOD_{ijd,t-1}, FDI_{jdt}, X_{ijdt}, dregion_d, dindustry_j, dyear_t\right) =$$

$$\Phi(\tau_0 + \tau_1 INNOD_{ijd,t-1} + \tau_2 FDI_{jdt} + \tau_3 FDI_{jdt} \times INST_{kt} + \tau_4 INST_{kt} + \tau' X_{ijdt} +$$

$$dregion_d + dindustry_j + dyear_t) \quad (3)$$

where $INNOD_{ijdt}$ is a set of dummy variables equal to 1 if firm *i* in industry *j* in region *d* engaged in a particular innovation activity at time *t*, and 0 otherwise. Since the interest is in product and process innovations, $INNOD_{ijdt} \in \{NPD_{ijdt}, NPC_{ijdt}\}$, where *NPD* indicates whether a firm introduces new products in the survey year or not, and *NPC* refers to the adoption of new processes/technologies. The one-year lag innovation variable $INNOD_{ijd,t-1}$ is included as an explanatory variable to control for the persistence tendency in innovation activity as suggested by prior literature on innovation (see, for example, Antonelli et al., 2012; Hecker & Ganter, 2014).

In addition to the probability of engaging in innovation activities, I also investigate how institutions and FDI jointly affect the extent to which SMEs innovate by using the number of newly introduced products and new processes as outcome variables, which take non-negative integer values. Scholars suggest that a Poisson distribution provides a good fit for count measures, with an assumption of equal mean and variance (García et al., 2013). In light of the assumption,

I conduct the over-dispersion test, which fails to reject the null hypothesis of equal mean and variance at the 5% level. Thus, with a Poisson distribution,[18] the conditional mean is specified as:

$$E\left(INNO_{ijdt}\middle|INNOD_{ijd,t-1}, FDI_{jdt}, X_{ijdt}, dregion_d, dindustry_j, dyear_t\right) =$$

$$exp(\varphi_0 + \varphi_1 INNOD_{ijd,t-1} + \varphi_2 FDI_{jdt} + \varphi_3 FDI_{jdt} \times INST_{kt} + \varphi_4 INST_{kt} + \varphi' X_{ijdt} +$$

$$dregion_d + dindustry_j + dyear_t) \quad (4)$$

where, $INNO_{ijdt}$ is the number of new products or processes/technologies of SME *i* in industry *j* in region *d* during year *t*. That is, $INNO_{ijdt} \in \{NPDN_{ijdt}, NPCN_{ijdt}\}$, where $NPDN_{ijdt}$ denotes the number of new products, and $NPCN_{ijdt}$ refers to the number of new processes/technologies. The other variables are defined as above.

4.3.3 A Structural Estimation of SMEs' Product Innovation

4.3.3.1 Theoretical Model. In addition to testing Hypotheses 1-3 in the reduced-form estimations, as discussed above, I also model firms' product innovation behaviour theoretically, and utilise the theoretical model to guide empirical estimations. Such a structural estimation allows for a deeper insight than the reduced-form estimations.

On the demand side, the preference of a representative consumer is represented by the following constant elasticity of substitution (CES) utility function:

$$U = \left[\int_{\omega\in\Omega} q_\omega^\rho d\omega\right]^{\frac{1}{\rho}},$$

[18] A problem with Poisson regression assumption is that it allows for the number of new products to be infinite which may be conceptually inappropriate given a firm's limited resources. The next subsection addresses this concern by using a binomial distribution and GMM estimator to estimate structural equations.

where Ω presents the sets of all products, ω denotes a particular product, q is the quantity of consumption, and $\frac{1}{1-\rho}$ is the elasticity of substitution $(0 < \rho < 1)$. Utility maximization, subject to a budget constraint, yields the following demand function:

$$q = \mathrm{A}p^{\frac{1}{\rho-1}}, \tag{5}$$

where p is the product price; $\mathrm{A} \equiv \frac{\Upsilon}{\int_{\omega\in\Omega} p(\omega)^{\frac{\rho}{\rho-1}} d\omega}$ measures the aggregate demand; and Υ is a consumer's income. Because firms are small relative to the market, they take Aas given.

On the production side, the industry consists of both foreign and domestic firms located in different provinces, where foreign firms account for γ proportion $(0 \leq \gamma \leq 1)$, and the local business environment is characterised by a level of institutional quality, denoted by h. Each firm pays a fixed entry cost due to activities including market research and business registration. Upon entry, firms have a capability endowment (λ) drawn from a log uniform distribution, namely $ln(\lambda) \sim U(0, ln\bar{\lambda})$.

In order to produce, firms need to set up production facilities, such as assembly lines. Costs associated with these facilities are fixed costs of production. If firms produce only existing products, their fixed costs of production are f_o. If, instead, they decide to produce new products, the fixed costs are f_n. Since producing new products involves the purchase of new equipment and advanced technologies, $f_n > f_o$.

Then, utilising the production facilities, firms employ workers to produce outputs, where one worker can, on average, produce *s* units of output. That is, *s* measures firms' labour productivity, which depends on a set of firm-specific observed characteristics (ζ) and an unobserved capability endowment (λ). In addition, FDI presence can generate positive productivity spillovers to domestic firms through such channels as worker mobility, demonstration and competition effects, and forward and backward linkages (Blomström & Kokko, 1998; Cheung & Ping, 2004; Spencer, 2008). On the other hand, the competition brought on by FDI can exert crowding-out effects that adversely affect the productivity of domestic firms (Huynh et al., 2019; Ni et al., 2017). In these

channels, institutions are likely to moderate the extent of FDI productivity spillovers by increasing the ability of FDI to generate technical spillovers, enhancing the absorptive capacity of domestic firms, and facilitating the interaction and linkages between FDI firms and domestic firms (Krammer, 2015; Yi et al., 2015; Zhang, 2019). Accordingly, firms' labour productivity is specified as follows:

$$s = \zeta\left[(1-\chi)\lambda + \chi\lambda^{\delta}\right]e^{\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h}, \tag{6}$$

where $\chi = 1$, if the firm produces new products; $\delta > 1$, which captures the possibility that firms with a higher endowment (λ) are more capable of producing new products; the parameters α_1, α_2 and α_3 respectively capture the sign and magnitude of the direct effect of FDI productivity spillovers on domestic firms, the direct institutional impact, and the moderating effect of institutions on FDI productivity spillovers.

Since producing one unit of output requires $\frac{1}{s}$ units of labour, given the wage rate of w, the marginal cost of production (c) can be written as:

$$c = \frac{w}{s}$$

Domestic firms are engaged in a two-stage game. In the first stage, they decide on an optimal number of innovation projects (experimental trials, *N*). Then, in the second stage, firms set the product price to maximize profits. The profit from producing a new product can be written as:

$$\pi = (p - \tfrac{w}{s})q - f_n \tag{7}$$

To maximize profit, firms set the price (p^*) as:

$$p^* = \frac{w}{\rho s} \tag{8}$$

Using the optimal price, the optimal profit (π^*) from producing new products can be written as below:

$$\pi^* = \mathrm{K}\lambda^{\frac{\delta\rho}{1-\rho}}e^{(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)\frac{\rho}{1-\rho}} - f_n, \tag{9}$$

where $\mathrm{K} = (1-\rho)\rho^{\frac{\rho}{1-\rho}}\mathrm{A}w^{\frac{\rho}{\rho-1}}\zeta^{\frac{\rho}{1-\rho}}$ and the asterisk denotes optimal profit.

The firms only innovate if they earn a non-negative profit from innovation, that is, $\pi^* \geq 0$. Since π^* is a monotone increasing function of capability (λ), the condition $\pi^* = 0$ defines a cut-off innovative capability ($\underline{\lambda}_n$), above which firms will innovate, as follows:

$$\underline{\lambda}_n = B_n e^{-\frac{1}{\delta}(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)}, \tag{10}$$

where $B_n = \rho^{-\frac{1}{\delta}}(1-\rho)^{\frac{\rho-1}{\delta\rho}}\mathrm{A}^{\frac{\rho-1}{\delta\rho}}w^{\frac{1}{\delta}}\zeta^{-\frac{1}{\delta}}f_n^{\frac{1-\rho}{\delta\rho}}$.

If firms produce existing products, their optimal prices and profits can be derived similarly, which in turn implies the cut-off capabilities as follows:

$$\underline{\lambda}_o = B_o e^{-(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)}, \tag{11}$$

where $B_o = \frac{1}{\rho}(1-\rho)^{\frac{\rho-1}{\rho}}\mathrm{A}^{\frac{\rho-1}{\rho}}w\zeta^{-1}f_o^{\frac{1-\rho}{\rho}}$

Equations (10) and (11) define two cut-off capabilities: $\underline{\lambda}_n$ and $\underline{\lambda}_o$, with $\underline{\lambda}_n > \underline{\lambda}_o$ (assuming that f_n is sufficiently greater than f_o such that $\underline{\lambda}_n$ is greater than $\underline{\lambda}_o$). If the realized capability of a firm is lower than $\underline{\lambda}_o$, the firm will not enter the market, hence unobserved in the data, causing endogenous sample selection. If the realized capability is between $\underline{\lambda}_o$ and $\underline{\lambda}_n$, the firm will enter the market but not innovate. If the realized capability is above $\underline{\lambda}_n$, the firm will conduct product innovation.

Once a firm has decided to innovate, it optimally chooses the number of innovation projects with which to experiment. In the experimentation, the firm has a probability μ ($\mu \in [0,1]$) of achieving success, which depends on FDI presence (γ), institutional quality (h), and their interaction, as below:

$$\mu = \frac{1}{1+e^{-(\beta_1\gamma+\beta_2 h+\beta_3\gamma h)}} \tag{12}$$

Experimentation is costly, and the more innovation projects a firm experiments, the higher the costs it must pay and the higher the marginal cost is. Accordingly, the total cost of innovation

(C_I) is a quadratic function of the number of innovation projects, namely $C_I = \frac{1}{2} f_n N^2$. The expected firm's profit from having *N* innovation projects can be derived as follows:

$$\Pi = \mu N \pi^* - \frac{1}{2} f_n N^2 \tag{13}$$

Hence, the optimal number of innovation projects:

$$N^* = \frac{\mu \pi^*}{f_n} \tag{14}$$

Let *Y* denote the number of new products a domestic firm introduces, which is observed in the data. It follows a binomial distribution with N^* independent trials and μ probability of success if the firm has decided to innovate. Note this is in contrast to the negative binomial distribution assumed in the existing studies. In particular, with scarce resources, the optimal number of experimental trials firms consider is finite, resulting in a finite *Y*. Using the expression of optimal profit given in equation (9), the expected number of new products, conditional on the firm's capability being higher than $\underline{\lambda}_n$, is as follows:

$$E\left[Y \middle| \lambda \geq \underline{\lambda}_n\right] = \mu E\left[N^* \middle| \lambda \geq \underline{\lambda}_n\right] = \frac{\mu^2}{f_n} E\left[\pi^* \middle| \lambda \geq \underline{\lambda}_n\right] =$$

$$\left(\frac{1}{1+e^{-(\beta_1\gamma+\beta_2 h+\beta_3\gamma h)}}\right)^2 \left[\frac{\frac{(1-\rho)^2}{\delta}\rho^{\frac{2\rho-1}{1-\rho}}\mathrm{A}w^{\frac{\rho}{\rho-1}}\zeta^{\frac{\rho}{1-\rho}}e^{(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)\frac{\rho}{1-\rho}}}{ln\bar{\lambda}+\frac{1}{\delta}ln\left[\rho(1-\rho)^{\frac{\rho-1}{\rho}}\right]+\frac{1-\rho}{\delta\rho}ln\mathrm{A}-\frac{1}{\delta}lnw+\frac{1}{\delta}ln\zeta-\frac{1-\rho}{\delta\rho}lnf_n+\frac{1}{\delta}(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)}\left(\frac{(\bar{\lambda})^{\frac{\delta\rho}{1-\rho}}}{f_n} - \right.\right.$$

$$\left.\left.\rho^{\frac{\rho}{\rho-1}}(1-\rho)^{-1}\mathrm{A}^{-1}w^{\frac{\rho}{1-\rho}}\zeta^{\frac{\rho}{\rho-1}}e^{\frac{\rho}{\rho-1}(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)}\right) - 1\right] \tag{15}$$

Taking the partial derivative of $E\left[Y \middle| \lambda \geq \underline{\lambda}_n\right]$ with respect to γ, the marginal effect of FDI presence on the firm's expected number of new products is obtained as follows:

$$\frac{\partial E[Y|\lambda \geq \underline{\lambda}_n]}{\partial \gamma} = \underbrace{\frac{\partial E[\pi^*|\lambda \geq \underline{\lambda}_n]}{\partial \gamma}}_{(i)} \frac{\mu^2}{f_n} + 2\mu \underbrace{\frac{\partial \mu}{\partial \gamma}}_{(ii)} \frac{E[\pi^*|\lambda \geq \underline{\lambda}_n]}{f_n} \tag{16}$$

Equation (16) shows that FDI presence and local institutions jointly affect the firm's number of new products through two channels: (*i*) the impact on the expected profit of each innovation

project and (*ii*) the impact on the probability of successful implementation of an innovation project.

The first channel involves two contrasting effects, specifically:

$$\frac{\partial E[\pi^*|\lambda \geq \underline{\lambda}_n]}{\partial \gamma} = \frac{\partial \left[\mathrm{K} e^{(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)\frac{\rho}{1-\rho}} \frac{1}{\frac{\delta\rho}{1-\rho}(ln\bar{\lambda}-ln\underline{\lambda}_n)} \left((\bar{\lambda})^{\frac{\delta\rho}{1-\rho}} - \underline{\lambda}_n{}^{\frac{\delta\rho}{1-\rho}} \right) \right]}{\partial \gamma}$$

$$= \underbrace{\frac{\partial \mathrm{K} e^{(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)\frac{\rho}{1-\rho}}}{\partial \gamma}}_{(i')} \underbrace{\frac{1}{\frac{\delta\rho}{1-\rho}(ln\bar{\lambda}-ln\underline{\lambda}_n)} \left((\bar{\lambda})^{\frac{\delta\rho}{1-\rho}} - \underline{\lambda}_n{}^{\frac{\delta\rho}{1-\rho}} \right)}_{\geq 0}$$

$$+ \underbrace{\frac{\partial \left[\frac{1}{\frac{\delta\rho}{1-\rho}(ln\bar{\lambda}-ln\underline{\lambda}_n)} \left((\bar{\lambda})^{\frac{\delta\rho}{1-\rho}} - \underline{\lambda}_n{}^{\frac{\delta\rho}{1-\rho}} \right) \right]}{\partial \gamma}}_{(i'')} \underbrace{\mathrm{K} e^{(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)\frac{\rho}{1-\rho}}}_{\geq 0}$$

where $(i') = (\alpha_1 + \alpha_3 h)\frac{\rho}{1-\rho}\mathrm{K} e^{(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)\frac{\rho}{1-\rho}} \geq 0 \Leftrightarrow \alpha_1 + \alpha_3 h \geq 0$. (i') suggests that when there exist positive (negative) productivity spillovers from FDI, the marginal cost of producing the new product is reduced (increased), leading to a higher (lower) expected profit.

In addition, $(i'') = \frac{\partial \frac{e^a - e^x}{a-x}}{\partial x}\frac{\partial x}{\partial \gamma} = \frac{e^x[e^{a-x}-(a-x)-1]}{(a-x)^2}\frac{\partial x}{\partial \gamma}$, where $x = \frac{1-\rho}{\delta\rho} ln\underline{\lambda}_n$, $a = \frac{1-\rho}{\delta\rho} ln\bar{\lambda}$ and $a \geq x$.

Since $\frac{e^x[e^{a-x}-(a-x)-1]}{(a-x)^2} \geq 0, \forall\, a \geq x$ and $\frac{\partial x}{\partial \gamma} = \frac{\partial\left(\frac{1-\rho}{\delta\rho} ln\underline{\lambda}_n\right)}{\partial \gamma} = \frac{\rho-1}{\delta^2\rho}(\alpha_1 + \alpha_3 h) \leq 0 \Leftrightarrow \alpha_1 + \alpha_3 h \geq 0$, (i'') suggests that in case of positive FDI productivity spillovers, the cut-off level of the innovative capability ($\underline{\lambda}_n$) is lowered, allowing more firms to innovate. This will heighten market competition (i.e., more variety of products) and subsequently put downward pressure on the expected profit. In contrast, negative FDI productivity spillovers raise the cut-off innovative capability, leading to a higher expected profit.

In the second channel (ii), $\frac{\partial \mu}{\partial \gamma} = 2(\beta_1 + \beta_3 h)\left(\frac{1}{1+e^{-(\beta_1\gamma+\beta_2 h+\beta_3\gamma h)}}\right)^2 \geq 0 \Leftrightarrow \beta_1 + \beta_3 h \geq 0$, suggesting that a positive (negative) effect of FDI presence on the success probability of innovation results in a higher (lower) expected number of new products.

The overall impact of FDI on the number of new products of domestic firms, after taking into account the moderating role of institutions, depends on the relative strengths of the three effects: (i'), (i''), and (ii). An increase in FDI presence increases the number of new products of domestic firms as long as (i') and (ii) are sufficiently strong.

4.3.3.2 Estimation Procedure. To estimate the parameters of interest, a two-stage estimation framework is implemented, guided by the theoretical model. In the first stage, the parameters α_1, α_2 and α_3 are estimated based on the optimal revenue of firms that do not intend to innovate ($\chi = 0$). In the second stage, with the first-stage parameter estimates, the moment conditions implied by equation (15) are then utilised to estimate β_1, β_2, and β_3, using firms that intend to innovate ($\chi = 1$).

One unique feature of the data is that it observes whether a firm intends to innovate. In the sample, firms were asked if they planned to start new product lines in the near future. If a firm answers "no" to this question and indeed does not introduce new/improved products in the following year, it has no intention to innovate ($\chi = 0$). This allows us to identify the reason for a firm reporting zero new/improved products: no intention to innovate or failure to innovate.

For firms that have no intention to innovate and, as such, produce only existing products, their optimal revenue (R) is as follows:

$$R = pq = \rho^{\frac{\rho}{1-\rho}} \mathrm{A} w^{\frac{\rho}{\rho-1}} \zeta^{\frac{\rho}{1-\rho}} e^{\frac{\rho}{1-\rho}(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)} \lambda^{\frac{\rho}{1-\rho}}$$

Taking expectation with respect to λ, the following expected revenue (in natural logarithm) is obtained:

$$E\left[lnR \middle| \chi = 0, \lambda \geq \underline{\lambda}_0\right] = E\left[lnR \middle| \underline{\lambda}_n > \lambda \geq \underline{\lambda}_0\right]$$

$$= \left\{\left[\frac{\rho}{1-\rho}\frac{\delta-1}{2\delta} ln\rho - \frac{1+\delta}{2\delta}\ln(1-\rho)\right] + \frac{1}{2\delta} lnf_n + \frac{1}{2} lnf_0\right\} + \frac{\delta-1}{2\delta}(ln\mathrm{A} - \frac{\rho}{1-\rho} lnw) + \frac{\rho}{1-\rho}\frac{\delta-1}{2\delta} ln\zeta +$$

$$\frac{\rho}{1-\rho}\frac{\delta-1}{2\delta}(\alpha_1\gamma + \alpha_2 h + \alpha_3\gamma h) \quad (17)$$

Equation (17) involves the CES preference parameter (ρ), which can be estimated using the following relationship between revenue and total variable cost, implied by the firm's profit maximization:

$$R = \rho TVC \quad (18)$$

where R represents the total revenue, TVC denotes the total variable cost.

Equation (17) implies the following population moments:

$$E\left[[lnR - (\theta_0 + \theta_1\Psi + \theta_2 FDI + \theta_3 INST + \theta_4 FDI \times INST + X'\theta_5)]Z\right] = 0 \quad (19)$$

where lnR is the natural logarithm of the total revenue of an SME that has no intention to innovate. $\Psi = ln\mathrm{A} - \frac{\rho}{1-\rho} lnw$, where w is the average wage of production workers in a firm in a given year, and Ais captured by real income, ρ is estimated from equation (18).[19] FDI is measured by the output share of foreign-invested firms in a given 4-digit industry in each region, while $INST$ presents the institutional quality of the local government. Their interaction term $FDI \times INST$ measures the moderating effect of institutions on FDI spillovers. I also include a vector X of control variables to account for firm-specific and industry-specific characteristics that may influence a firm's productivity and, hence, its revenue. Specifically, $X = \{FIRMSIZE, FIRMAGE, GENDER, AGE, HUMANCAP, LSKILL, EXPORT, ZONE, HERFINDAHL, TECHGAP\}$. Definitions of the main variables are provided in Table 4.1 in *Subsection 4.4.3*

[19] The estimation yields $\rho = 0.92108$ with a standard error of 0.036, therefore $\Psi_t = ln\Phi - 11.671 \times lnw$.

Control variables. Z is the vector of instrumental variables (IVs). The choice of IVs is discussed in *Subsection 4.5.2 Instrumental variable approach*.

Regarding the parameters, the constant term in equation (19) equals the first component on the right-hand side of equation (17), namely $\theta_0 = \left[\frac{\rho}{1-\rho}\frac{\delta-1}{2\delta}ln\rho - \frac{1+\delta}{2\delta}\ln(1-\rho)\right] + \frac{1}{2\delta}lnf_n + \frac{1}{2}lnf_0$. The coefficient of Ψ is $\theta_1 = \frac{\delta-1}{2\delta}$. Parameter θ_5 is a vector that captures the marginal effects of control variables X. Parameters θ_2, θ_3 and θ_4 are quantities of interest in estimating equation (19). With their estimates, parameters α_1, α_2 and α_3 can be computed as $\alpha = \theta/(\frac{\rho}{1-\rho}\frac{\delta-1}{2\delta})$, where $\theta = (\theta_2 \quad \theta_3 \quad \theta_4)'$ and $\alpha = (\alpha_1 \quad \alpha_2 \quad \alpha_3)'$.

In stage two, the estimation is based on firms that intend to innovate. Equation (15) implies the following population moments:

$$E\left[\left[Y - \left(\frac{1}{1+e^{-(\beta_1 FDI+\beta_2 INST+\beta_3 FDI\times INST)}}\right)^2\left(\frac{De^{\beta_4}-1}{\beta_4+lnD}-1\right)\right]Z\right] = 0, \tag{20}$$

where Y is the number of observed new products; D can be calculated using the results from the first stage estimation as below:

$$D = (1-\rho)\rho^{\frac{\rho}{1-\rho}}\mathrm{A}w^{\frac{\rho}{\rho-1}}\zeta^{\frac{\rho}{1-\rho}}e^{(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)\frac{\rho}{1-\rho}};$$

$\beta_4 = \frac{\delta\rho}{1-\rho}ln\bar{\lambda} - lnf_n$; and Z is the set of instrumental variables. The generalized method of moments (GMM) estimator is employed to estimate both Equations (19) and (20).

In estimating Equation (20), I compute bootstrap standard errors to account for the fact that the stage-two estimation utilises estimates from stage one. Specifically, 100 random samples of the first-stage estimates of α_1 are drawn from $\mathcal{N}\left[\hat{\alpha}_1, \widehat{VAR}(\hat{\alpha}_1)\right]$, α_2 from $\mathcal{N}\left[\hat{\alpha}_2, \widehat{VAR}(\hat{\alpha}_2)\right]$, α_3 from $\mathcal{N}\left[\hat{\alpha}_3, \widehat{VAR}(\hat{\alpha}_3)\right]$ and ρ from $\mathcal{N}\left[\hat{\rho}, \widehat{VAR}(\hat{\rho})\right]$, where $\mathcal{N}$ stands for the normal distribution, the hats represent estimates, and *VAR* denotes variance. With each sample of first-stage estimates, I then resample the data with replacement and estimate equation (20), which results in 100

estimates of β_1, β_2, β_3, and β_4. Bootstrapped standard errors are calculated as the standard deviations of these 100 estimates.

Figure 4.2 presents a decision tree illustrating different stages of producing new products to summarise the theory set out in this subsection.

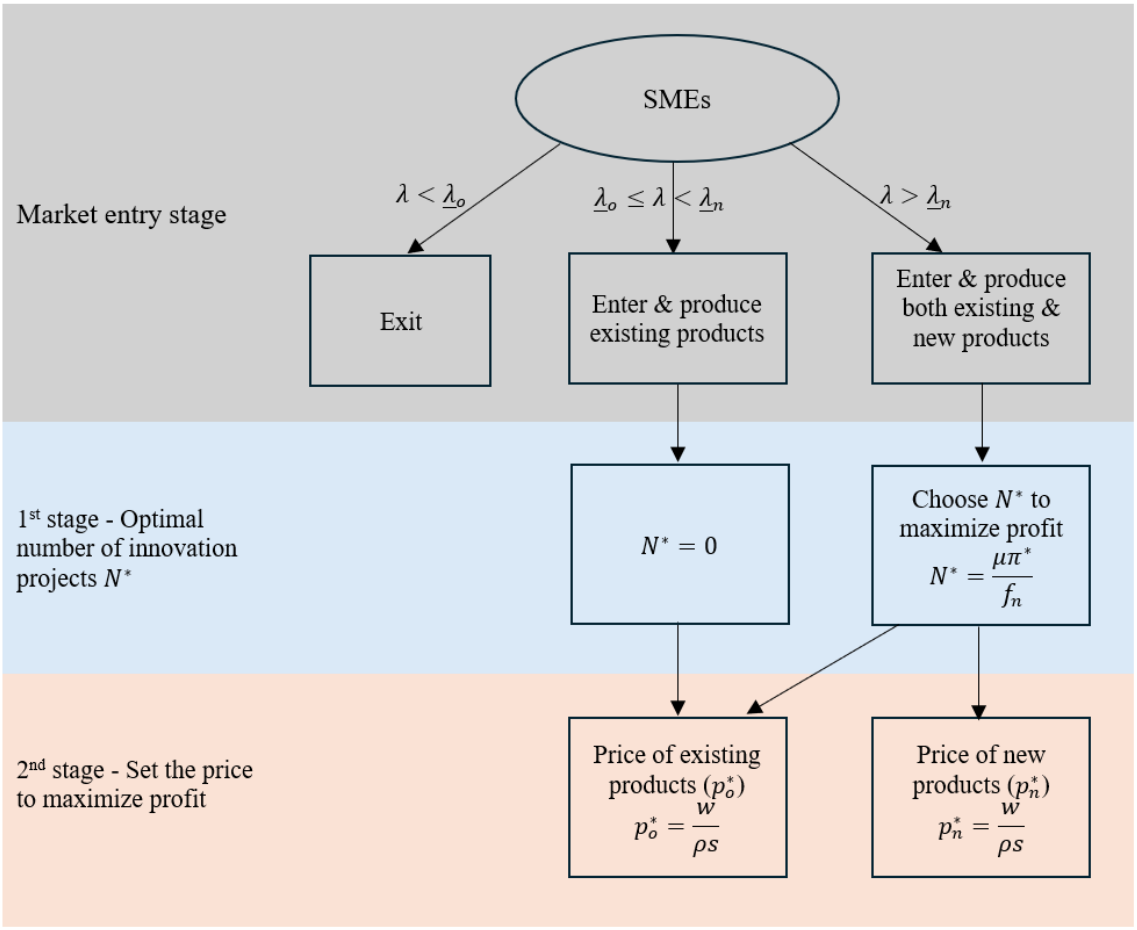

Figure 4.2. Decision tree of product innovation

4.4 Estimation Strategy

4.4.1 Endogeneity Issue of FDI and Institutional Variables

Equations (1) - (4) first assume the exogeneity of the right-hand-side variables. However, FDI and institutions can be endogenous. Foreign firms are more likely to enter industries with high innovation performance (Ito et al., 2012; Wang & Kafouros, 2009). This entry decision may partially contribute to the observed positive correlation between FDI presence and R&D activities in the industry, leading to an upward bias in the estimation of FDI spillovers. Institutions can also be endogenous due to reverse causality from R&D investment to institutions. Arguably, with profits from innovation projects, firms can collectively put upward pressure on the government to enhance institutional quality (Tran, 2019). In addition, other uncontrolled factors that influence institutions and/or FDI presence may lead to a correlation between institutions/FDI and the error term.

4.4.2 Instrumental Variable Approach

4.4.2.1 Instrumental Variables for FDI Measures. Instrumental variables are used to address the endogeneity issue. An appropriate instrumental variable (IV) needs to be correlated with the endogenous variable and uncorrelated with the error term. Following the approach proposed by Nguyen et al. (2019), FDI presence in manufacturing industry *j* in region *d* by the output share of FDI in two service industries in a region not adjacent to region *d*. It is reasonable to expect a correlation between FDI in manufacturing and service industries since national competitive advantages, such as cheap labour, growing market, and policy incentives, affect FDI in both sectors (Nguyen et al., 2019). On the other hand, FDI presence in an unrelated service industry in a non-neighbouring region is unlikely to directly affect innovations of domestic firms in the manufacturing sector.

4.4.2.2 Instrumental Variables for Institutional Measures. Institutional variables are instrumented by the characteristics of the provincial leader - the Secretary of the provincial Communist Party committee. Previous literature suggests a potential association between institutional quality and provincial leader characteristics, such as leadership tenure (Tran, 2019), frequency of turnover (Nguyen et al., 2018), education (Svensson, 2005) and leader origin (Nie & Wang, 2016). Therefore, the following IVs are employed: *TENURE* - the tenure of the provincial leader as months in position; *SWITCH* - the turnover of the provincial leader, which is a dummy variable indicating whether there is a leader switch in a given year; *HIGHEDU* - the educational level of the provincial leader which is a dummy variable taking the value of one if the leader holds a postgraduate degree; *NONLOCAL* - a dummy variable indicating whether the leader originates from a different province. Importantly, since the appointment of provincial leaders in Vietnam complies with the direction, guidance and procedures set out by the central government, their characteristics are unlikely to be correlated with the error term. It is important to note that the interaction term $FDI_{jdt} \times INST_{kt}$ is instrumented by the interaction between the IVs for FDI and the leadership tenure of the provincial secretary.

Among the aforementioned IVs, the tenure of the Provincial Secretary of the Communist Party,[20] measured by the number of months in the position, is employed as the main IV for

[20] As per Regulation No. 42-QD/TW of the Secretariat, issued on October 3, 2016, the role of the provincial secretary can be summarised as follows: The Secretary serves as the head of the provincial Party Committee and assumes responsibility for providing Communist Party leadership across all local domains. Key responsibilities of the Secretary include overseeing the development of significant projects to implement Party resolutions and directives, handling confidential matters of national defence, security, foreign affairs, and Party safeguarding, as well as directing organisational and personnel management in accordance with the regulations set forth by the Politburo and the Secretariat. Additionally, the Secretary bears full responsibility for political ideology, organisational affairs, and the management of local cadres. Proactively

institutional quality throughout the empirical analysis. Literature on the connection between political tenure and institutional quality has been well-established, even though there is no consensus on the direction of the correlation. On the one hand, several hypotheses and pieces of evidence suggest that longer tenures promote institutional quality rather than shorter ones. Shorter tenures might psychologically affect leaders, making them less willing to pursue policies that yield long-term benefits but require immediate sacrifices (Blondel, 1987). Due to the tendency to focus solely on short- or medium-term performance, leaders often fail to realise their full potential or initiate institutional reforms that can bring about significant changes (Aghion et al., 2004). Leaders expecting longer tenures are more incentivised to engage in long-term planning, such as limiting expropriation, strengthening contract enforcement and ensuring economic stability, which in turn promotes investment and trade (Olson, 1993). The subsequent empirical work by Clague et al. (1996) shows that an increase in the tenure of autocrats leads to enhancements in both property and contract rights. According to McCulloch et al. (2013), leaders have incentives to generate relatively better institutional economic performance towards the end of their tenure to secure their promotion prospects. Tran (2019) proposes that longer tenure may introduce institutional stability through consistency in managing styles and deep knowledge of the local administration. In addition, shorter tenure may encourage opportunistic behaviours, as public officials aim to maximize rents over their limited time in power (Nguyen et al., 2018).

On the other hand, some literature suggests a potential negative correlation between political tenure and institutional quality. Restricting tenure duration can dilute the power concentrated in the hands of leaders, thereby encouraging political competition and democratic participation

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proposing measures to enhance and modernize the leadership approach of the Party Committee is also a crucial duty entrusted to the Secretary, who presents these proposals to the Standing Board of the Provincial Party Committee.

(Blondel, 1987). Prolonged tenure can lead to the entrenchment of local informal power structures that cater to special interests (Aghion et al., 2004). Consequently, this can pave the way for increased corruption, diminished transparency, and reduced government proactivity in addressing business issues (Nguyen et al., 2018). The theoretical model of Acemoglu and Robinson (2006) demonstrates that leaders whose power is threatened by technological and institutional advancements may intentionally impede these economic development factors to lengthen their tenure. Supporting this perspective, Holcombe and Boudreaux (2013) provide empirical evidence of the negative impact of the quality of economic institution on political tenure. Nevertheless, regardless direction, tenure is conceptually correlated with institutional quality.

The leadership tenure of a provincial secretary is usually five years in compliance with the regulations of the Central Committee of the Communist Party of Vietnam.[21] A shorter tenure usually happens when the secretary reaches the mandatory retirement age, resigns, is rotated to another position in the political system, or is dismissed by the Politburo. On the other hand, longer tenure is observed when the leader is reappointed by the Politburo. The length of tenure relies on natural causes or the decisions of the Central Party, which is outside the control of firms, especially SMEs. Therefore, leadership tenure is unlikely to be directly associated with the innovative capability of SMEs.

4.4.3 Estimation Methods

Equations (1) and (2) are derived from a two-stage decision process by firms. In stage one, a firm chooses whether to conduct R&D to maximise its profit and in stage two, it decides how much to spend on R&D, if it has decided to innovate. Solving the two-stage problem backward,

[21] Regulation No. 105-QD/TW, 19 February 2017 on decentralization of cadre management and the appointment and introduction of candidates.

one can derive the optimal R&D expenditure as a function of a set of right-hand-side variables (Equation (2)). In stage one, the firm compares the profits with and without R&D. Assuming the profit difference is a standard normal random variable, conditional on the right-hand-side variables; one can derive the probability of conducting R&D as Equation (1). Note that R&D status (RDD_{ijdt-1}) in the previous period can be correlated with the random component of the profit function, which is then integrated out to derive the probability.

Equation (1) naturally leads to the maximum likelihood estimation method with IVs due to the potential endogeneity of FDI and institutional variables. In addition, the two-stage least squares (2SLS) approach is employed to estimate a linear probability model as a robustness check.

For Equation (2), taking expectation at both sides of the equation, conditional on the instruments of FDI and institutions and the exogenous right-hand-side variables (excluding RDD_{ijdt-1}), I can derive a set of moment conditions which in turn leads to the generalised method of moments (GMM) estimation. Since a firm's optimal level of R&D investment is unobserved if it decides not to invest, one is faced with a sample selection issue in estimation. In Equation (2), the sample selection issue is addressed by conditioning the expected amount of R&D investment on the R&D investment status in the previous period (RDD_{ijdt-1}). Note firms' R&D status in the previous period (RDD_{ijdt-1}) is correlated with the error term due to unobserved firm fixed effects, resulting in RDD_{ijdt-1} being endogenous. By taking expectation (integration), I obtain $E\left[RDD_{ijdt-1}\middle|Z\right] = Pr\left(RDD_{ijdt-1} = 1\middle|Z\right)$, where Z denotes the instruments and exogenous right-hand-side variables. Hence, from the estimation of Equation (1), I predict the lagged probability of conducting R&D and plug it into the GMM estimation of Equation (2). Such a two-step procedure allows us to control the endogeneity of RDD_{ijdt-1}. The standard errors in Equation (2) estimation are bootstrap standard errors to account for the fact that the predicted probability contains estimation errors in Equation (1).

Regarding product and process innovations, Equations (3) and (4) describe the two stages in a firm's innovative decision process. A firm first decides whether to innovate by comparing the

profit of innovation with that of no innovation, resulting in the probability of innovation being a function of a set of explanatory variables, including FDI presence and institutions, as specified in the Probit model of Equation (3). Equation (3) is estimated using the conditional maximum likelihood method. Since researchers have suggested that a linear probability model can be more reliable in dealing with the endogeneity problem (see, for example, Crescenzi et al., 2015), the two-stage least squares (2SLS) estimation is also employed as a robustness check. Then, should the firm decide to innovate, it determines an optimal extent of innovation (the number of introduced new products and processes). Since a firm's optimal decision on the extent of innovation is unobserved if it decides not to innovate, one is faced with a sample selection issue in estimation. In Equation (4), I address this sample selection issue by conditioning on the innovation status in the previous period ($INNOD_{ijdt-1}$). If a firm innovated previously, it is more likely to innovate in the current period. Hence, by conditioning on the innovation status in the previous period, it accommodates the sample selection issue.

Equation (4) implies a set of unconditional population moments, which can be taken to data using the generalized method of moments (GMM) estimator. Notably, the innovation status in the previous period ($INNOD_{ijdt-1}$) is likely endogenous because it can correlate with the error term through unobserved firm fixed effects. By taking the expectation conditional on the instruments and exogenous right-hand-side variables (denoted as Z), $E\left[INNOD_{ijdt-1}\middle|Z\right] = Pr\left(INNOD_{ijdt-1} = 1\middle|Z\right)$ is obtained. Thus, leveraging the estimation from Equation (1), the one-year lagged probability of innovation is predicted and incorporated into the GMM estimation of Equation (4). This two-step approach mitigates the endogeneity (sample selection) issue associated with the innovation status in the previous period. In addition, bootstrap standard errors are employed in estimating Equation (4) to account for the estimation errors arising from the predicted probability in Equation (3).

4.4.4 Diagnostic Testing

4.4.4.1 Testing for Endogeneity of FDI and Institutional Variables. Endogeneity arises as regressors are correlated with the error term, leading to biased and inconsistent estimates under the OLS estimator. In this case, an IV approach, for example, 2SLS estimator, is employed to provide consistent estimates, yet at the expense of lower efficiency. To test for potential endogeneity, the null hypothesis is that regressors are exogenous. The OLS estimator is consistent under the null hypothesis but not under the alternative hypothesis, whereas the 2SLS estimator is consistent under both hypotheses, assuming that IVs are valid and relevant. Therefore, the estimates obtained from the OLS estimator can be compared with the estimates obtained from the 2SLS estimator using the following Hausman test statistics: $\left(\hat{\beta}_{2SLS} - \hat{\beta}_{OLS}\right)' \left[Var\left[\hat{\beta}_{2SLS}\right] - \left(\hat{\beta}_{2SLS} - \hat{\beta}_{OLS}\right)' \left[Var\left[\hat{\beta}_{2SLS}\right] - Var\left[\hat{\beta}_{OLS}\right]\right]^{-1} \left(\hat{\beta}_{2SLS} - \hat{\beta}_{OLS}\right)$

The Hausman test statistics are asymptotically Chi-square distributed with the degree of freedom equal to the number of endogenous regressors. If the test statistic is large, meaning that the difference between $\hat{\beta}_{2SLS}$ and $\hat{\beta}_{OLS}$ is statistically significant, the null hypothesis of no endogeneity is rejected.

4.4.4.2 Relevance of Instrumental Variables for FDI and Institutions. The relevance requirement means that the instruments are correlated with the endogenous regressors. To check this, one can perform an underidentification test to check whether the matrix of reduced-form coefficients is of full rank. The test is a Lagrange multiplier test, with the test statistic developed by Kleibergen and Paap (2006). Under the null hypothesis of full rank, the statistic follows a Chi-square distribution. If the null hypothesis is rejected, the model is identified, indicating that the excluded IVs are correlated with the endogenous regressors.In addition, if the excluded instruments are only weakly correlated with the endogenous regressors, the point estimates are biased. In the analysis, weak instruments are detected by comparing the first-stage F-statistics to the critical Stock and Yogo value at 10% (Stock & Yogo, 2005).

4.4.4.3 Validity of Instrumental Variables for FDI and Institutions. The validity of IVs requires that they are uncorrelated with the error term. That is, given that the econometric model

is correctly specified, the IVs are orthogonal to the error term. When the model is exactly identified with the number of endogenous variables equal to the number of excluded instruments, one cannot test the validity of IVs. In contrast, if the model is overidentified, that is, the number of excluded instruments exceeds the number of endogenous variables (Baum et al., 2003), one can test the validity by the overidentification test. In the context of GMM, one can utilise the J statistics developed by Hansen (1982) to test for overidentifying restrictions. The Hansen J statistic is obtained by evaluating the value of the GMM objective function at the estimated parameters $\hat{\beta}$. It is Chi-square distributed, with degrees of freedom equal to the number of overidentifying restrictions. Failure to reject the null hypothesis suggests that the IVs satisfy the exogeneity requirement.

4.5 Summary

This chapter details the conceptual framework and research method. The conceptual framework suggests that FDI presence may impede the innovation activities of domestic SMEs, probably due to SMEs' low absorptive capacity, large technological gap, limited economies of scale, and low market power. However, institutions can positively moderate FDI spillovers to SMEs' innovation by promoting the foreign investors' incentive and ability to create technological spillovers, mitigating FDI crowding-out effects, enhancing domestic SMEs' absorptive capacity, and facilitating interaction and knowledge sharing in the local business environment. The institutional moderating effect may be stronger for FDI originating from developing countries/countries with lower institutional quality compared to that from developed countries/countries with higher institutional quality.

The modelling of innovation of domestic SMEs features a two-step decision-making process, where SMEs first decide whether to innovate, and if they choose to do so, they determine the optimal extent of innovation. In the first stage, the probability of innovation is specified in a Probit model as a function of a set of explanatory variables, including FDI presence, institutions and their interaction term. In the second stage, the observed innovation extent (R&D expenditure or the number of new products or processes) is conditioned on past innovation status to address the

sample selection issue. The key measures of innovation performance include R&D investment which indicates innovation input and product and process innovations which indicate innovation output.

In addition, a theoretical model with firm heterogeneity is established, which shows that FDI affects the number of new/improved products introduced by domestic firms through two channels: (*i*) the productivity and cut-off innovative capability of domestic firms and (*ii*) the probability of successful implementation of an innovation project. Based on the prediction of the theoretical model, the impacts of FDI presence and institutional moderation on the observed number of new/improved products are estimated through a two-stage estimation procedure.

An instrumental variable (IV) approach is utilised to address potential endogeneity problems of both FDI and institutional measures. IVs for FDI are constructed based on the regional and industrial dimensions of FDI presence. Institution quality is instrumented by multiple characteristics of the provincial leaders, of which tenure is the most important IV. The diagnostic tests for IVs include endogeneity, underidentification, and overidentification tests.

Chapter 5: Data

5.1. Introduction

This chapter describes the data used in the empirical analysis. Section 5.2 details the data sources comprising three different sources. Section 5.3 describes the construction of the main variables in the econometric models, including FDI presence, the institutional measure and other control variables. Section 5.4 describes the steps in data screening and construction of panel data. Section 5.5 reports and discusses summary statistics and the correlation matrix of the main variables in the analysis. Summary statistics for FDI presence and innovation of domestic SMEs by regions and industries are also presented, showing significant variation. Section 5.6 provides a preliminary analysis of the bivariate relationship between the explanatory and independent variables. Finally, Section 5.7 summarises the chapter.

5.2 Data Sources

The data for empirical analysis are constructed by merging different datasets from the following sources:

5.2.1 SME Survey Data

Data on SMEs come from the Small and Medium-sized Enterprise Survey (SME survey) provided by the United Nations University World Institute for Development Economics Research (UNU-WIDER) in collaboration with the Central Institute for Economic Management (CIEM), the Institute of Labour Science and Social Affairs (ILSSA), and the Development Economics Research Group (DERG) at the University of Copenhagen (CIEM et al., 2015). The survey is conducted every two years, tracking over 2,500 private manufacturing SMEs from 2005 to 2015

across nine provinces in Vietnam,[22] namely Hanoi, Hai Phong, Ho Chi Minh City, Phu Tho, Nghe An, Quang Nam, Khanh Hoa, Lam Dong, and Long An. The surveys interview SMEs owners/managers about firms' identity, production and technology, sale structure, inputs, finance, employment, owners/managers' characteristics, and firms' operational strategies, including innovation. I retrieved the survey rounds in 2011, 2013, and 2015 for analysis and excluded those from 2005 to 2009 due to a lack of critical information on standard 4-digit industry classification.

The information is collected from in-person interviews with business owners/managers and employees. The survey instrument is structured into three components: (*i*) the main component designed for business owners or managers; (*ii*) a questionnaire tailored for employees, distributed among a randomly selected subset of employees from 25% of enterprises chosen at random; and (*iii*) an economic accounts component. The enterprise-level survey gathers details on firm performance, historical background, employment, the business environment, and the background characteristics of owners/managers. In addition, the employee survey gathers information on employees' educational backgrounds, work experiences, training, union membership, and household characteristics. The economic accounts module provides details on revenues, costs, assets, and liabilities. The data used in this thesis are derived from the first and the third components to construct the panel data of SMEs.

To ensure a representative sample, stratified sampling was employed, aiming for a sufficient number of enterprises in each province with various ownership forms. The surveyed firms span

[22] Vietnam has a total of 63 provinces. The General Statistic Office of Vietnam groups the country's provinces into 6 regions, comprising: Northern Midlands and Mountains, Red River Delta, North and Central Coast, Central Highlands, South East, and Mekong River Delta. The classification is based on similarities in geographical location, natural, historical and socio-economic characteristics, and regional economic linkages. The 9 provinces covered in the data sample represent all 6 regions across the country.

24 manufacturing industries. The complete industry list is presented in Table A1 of the Appendix. The surveyed enterprises are categorized based on the latest World Bank classification, with micro-enterprises employing up to 10 workers, small-scale enterprises up to 50 employees, and medium-sized enterprises up to 300 employees.

5.2.2 FDI Data

FDI presence is retrieved from the Enterprise Survey compiled by the General Statistics Office (GSO) of Vietnam. This is possible because the survey provides a census record of ownership types and accounting information for virtually all formally registered enterprises operating in the country, with the only minor omission of domestic firms having less than 20 employees in several provinces. Among the firm-level surveys ever conducted in Vietnam, the GSO's Enterprise Survey has the largest coverage, consisting of approximately two million firm-year observations for 2011- 2015.

5.2.3 Institutional Data

Information on institutional quality is derived from the Provincial Competitiveness Index (PCI) constructed by the Vietnam Chamber of Commerce and Industry (VCCI). VCCI annually surveyed firms in Vietnam for their perceptions of the business environment, with support from the United States Agency for International Development (USAID). Notably, firms surveyed by VCCI may not be the same firms included in the SME data, mitigating the bias due to self-reporting.

The PCI assesses the quality of economic management, the business environment's convenience and friendliness, and the administrative reform efforts of provincial governments in Vietnam. In general, the PCI measures and evaluates the ability of provincial governments to promote the development of the private economic sector. It is not purely for scientific research or to laud or criticise provinces based on their PCI scores. Instead, the PCI helps explain why certain provinces surpass others in private economic development, job creation, and economic growth.

Annual PCI survey findings are available on the project's website,[23] serving as a valuable resource for provincial leaders and policymakers to pinpoint economic management obstacles and devise appropriate solutions for effective reform implementation.

The construction procedure of the PCI consists of three steps: firstly, gathering data from business surveys and published sources; secondly, computing nine sub-indices and standardizing them to a 10-point scale; and finally, calculating the composite PCI as the weighted average of the nine sub-indices. Firms are chosen through random sampling to reflect provincial demographics, with stratification employed to ensure adequate representation of legal types, industrial sectors, and firm age. Regarding the legal type, the lists of firms provided by the local tax authorities are used to group businesses by type, comprising private enterprise, limited liability company, and joint stock company. The list of industries includes industrial production, construction, resource exploitation, services and trade and agriculture, forestry and fishery. Three age groups are considered, including enterprises established before 2000, when the 2000 *Enterprise Law* took effect; those established in 2000-2009; and those from 2010 onwards. The business size is not used for grouping because this criterion is highly correlated with the business type criterion.

The PCI involves nine sub-indices, each assessing a different aspect of institutions. Each subindex is a continuous variable, ranging from 1 to 10, with a higher score indicating a higher quality of the institutional environment. The description of the nine sub-indices is as follows:

(*i*) Low entry costs for new business (*entry cost*): Assesses the difference in market entry costs of newly established businesses across provinces;

[23] Accessible at www.pcivietnam.vn.

(*ii*) Easy access to land and security of business premises (*land access*): Measures two aspects of land issues that firms potentially face, whether it is easy for firms to access land and whether firms feel secure and assured of stability after acquiring business premises;

(*iii*) Transparency in a business environment and equal access to business information (*transparency*): Measures the ability to access provincial plans and legal documents necessary for business operations, whether firms can equally access these documents, whether policy makers have consulted with firms about new policies and regulations and the predictability in implementing those policies and regulations, and the level of convenience of the provincial website for firms;

(*iv*) Minimal bribe payments in exchange for public services (*control of corruption*): Measures the costs of bribery that firms have to pay and the obstacles these unofficial costs cause to the business activities of the business, whether paying bribes brings the expected results or services and whether public officials make use of local regulations for bribery extraction;

(*v*) Less time spent on performing bureaucratic procedures and inspections (*time cost*): Measures the time firms have to spend to carry out administrative procedures and how often and how long firms have to suspend their business operation to allow local public agencies to carry out inspections and checks;

(*vi*) Proactivity and creativeness of provincial leadership in addressing enterprises' problems (*proactivity*): Measures the creativity and insight of provincial leaders in the process of implementing central policies as well as in launching local initiatives to develop the private economic sector and at the same time evaluate the ability to support and apply unclear central policies in a direction that is beneficial to businesses;

(*vii*) The quality of business support services (*business support*): Evaluates the public services of a province to foster the development of the private sector, such as trade promotion, providing legal advice to businesses, supporting finding business partners, developing industrial zones, and provide technology services for businesses;

(*viii*) Sound labour training policies (*labour train*): Measures provincial leaders' efforts to promote vocational training and skills development to support local industries and help workers find jobs;

(*ix*) The ability of the legal and judicial system to settle disputes fairly and effectively (*rule of law*): Measures the trust of private businesses in the province's court and judicial system, whether firms consider these legal institutions to be effective tools to resolve disputes, and the availability of a place where firms can complain about misconduct by local public officials.

5.3 Variable Construction

5.3.1 FDI Measures

In the baseline analysis, FDI is proxied by the horizontal FDI presence (FDI_H_{jdt}) measured as the proportion of FDI firms' outputs in each 4-digit industry in each region and year:

$$FDI\_H_{jdt} = \frac{\sum_{i \in \mathrm{M}_{jdt}^{F}} \mathrm{O}_{ijdt}}{\sum_{i \in \mathrm{M}_{jdt}^{F} \cup \mathrm{M}_{jdt}^{D}} \mathrm{O}_{ijdt}}$$

where O denotes outputs; M_{jdt}^{F} is the set of FDI firms and M_{jdt}^{D} is the set of domestic firms.

Later, I also conduct sensitivity analysis for different measures of FDI presence, including forward FDI (FDI_F_{jdt}) and backward FDI (FDI_B_{jdt}). Following prior literature on FDI spillovers (see, e.g., Anwar & Nguyen, 2011a; Newman et al., 2015; Nguyen et al., 2019), the backward linkage is measured as follows:

$$FDI\_B_{jdt} = \sum\nolimits_{l \neq j} \nu_{ljd} FDI\_H_{ldt}$$

where ν_{ljd} is the proportion of the outputs of industry *j* supplied to industry *l* in region *d*. In addition, the forward linkage is measured as follows:

$$FDI\_F_{jdt} = \sum\nolimits_{h \neq j} \varsigma_{gjd} FDI\_H_{hdt}$$

where ς_{gjd} is the proportion of the output of industry j purchased from industry g in region d. The values of ν_{ljd} and ς_{gjd} are calculated from the 2012 Input-Output Tables, estimated by the General Statistics Office (GSO) of Vietnam. Since different measures of FDI presence are highly correlated with each other, later in the analysis, I also use the principal component analysis (PCA) to construct a composite FDI index (FDI_index_{jdt}) that incorporates both horizontal FDI and vertical FDI.

5.3.2 Institutional Measures

The Provincial Competitiveness Index (PCI) from 2011-2015 assesses institutional development based on the following nine criteria: (i) *entry cost*, (ii) *land access*, (iii) *transparency*, (iv) *control of corruption*, (v) *time cost*, (vi) *proactivity*, (vii) *business support*, (viii) *labour training*, and (ix) *rule of law*.[24] These indicators have been widely accepted as appropriate and comprehensive measures of institutional quality and have been used in institutional-related literature (see, e.g., Bai et al., 2019; Nguyen & Van Dijk, 2012; Tran, 2019). These sub-indices are continuous variables that take values from 1 to 10, with a higher score indicating higher institutional quality.[25]

Due to the multi-dimensional nature of institutions, principal component analysis (PCA) is employed to construct a single index that captures the overall quality of the institutional environment. PCA is a commonly used statistical technique to reduce the data dimensionality. Following the steps set out by Phan et al. (2020), I first calculate factor scores from the nine initial institutional sub-indices. Through PCA, factor scores are derived from the eigenvectors

[24] The definitions of these indices are presented in *Subsection 5.2.3. Institutional Data*.
[25] Details on questionnaires and methodology can be found on the official PCI website at https://pcivietnam.vn/, and the PCI handbook of instructions available online at https://pcivietnam.vn/uploads//VN-Nghien-cuu-khac/So-tay-2018-PCI.pdf.

associated with the covariance matrix of the initial variables. These factors are linearly weighted combinations of the initial variables, which account for more data variations than any other linear combinations. The factors are arranged in order, with the first one explaining the most significant data variations. Subsequent factors, which are orthogonal to the preceding ones, describe additional variations, though to a lesser degree. As a result, each factor captures a distinct dimension to the original data. The factor scores of PCA analysis are presented in Table A3 of the Appendix.

Next, the factors that explain the largest variations in the data (weighted by the shares of variation explained) are linearly combined to produce a single institutional index. Consistent with standard practice, I use factors with eigenvalues of no less than 1 and exclude the others. Finally, for ease of result interpretation, the index is rescaled to range from 1 to 10 using the following formula: $INST = \frac{x - x\_min}{x\_max - x\_min} \times 9 + 1$, where x is a particular factor score, and x_max and x_min are the maximum and minimum factor scores of all province-year observations, respectively.

5.3.3 Control Variables

Following prior studies on determinants of innovation (e.g., Anwar & Sun, 2014; Lai et al., 2015; Lee & Sung, 2005), several firm-specific and industry-specific characteristics are included as control variables in the analysis. Specifically, firm size (*FIRMSIZE*) is measured by the natural logarithm of total assets. Firm age (*FIRMAGE*) is the number of years in operation. Return on Assets (*ROA*), which indicates profitability, is measured by the ratio of net profit against total assets. I also incorporate several managerial characteristics, including *GENDER* which equals 1 if the SME owner/manager is male, and 0 otherwise; *AGE* which is the age of the SME owner/manager; and *HUMANCAP* which equals 1 if the owner/manager has obtained upper secondary education and above, and 0 otherwise. The quality of the labour force (*LSKILL*) is the ratio of qualified professional employees to the total workforce. *EXPORT* equals 1 if the firm exported its products in the survey period, and 0 otherwise; while *ZONE* is a dummy variable

indicating whether the firm is located in an industrial zone. Finally, industry effects are controlled by the technological gap (*TECHGAP*), measured by the percentage difference in the average productivity between foreign firms and domestic firms in the same industry. Market concentration is measured by the Herfindahl index (*HERFINDAHL*), which is calculated by the sum of squared market shares in a 4-digit industry. provides the description and data sources of the main variables in the empirical analysis.

Table 5.1. Variable description

Variables	Description	Data source[a]
Innovation measures		**SME survey**
RDD	Dummy variable, equal 1 if the firm engaged in R&D activity in the survey year	
RDE	Natural logarithm of real R&D expenditure	
NPD	Dummy variable, equal 1 if the firm has introduced new product groups since the last survey	
NPDN	The number of new products	
NPC	Dummy variable, equal 1 if the firm has introduced new production processes/new technology.	
NPCN	The number of new production processes/new technology	
Institutional measure		**PCI survey**
INST	Institutional quality index	
Firm-level controls		**SME survey**
ROA	Firm performance measured by the ratio of net profit to total assets	
FIRMSIZE	Firm size measured by the natural log of total assets	
FIRMAGE	Firm age calculated by subtracting the year of establishment from the survey year	
GENDER	Dummy variable, equal 1 if the SME owner/manager is male, and 0 otherwise	
AGE	Age of SME's owner/manager	
HUMANCAP	Equal 1 if an SME's owner/manager obtained upper secondary education, 0 otherwise	
LSKILL	The ratio of professional employees with qualifications to total employees	
EXPORT	Equal 1 if the firm exported its products in the survey period	
ZONE	Equal 1 if the firm is located in an industrial zone	
Industry-level controls		
HERFINDAHL	Herfindahl index	**Enterprise Survey – General Statistics Office of Vietnam**
TECHGAP	Percentage difference in the average productivity between foreign firms and domestic firms in the same sector	

[a] The details of data sources are presented in Subsection 5.2 Data Sources.

5.4 Data Screening and Construction of Panel Data

The panel data construction begins with processing the GSO's Enterprise Survey. A dummy variable indicating FDI firms is created, encompassing both wholly foreign-owned and joint-ventured firms. 4-digit industry codes are extracted from the information on Vietnam Standard Industrial Classification (VSIC). Sales revenue is aggregated by 4-digit industry and region to

calculate the total output in each industry in each region. Only FDI firms are retained, and FDI sales revenue is summed by 4-digit industry and region to calculate industry-region FDI output. Data on total output and FDI output are merged based on the 4-digit industry code and region code. Subsequently, horizontal FDI presence is calculated by dividing FDI output by total output. After obtaining ν_{ljd} (the weight of upstream linkages) and ς_{gjd} (the weight of downstream linkages) from the 2012 Input-Output Tables, backward FDI and forward FDI are constructed following the formulas given in *Subsection 5.3.1 FDI measures*. FDI presence is calculated for 2011, 2013 and 2015 and appended using the 4-digit industry code to form a longitudinal dataset. Meanwhile, the Herfindahl index and technology gap are also calculated for each 4-digit industry in each year.

Second, PCI data are prepared for each year. Institutional sub-indices are re-coded and labelled for consistency across years. It is worth noting that in 2013, the PCI survey introduced a new subindex that evaluates the ability of the provincial government to create equal treatment for firms.[26] However, this index is ruled out to ensure that the institutional measures are comparable across years. In addition, provinces are re-coded to match the province codes in the SME survey data.

Third, SME survey data are processed. 2-digit and 4-digit industry codes are extracted. Innovation variables and firm-level control variables are constructed for each survey year, following the specifications in *Subsection 5.3.3 Control variable*. Among these, wages are deflated to the 2011 constant price using the CPI provided by GSO. Total assets and R&D expenditure are deflated to the 2011 constant price using the Producer Price Index from GSO. All key monetary variables are deflated and measured consistently across years, that is million VND.

[26] Equal treatment is evident by no excessive favours towards FDI firms, state-owned firms, firms with political connection or large firms.

Observations with missing or unreliable values, such as 2-digit industry codes[27] greater than 33 and labour sizes greater than 300, are removed. A panel dataset on SMEs is established by aligning firms' unique identifiers across years. The dataset is unbalanced, reflecting SMEs' entry and exit during the survey period.

The final step is to combine the above datasets to obtain a single panel dataset for examining the moderating effects of institutions on FDI spillovers to the innovation of domestic SMEs. Data on FDI presence, the Herfindahl index and the technology gap are merged into the SME dataset based on 4-digit industry, region, and year codes. Data on institutional quality are merged into the SME data set based on province and year code. After winsorising data at the 1st and 99th percentile, the final panel data set consists of 7,563 firm-year observations covering 2,690 Vietnamese SMEs during 2011-2015.

5.5 Summary Statistics

Table 5.2 provides summary statistics of the main variables in the empirical analysis, which shows substantial variation for estimations. The probability of domestic SMEs having R&D activities is merely 0.7%. The proportions of firm-year observations of domestic SMEs introducing new products and adopting new processes/technologies are modest at 9.4% and 8.l%, respectively. The main type of innovative activity of domestic SMEs is incremental innovation, which is indicated by a large probability of product improvement at 76%. As the vast majority of SMEs do not conduct R&D investment, the sample average of R&D expenditure is very small at 2.213 million VND, with a standard deviation of 53.296 million VND. The number of new products introduced by SMEs ranges from 0 to 21, with a sample average of 0.134. The number

[27] The 2-digit code for manufacturing industries ranges from 10 to 33, and SMEs are defined as enterprises having no more than 300 employees.

of product improvements has a greater range from 0 to 98, with a larger sample average of 0.76. The number of new processes/technologies introduced by SMEs ranges from 0 to 16, with a small sample average of 0.159.

FDI firms display a moderate presence in manufacturing, with an average output share of 27.9%. The maximum FDI output share is 100%, which is possible since the GSO Enterprise Survey omits domestic micro firms in some provinces. The minimum FDI output share is zero, implying no presence of FDI. The presence of backward FDI is 22%, and that of forward FDI is 19.9%. The composite institutional index ranges from 1 to 10, which is consistent with the construction described in *Subsection 5.3.2 Institutional Measure*.

The summary statistics of other control variables provide some insight into the generalized characteristics of SMEs. The average ROA is 0.295, with a standard deviation of 0.4516. A negative ROA means that the firm is making a loss, which accounts for 2% of the sample. Approximately 10% of the sample have a value of ROA greater than 1. Firm size is summarised using the initial value before log transforming the data, with a sample average of 4.833 billion VND. SMEs' owners/managers have an average age of 46.122, among whom 60.7% are male and 68% have an education level of upper secondary or above. On average, only 6.4% of SMEs' employees have professional qualifications, suggesting an overall low level of labour skills. Merely 4.8% of the total firm-year observations engage in export, and 2.4% of the sample are located in an industrial zone. The sample average of market concentration measured by the Herfindahl index is relatively low at 0.065, which features monopolistically competitive markets. As for the technological gap, the negative values mean that the average productivity of domestic firms is greater than that of foreign firms in the same industry. Only 18% of 4-digit industries in the sample have negative values of technological gap.

Table 5.2. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RDD	7,563	0.007	0.083	0	1
RDE	7,563	2.213	53.296	0	2,281.235
NPD	7,563	0.094	0.292	0	1
NPDN	7,563	0.134	0.582	0	21
IMPDN	7,563	0.760	2.645	0	98
NPC	7,563	0.081	0.273	0	1
NPCN	7,563	0.159	0.675	0	16
FDI_H	7,563	0.279	0.271	0	1
FDI_B	7,563	0.220	0.159	0	0.860
FDI_F	7,563	0.199	0.162	0	0.690
FDI_index	7,563	0.248	0.180	0	1
INST	7,563	4.089	2.153	1	10
ROA	7,563	0.295	0.416	-0.033	2.440
FIRMSIZE	7,563	4,833	9,878	22,100	6.49e+07
FIRMAGE	7,563	15.204	9.973	2	76
GENDER	7,563	0.607	0.488	0	1
AGE	7,563	46.122	10.851	17	94
HUMANCAP	7,563	0.680	0.467	0	1
LSKILL	7,563	0.064	0.245	0	1
EXPORT	7,563	0.048	0.213	0	1
ZONE	7,563	0.024	0.059	0.000	0.800
HERFINDAHL	7,563	0.065	0.098	0.002	1
TECHGAP	7,563	1.021	1.674	-0.890	14.367

Note. This table reports the summary statistics of the main variables in the analysis.

Table 5.3 reports the correlation matrix of the main explanatory variables in the empirical analysis, which enables the detection of multicollinearity. Multicollinearity arises when two or more independent variables are highly, but not perfectly, correlated with one another. A strong linear relationship between independent variables can enlarge the variance for the estimator, thereby reducing the estimation efficiency (Wooldridge, 2006). Table 5.3 shows small values of correlation coefficients among independent variables, which are all less than 0.36. Therefore, multicollinearity is not a severe problem in the analysis.

Table 5.3. Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	*FDI*	1												
2	*INST*	0.021	1											
3	*ROA*	0.006	0.027*	1										
4	*FIRMSIZE*	0.168***	-0.144***	-0.484***	1									
5	*FIRMAGE*	-0.125***	-0.024*	-0.025*	-0.133***	1								
6	*GENDER*	-0.093***	-0.033**	-0.010	-0.060***	0.040***	1							
7	*AGE*	-0.080***	0.008	-0.069***	-0.090***	0.353***	0.167***	1						
8	*HUMANCAP*	0.126***	-0.107***	-0.058***	0.305***	-0.152***	-0.010	-0.146***	1					
9	*LSKILL*	0.103***	0.008	-0.040***	0.360***	-0.128***	-0.092***	-0.110***	0.232***	1				
10	*EXPORT*	0.056***	-0.065***	0.007	0.262***	-0.043***	-0.051***	-0.074***	0.140***	0.161***	1			
11	*ZONE*	-0.005	-0.095***	-0.044***	0.260***	-0.055***	-0.042***	-0.063***	0.129***	0.184***	0.156***	1		
12	*HERFINDAHL*	-0.055***	0.047***	0.004	-0.074***	0.041***	-0.036**	0.035**	-0.096***	-0.044***	-0.060***	-0.048***	1	
13	*TECHGAP*	0.032**	0.099***	0.060***	-0.079***	-0.049***	-0.032**	0.008	-0.022	0.046***	-0.0111	-0.0115	0.229***	1

Note. *FDI* is measured by horizontal FDI presence (*FDI_H*). *,** and *** denote significant levels at 10%, 5% and 1%, respectively

It is important to highlight geographical and industry heterogeneity with respect to domestic SMEs' innovation behaviour. Therefore, I also calculate the means of dependent variables, including the dummy variables for new product innovation (*NPD*), the number of new products (*NPDN*), the dummy variable for new process innovation (*NPC*) and the number of new processes (*NPCN*) across regions and industries. Table 5.4 reports the descriptive statistics grouped by region, while Chi-square statistics and F-statistics are reported to test whether the mean values are significantly different across regions and industries.

Table 5.4 shows that the mean values of *NPD* and *NPDN* for Northern and Central Coast are higher than the sample average. South East has relatively higher mean values for both *NPC* and *NPCN* (higher than the sample average). In Mekong River Delta, the mean values of three innovation indicators, including *RDD*, *NPC* and *NPCN,* are higher than the sample average. Notably, Central Highlands have relatively higher mean values for five out of six innovation indicators (except for *NPD*), implying that SMEs in Central Highlands engage the most in innovative activities. The statistics of Chi-square tests and F tests are statistically significant, indicating that product and process innovations of SMEs vary significantly across regions.

Table 5.4. Mean values of innovation variables across regions

Region	*RDD*	*RDE*	*NPD*	*NPDN*	*NPC*	*NPCN*
Northern Midlands and Mountains	0.005	2.536	0.105	0.117	0.047	0.107
Red River Delta	0.011	3.084	0.076	0.119	0.070	0.139
North and Central Coast	0.005	0.722	0.119	0.175	0.077	0.151
Central Highlands	0.015	11.731	0.092	0.254	0.115	0.185
South East	0.003	1.380	0.092	0.107	0.101	0.204
Mekong River Delta	0.008	1.827	0.090	0.130	0.113	0.197
Chi-square statistics	12.882**		23.803***		35.610***	
F statistics		2.04*		5.24***		3.41***

Note. ***, **, * denote significant levels at 1%, 5% and 10%, respectively. *RDE* is in million VND.

Table 5.5 reports the descriptive statistics grouped by 2-digit industry. The table also demonstrates significant differences in the distribution of domestic SMEs' product and process innovations among industries. The top 4 industries with the highest probabilities of firms conducting R&D investment are Computer, electronic and optical products; Pharmaceuticals' Basic metals; and Paper and paper products. The top 4 industries with the highest levels of R&D expenditure are Basic metals, Beverages, Leather, and Paper and paper products.

The top 4 industries with the highest level of product innovation are Machinery and equipment, Vehicles, Transportation equipment, and Computer, electronic and optical products. The top 4 industries with the highest level of product innovation are Electrical equipment, Paper and paper products, Pharmaceuticals, and Vehicles. This is not surprising given that these industries are classified as highly technologically intensive industries according to OECD (2011) and Eurostat (2022) (except for Paper and paper products). Chi-square tests and F tests produce statistically significant statistics, indicating that product and process innovations of SMEs differ significantly among industries.

Table 5.5. Mean values of innovation variables across 2-digit industries

Industry code	Industry	*RDD*	*RDE*	*NPD*	*NPDN*	*NPC*	*NPCN*
10	Food products	0.005	2.467	0.083	0.108	0.081	0.125
11	Beverages	0.011	7.386	0.057	0.074	0.085	0.188
13	Textiles	0.000	0.000	0.072	0.165	0.082	0.169
14	Wearing apparel	0.003	1.034	0.080	0.124	0.067	0.186
15	Leather and related products	0.006	6.790	0.105	0.148	0.086	0.142
16	Wood and products of wood and cork	0.005	0.154	0.123	0.145	0.049	0.129
17	Paper and paper products	0.025	6.164	0.109	0.149	0.164	0.338
18	Printing and reproduction of recorded media	0.000	0.000	0.080	0.080	0.094	0.259
19	Coke and refined petroleum products	0.000	0.000	0.042	0.042	0.042	0.042
20	Chemicals and chemical products	0.010	5.000	0.060	0.060	0.110	0.172
21	Pharmaceuticals, medicinal chemicals and botanical products	0.047	3.256	0.023	0.023	0.163	0.605
22	Rubber and plastic products	0.007	4.974	0.052	0.066	0.088	0.150
23	Non-metallic mineral products	0.013	0.668	0.100	0.160	0.097	0.138
24	Basic metals	0.033	7.582	0.143	0.154	0.088	0.121
25	Fabricated metal products	0.004	0.288	0.116	0.169	0.067	0.143
26	Computer, electronic and optical products	0.071	3.571	0.143	0.250	0.071	0.071
27	Electrical equipment	0.000	0.000	0.078	0.108	0.186	0.314
28	Machinery and equipment	0.015	4.773	0.182	0.530	0.106	0.212
29	Motor vehicles, trailers and semitrailers	0.000	0.000	0.158	0.368	0.132	0.316
30	Other transport equipment	0.000	0.000	0.167	0.250	0.042	0.042
31	Furniture	0.006	1.772	0.079	0.132	0.085	0.213
32	Other manufacturing	0.071	43.214	0.125	0.179	0.071	0.143
33	Repair and installation of machinery and equipment	0.000	0.000	0.227	0.273	0.000	0.000
	Chi-square statistics	136.26***		68.327***		67.065***	
	F statistics		1.44*		2.63***		2.71***

Note. ***, **, * denote significant levels at 1%, 5% and 10%, respectively. *RDE* is in million VND.

Table 5.6 reports the average of horizontal and vertical FDI presence across regions. The region with the highest FDI presence in terms of output share is the South East region, with an average horizontal FDI presence of 0.510, backward FDI presence of 0.412, and forward FDI presence of 0.412. The lowest FDI presence is observed in the Central Highlands region, with average horizontal FDI, backward FDI and forward FDI presence of 0.045, 0.057, and 0.043, respectively. There is a noticeable difference in the FDI presence between the South East region and the other regions, with significantly higher values for all types of FDI. The high FDI presence in the South East region can be attributed to various factors such as its proximity to major ports

and airports, availability of skilled labour, and favourable business environment. The low FDI presence in the Central Highlands region could be due to its relatively remote location, limited infrastructure, and a less developed industrial base. Interestingly, Table 5.4 suggests that SMEs in Central Highlands tend to perform the best in terms of innovation. The F tests produce statistically significant statistics, indicating that FDI presence differs significantly among regions.

Table 5.6. Mean values of FDI variables across regions

Region code	Region	*FDI_H*	*FDI_B*	*FDI_F*
1	Northern Midlands and Mountains	0.220	0.154	0.158
2	Red River Delta	0.216	0.181	0.150
3	North and Central Coast	0.200	0.135	0.090
4	Central Highlands	0.045	0.057	0.043
5	South East	0.510	0.412	0.412
6	Mekong River Delta	0.228	0.181	0.189
	F statistics	496.34***	1522.58***	2249.56***

Note. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.

Table 5.7 shows the average horizontal and vertical FDI presence across 2-digit manufacturing industries. Industries with the highest levels of FDI presence, both horizontally and vertically, are Computer, electronic and optical products, with *FDI_H* at 0.797, *FDI_B* at 0.665, and *FDI_F* at 0.664; Wearing apparel, with *FDI_H* at 0.511, *FDI_B* at 0.439, and *FDI_F* at 0.412; and Motor vehicles, trailers and semitrailers, with *FDI_H* at 0.609, *FDI_B* at 0.578, and *FDI_F* at 0.475. In addition, Electrical equipment has a high level of horizontal FDI presence with an output share of 58.4%. Most of the aforementioned industries are medium and high-tech, indicating that FDI plays a dominant role in industries with high levels of technological intensity. Overall, there is some overlap between high-tech industries and those that attract FDI inflows.

This is consistent with the analysis provided in Chapter 3,[28] that is, Vietnam prioritises attracting significant foreign investment in industries with high levels of technological intensity. This could be due to factors such as the development of a skilled workforce, favourable government policies for FDI in high-tech industry, and a growing market for technology products.

There are differences in the presence of horizontal FDI, backward FDI, and forward FDI across industries. For example, in the Computer, electronic and optical products industry, all three types of FDI have a high presence, indicating a diverse range of intra-industry and inter-industry linkages. In contrast, in the Wood and products of wood and cork industry, the presence of backward FDI is significantly higher than horizontal and forward FDI. This suggests that the industry plays a more important role as a supplier to foreign firms. The Electrical equipment industry has a high level of FDI presence in the same industry but low FDI presence in upstream and downstream industries, suggesting weak inter-industry linkages. The high F-test statistics (99.38 for horizontal FDI, 329.31 for backward FDI, and 312.93 for forward FDI) suggest that the FDI presence varies significantly among different industries. This could be due to factors such as industry-specific characteristics, market conditions, and investment incentives.

Table 5.7. Mean values of FDI variables across 2-digit industries

Industry code	Industry	*FDI_H*	*FDI_B*	*FDI_F*
10	Food products	0.241	0.142	0.111
11	Beverages	0.225	0.130	0.180
13	Textiles	0.394	0.366	0.312
14	Wearing apparel	0.511	0.439	0.412
15	Leather and related products	0.658	0.562	0.435
16	Wood and products of wood and cork	0.057	0.140	0.064
17	Paper and paper products	0.327	0.322	0.282

[28] It is worth noting that Chapter 3 presents population FDI presence while the summary statistics in this section are drawn from the sample of 2,690 SMEs used in the empirical analysis.

18	Printing and reproduction of recorded media	0.100	0.167	0.299
19	Coke and refined petroleum products	0.326	0.098	0.126
20	Chemicals and chemical products	0.505	0.332	0.294
21	Pharmaceuticals, medicinal chemical and botanical products	0.259	0.167	0.259
22	Rubber and plastics products	0.385	0.400	0.418
23	Non-metallic mineral products	0.219	0.094	0.122
24	Basic metals	0.148	0.233	0.202
25	Fabricated metal products	0.324	0.241	0.215
26	Computer, electronic and optical products	0.797	0.665	0.664
27	Electrical equipment	0.584	0.361	0.390
28	Machinery and equipment	0.291	0.164	0.310
29	Motor vehicles, trailers and semitrailers	0.609	0.578	0.475
30	Other transport equipment	0.348	0.415	0.300
31	Furniture	0.167	0.111	0.102
32	Other manufacturing	0.732	0.291	0.355
33	Repair and installation of machinery and equipment	0.071	0.198	0.278
	F statistics	99.38***	329.31***	312.93***

Note. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.

5.6 Preliminary Analysis

This section provides a preliminary analysis of the relationship between explanatory variables and dependent variables. The focus is on the dummy innovation variables because investigating the count variables requires advanced econometric techniques set out in *Section 4.3 Model Specifications*. The purpose of this section is to form a rough idea of the relevance of each explanatory variable to the innovation decision of domestic SMEs, that is, whether the firm chooses to innovate or not. Accordingly, a bivariate analysis is conducted using data visualization and test statistics.

5.6.1 Numerical Explanatory Variables

Regarding the relationship between the numerical explanatory variables and the dummy dependent variables, the mean and confidence intervals of a numerical variable are plotted separately for with and without innovation SME groups. In addition, a t-test is employed to compare the means of a continuous variable between two categories, that is, with and without innovation activity. Under the null hypothesis, there is no difference between the means of the

two groups, and the alternative hypothesis is that the difference is different from zero. The summary of t-test statistics is presented in Table 5.8.

Figure 5.1 plots the mean and confidence limits of FDI presence measured by FDI output share in the same industry against innovation status, including R&D investment, the new product introduction, product improvement and new processes/technologies adoption. These plots show no apparent difference in FDI presence between innovators and non-innovators. According to the t statistics in Table 5.8, there is no statistically significant relationship between FDI presence and R&D investment and between FDI presence and new product innovation. On the other hand, SMEs with product improvement and those with new processes/technologies tend to have higher average FDI presence than their non-innovating counterparts. These differences are statistically significant, yet the magnitudes are minimal.

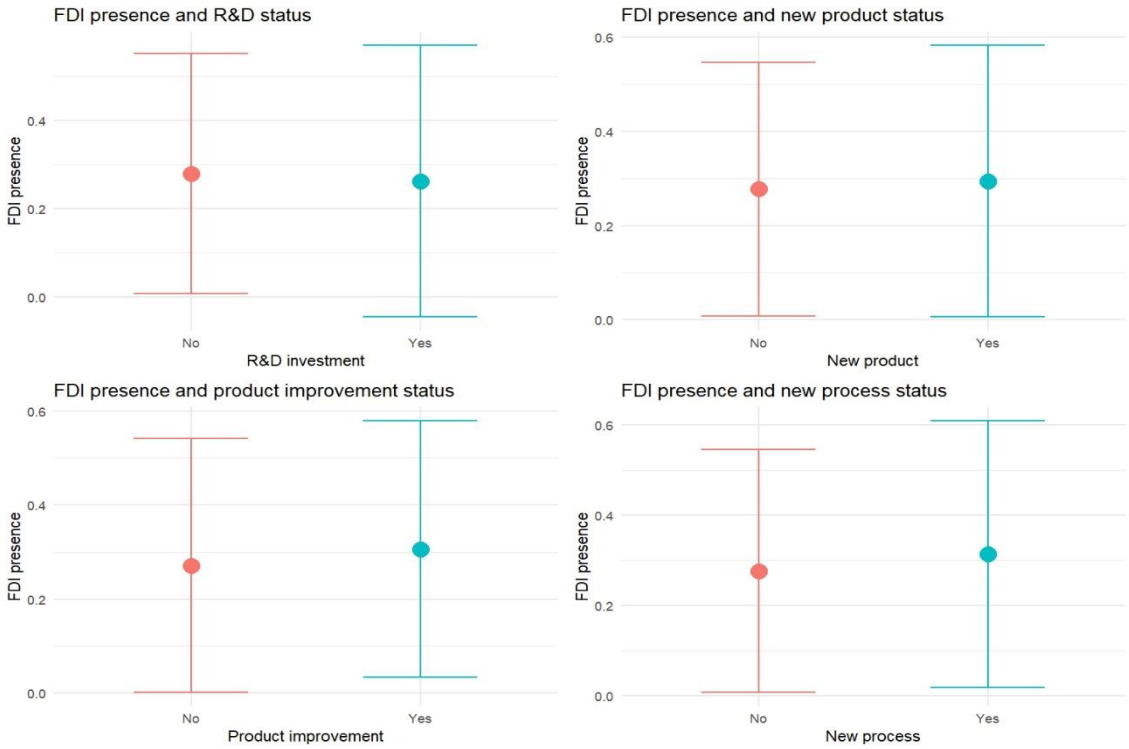

Figure 5.1. FDI presence and innovation status of domestic SMEs

Figure 5.2 plots the mean and confidence intervals of institutional quality scores against innovation status, including R&D investment, new product introduction, product improvement and new processes/technologies adoption. The figure shows no significant difference between firms with and without R&D investment. The average institutional quality score is lower for firms

with new products than those without, but higher for firms with product improvement and process innovation as opposed to the non-innovator groups. The t-test statistics in Table 5.8 confirm that these differences are statistically significant.

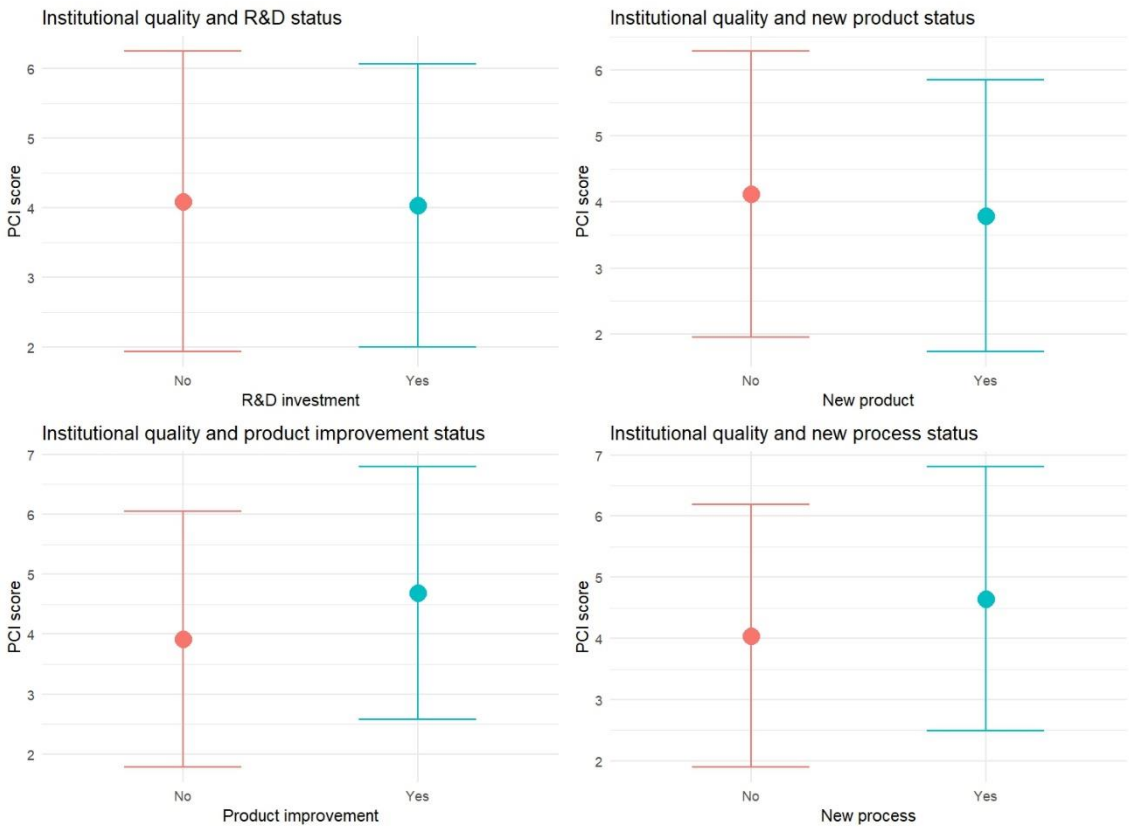

Figure 5.2. Institutional quality and innovation status of domestic SMEs

Figure 5.3 plots the mean and confidence intervals of ROA against innovation status, including R&D investment, new product introduction, product improvement and new processes/technologies adoption. The figure illustrates that innovators tend to have higher average ROA than non-innovators, except for new product innovation. The t-statistics in Table 5.8 indicate that the differences in average ROA between innovators and non-innovators are statistically significant in terms of R&D investment, new product introduction, and process innovation.

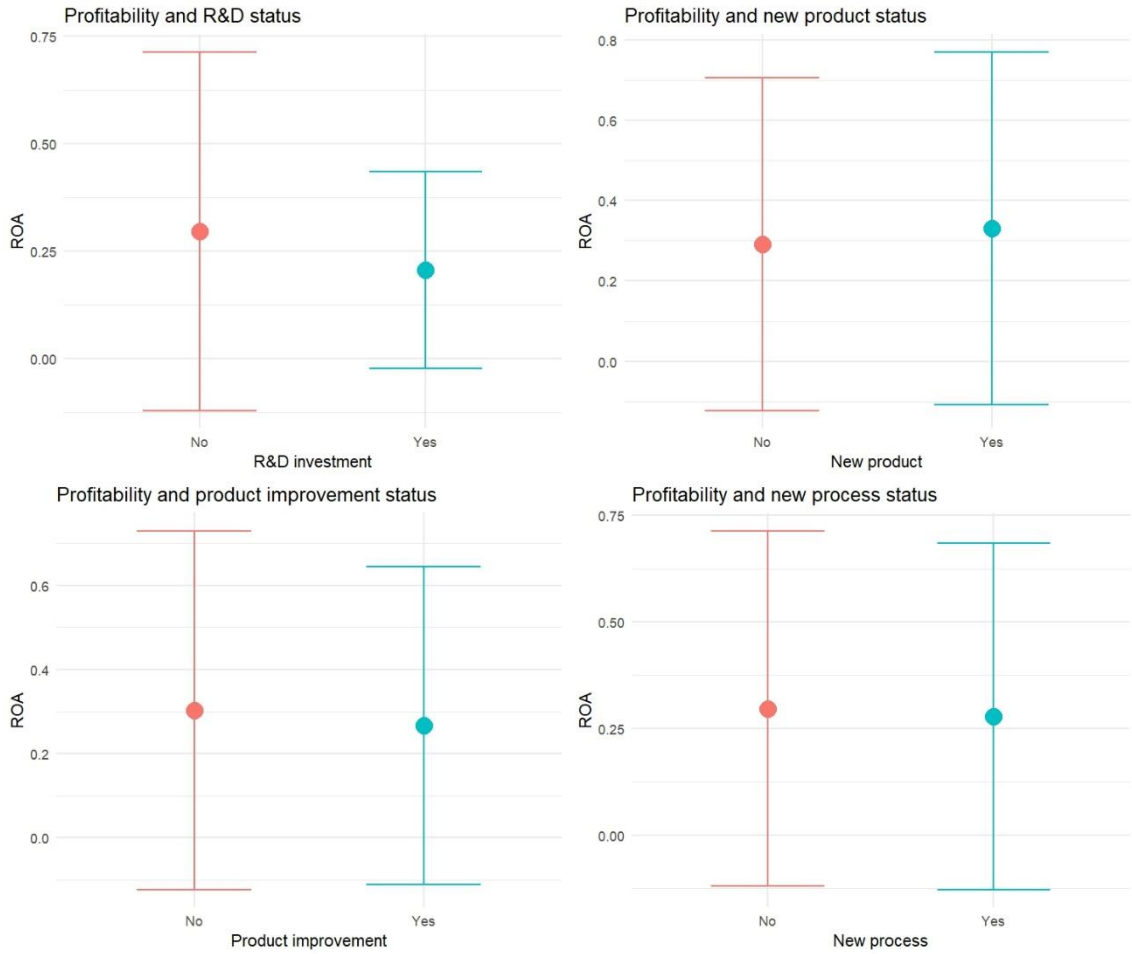

Figure 5.3. Profitability and innovation status of domestic SMEs

Figure 5.4 plots the mean and confidence intervals of firm size measured by the natural logarithm of total assets against innovation status, including R&D investment, new product introduction, product improvement and new processes/technologies adoption. As can be seen from the figure, there is no obvious difference in average firm size between firms with and without new products. However, the average firm size is higher for firms engaging in R&D activity, improving existing products and adopting new technologies than their non-innovating counterparts. The t-statistics in Table 5.8 support this, indicating that the differences in average firm size between innovators and non-innovators are statistically significant regarding R&D investment, product improvement, and process innovation.

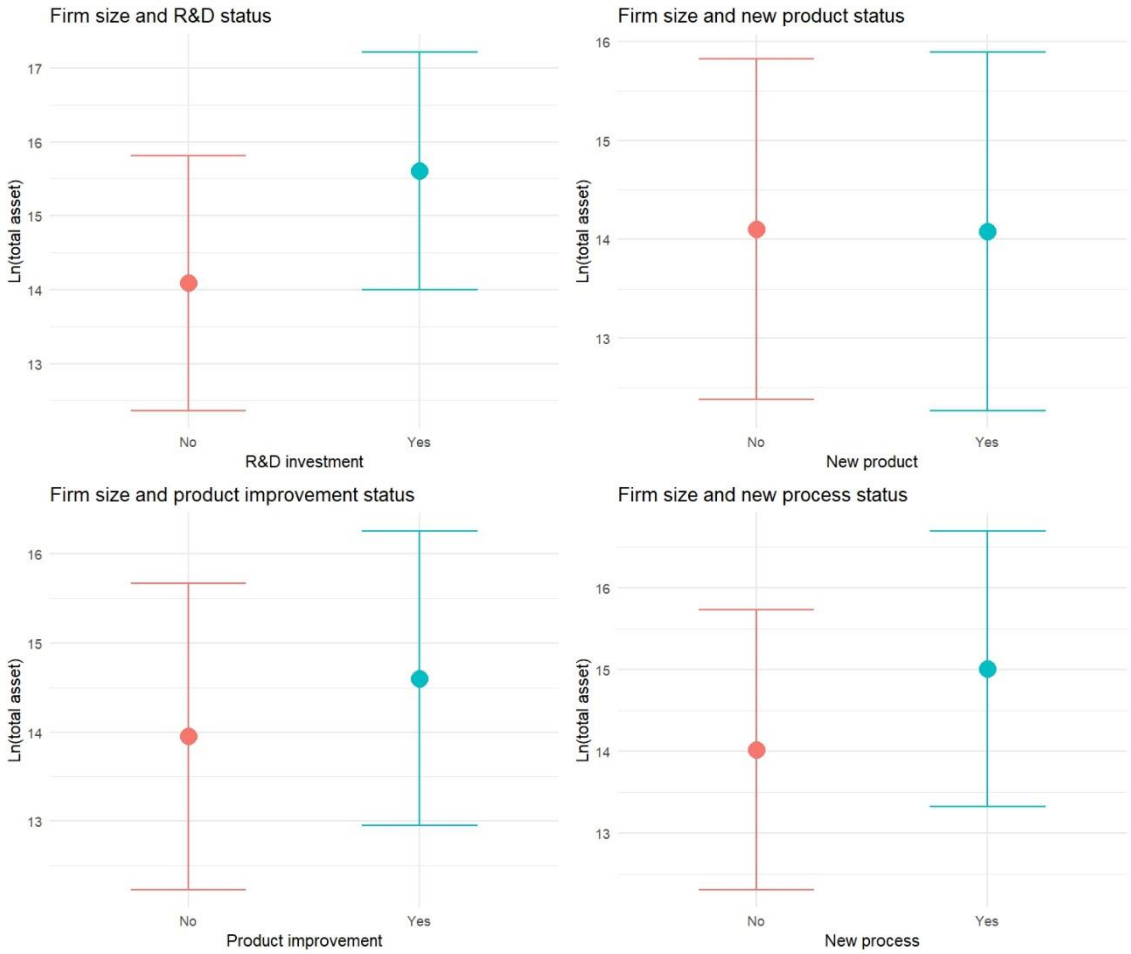

Figure 5.4. Firm size and innovation status of domestic SMEs

Figure 5.5 plots the mean and confidence intervals of firm age against innovation status, including R&D investment, new product introduction, product improvement and new processes/technologies adoption. As demonstrated in the figure, the average firm age is higher for firms introducing new products than those who do not. However, the average firm age is lower for firms engaging in R&D activity, improving existing products and adopting new technologies compared to their non-innovating counterparts. The t-statistics in Table 5.8 support this, indicating that the differences in average firm age between innovators and non-innovators are statistically significant regarding R&D investment, product improvement, and process innovation.

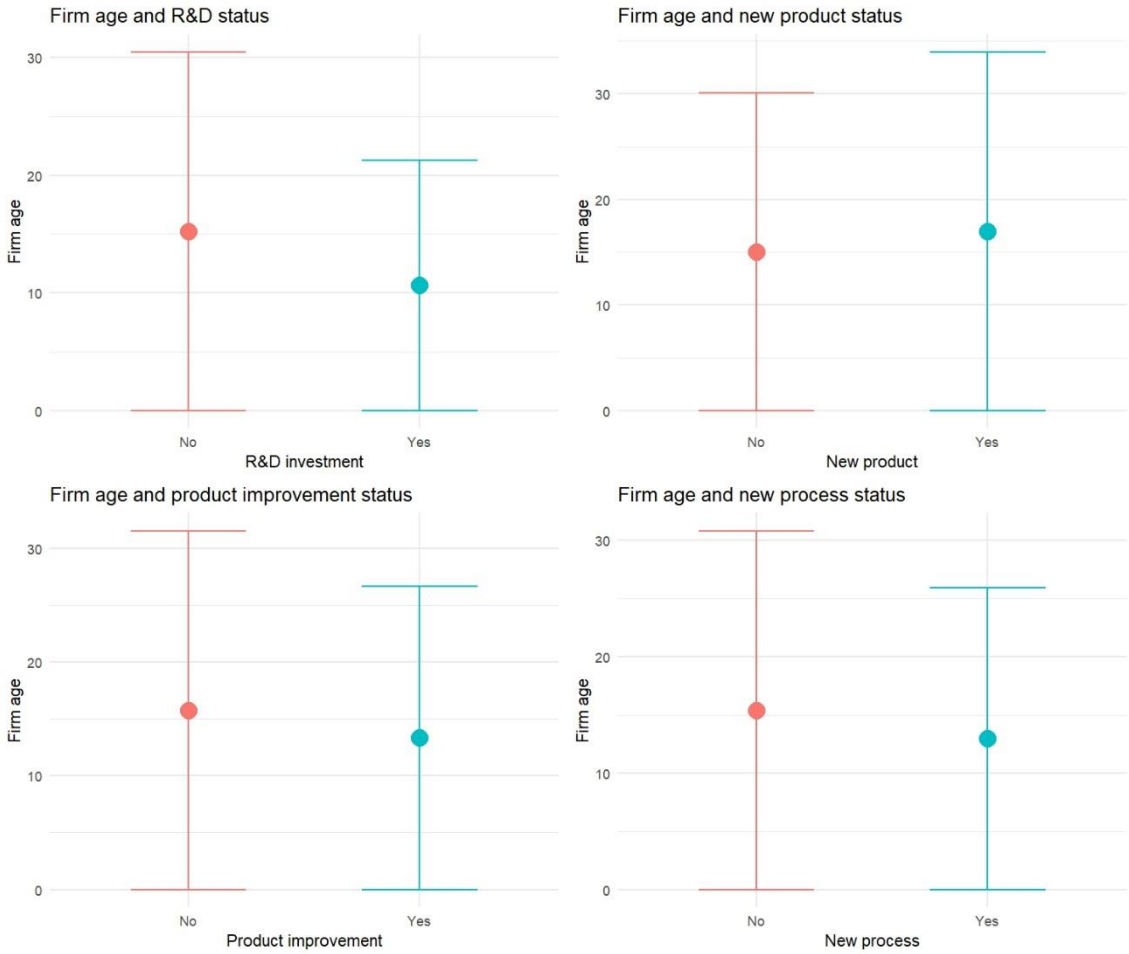

Figure 5.5. Firm age and innovation status of domestic SMEs

Figure 5.6 plots the mean and confidence intervals of SME owners/managers' age against their innovation status, including R&D investment, new product introduction, product improvement and new processes/technologies adoption. As shown in the figure, there is no noticeable difference in owners/managers' age between firms introducing new products and those who do not. However, the average age of owners/managers is slightly lower for firms engaging in R&D activity, improving existing products, and adopting new technologies compared to their non-innovating counterparts. The t-statistics in Table 5.8 support this, indicating that the differences in average owners/managers' age between innovators and non-innovators are statistically significant regarding R&D investment, product improvement, and process innovation.

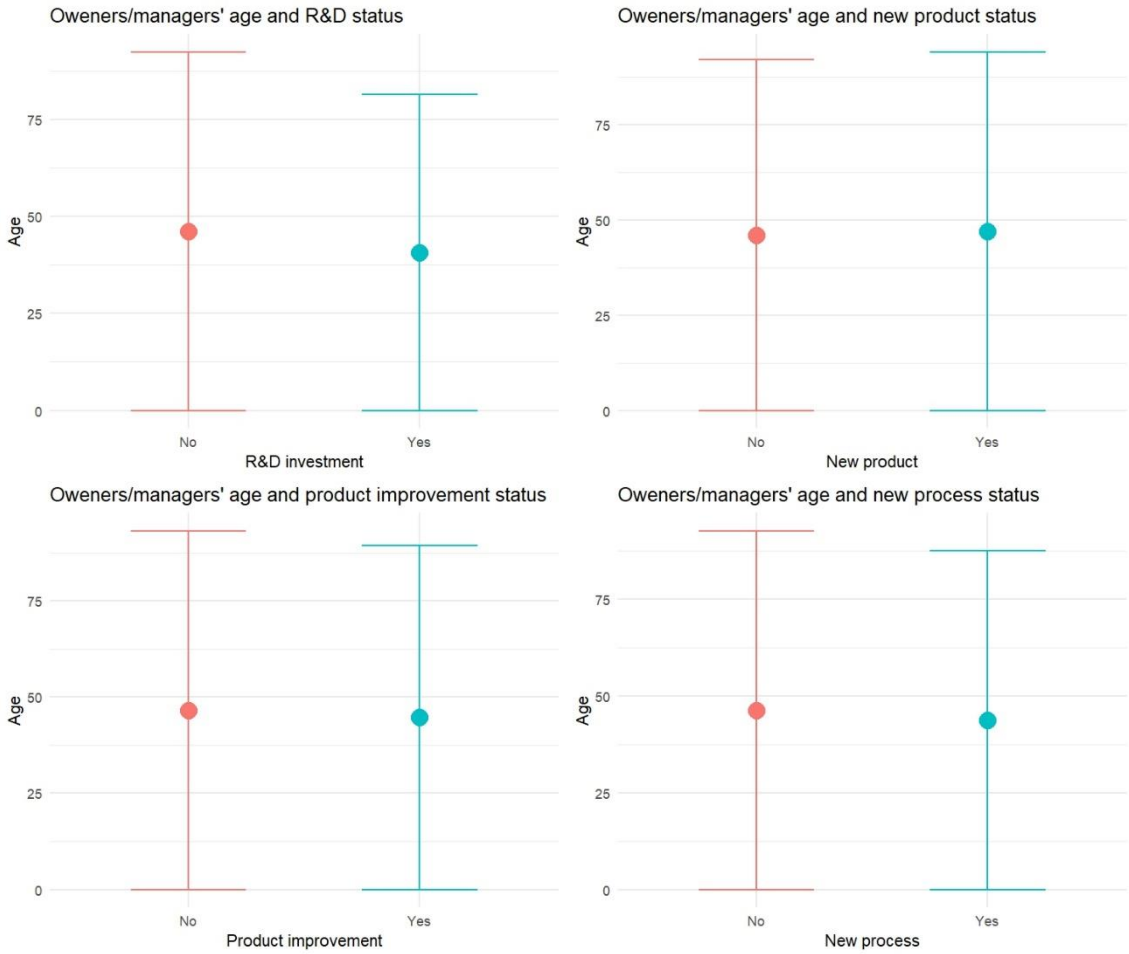

Figure 5.6. SME owners/managers' age and innovation status of domestic SMEs

Figure 5.7 plots the mean and confidence intervals of SMEs' labour skills measured by the proportion of workers with professional qualifications against their innovation status, including R&D investment, new product introduction, product improvement and new processes/technologies adoption. The figure strongly suggests that the average level of labour skill is higher for innovators than non-innovators, regardless of the types of innovation. The t-statistics in Table 5.8 confirm that these differences are statistically significant.

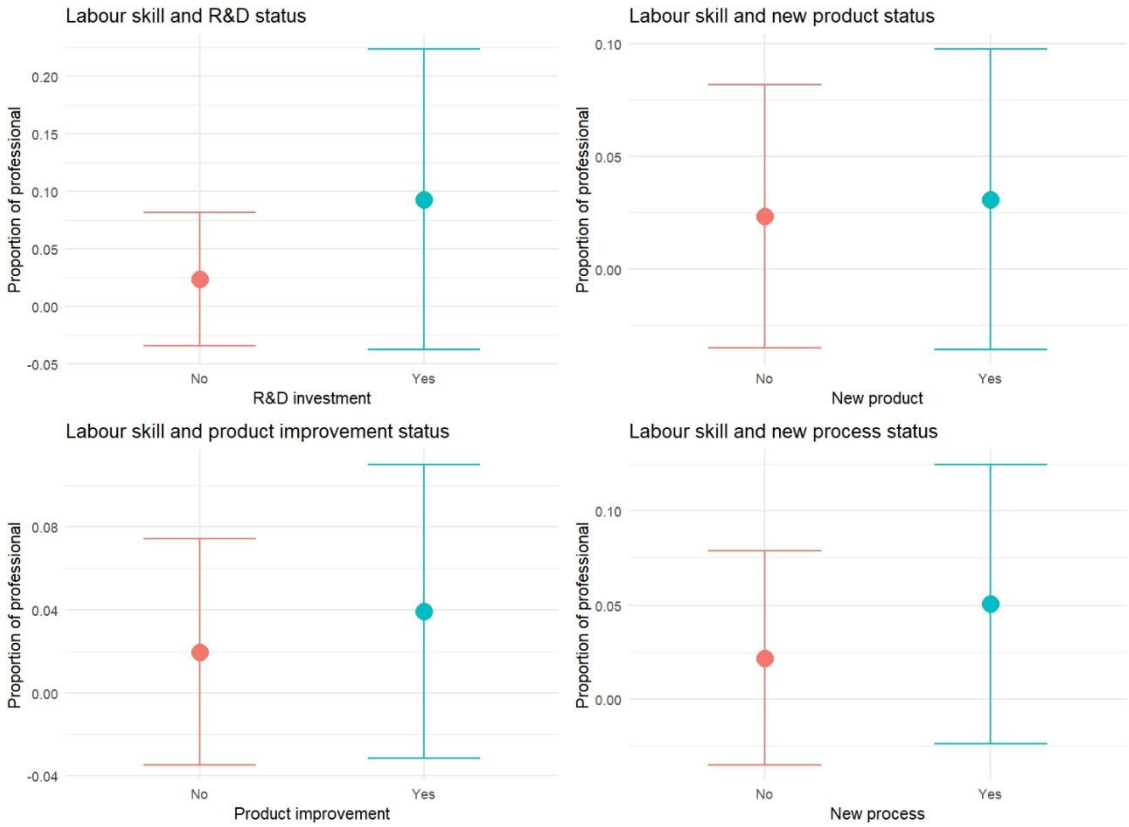

Figure 5.7. Labour skill and innovation status of domestic SMEs

Figure 5.8 plots the mean and confidence intervals of market concentration measured by the Herfindahl index against firms' innovation status, including R&D investment, new product introduction, product improvement and new processes/technologies adoption. The figure shows that SMEs engaging in R&D experience a higher average market concentration than those who do not, but that difference is not statistically significant as suggested by the t statistics. On the other hand, SMEs conducting product innovation (by introducing new products or improving existing products) or process innovation observe a lower average market concentration than their non-innovative counterparts, yet only the mean difference regarding product improvement is statistically significant.

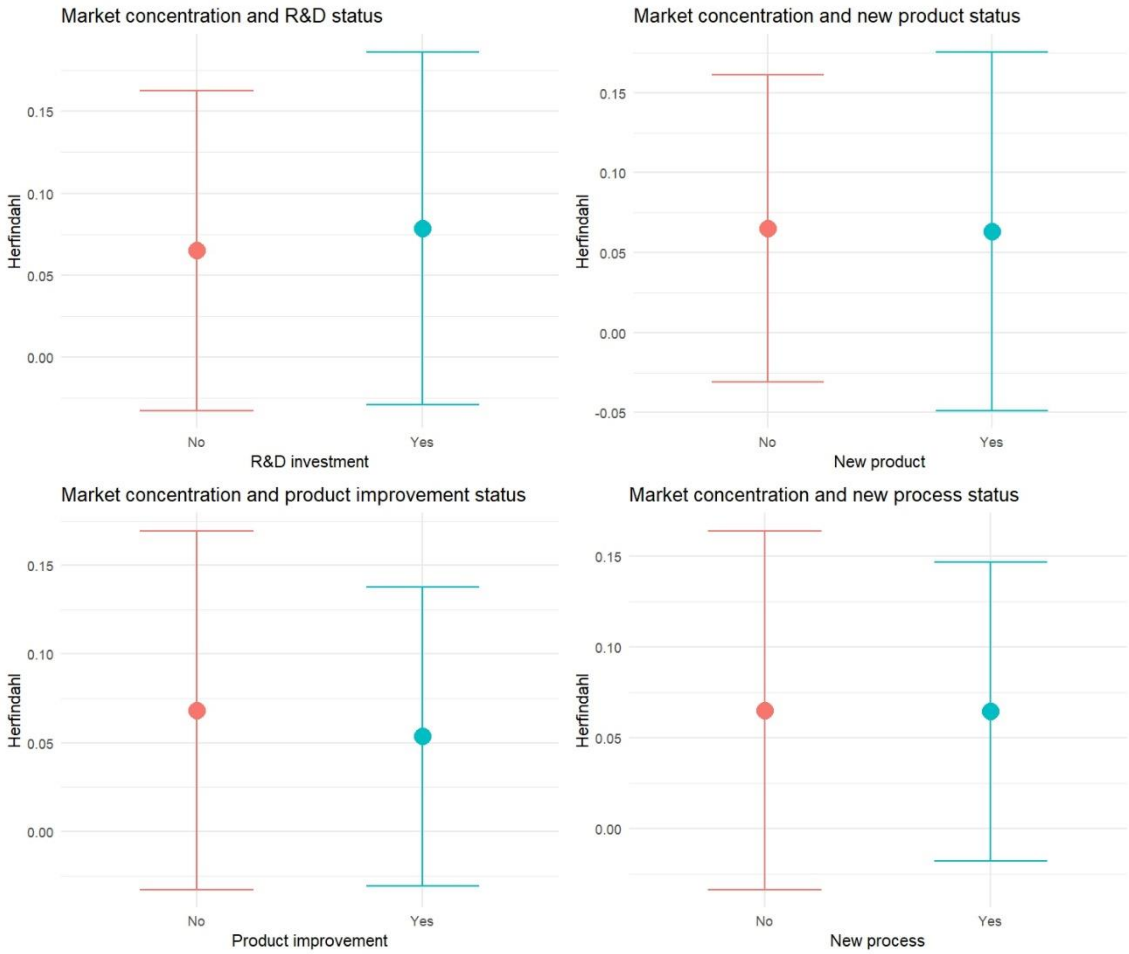

Figure 5.8. Market concentration and innovation status of domestic SMEs

Figure 5.9 plots the mean and confidence intervals of the technological gap (measured by the difference in labour productivity between foreign firms and domestic firms) against the innovation status of domestic SMEs, including R&D investment, new product introduction, product improvement and new processes/technologies adoption. The differences in the average technology gap between innovators and non-innovators are inconsistent across different types of innovation. It is positive for product innovation (both the introduction of new products or product improvement), but negative regarding R&D investment and process innovation. The t statistics in Table 5.8 largely confirm the statistical significance of these differences, except for R&D investment.

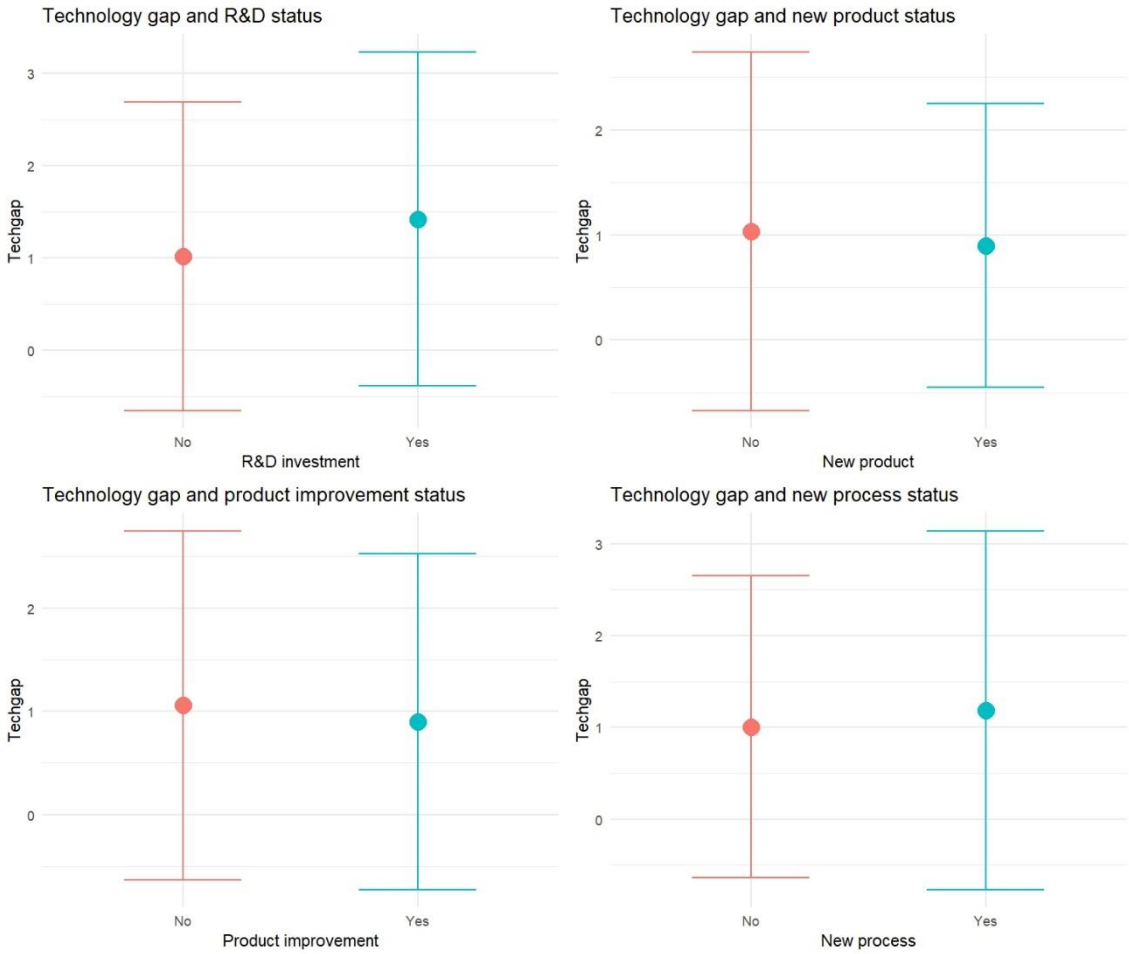

Figure 5.9. Technology gap and innovation status of domestic SMEs

Table 5.8. Summary of t-test results

Variables	*RD*	*NPD*	*IMPD*	*NPC*
FDI	-0.410	-1.462	4.591***	3.039***
INST	-0.214	-4.073***	13.304***	6.710***
ROA	-2.812***	2.269**	-3.454***	-1.059
FIRMSIZE	6.855***	-0.291	14.119***	13.92***
FRIMAGE	-5.368***	5.314***	-9.717***	-6.825***
AGE	-3.491***	2.213***	-6.298***	-5.412***
LSKILL	3.857***	2.882***	10.598***	9.309***
HERFINDAHL	0.923	-0.404	-6.086***	-0.199
TECHGAP	1.620	-2.505**	-3.466***	2.199**

Note. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.

5.6.2 Categorical Explanatory Variables

Regarding the relationship between categorical explanatory variables and dummy independent variables, the proportions of observation in each categorical group are visualized

using mosaic plots. In addition, a Chi-square contingency test is employed to compare the frequency distributions between explanatory firm-specific characteristics and innovation status. The summary of test statistics is presented in Table 5.9.

Figure 5.10 plots the proportions of each combination of SME owners/managers' gender and innovation status, including R&D investment, new product introduction, product improvement and new processes/technologies adoption. The figure shows no apparent difference in the proportion of innovation between firms led by male and female owners/managers, except for the bottom right plot that shows a slightly smaller frequency of adopting new processes for the former compared to the latter. The Chi-square statistics in Table 5.9 indicate no statistically significant relationship between SME owners/managers' gender and innovation status, except for process innovation.

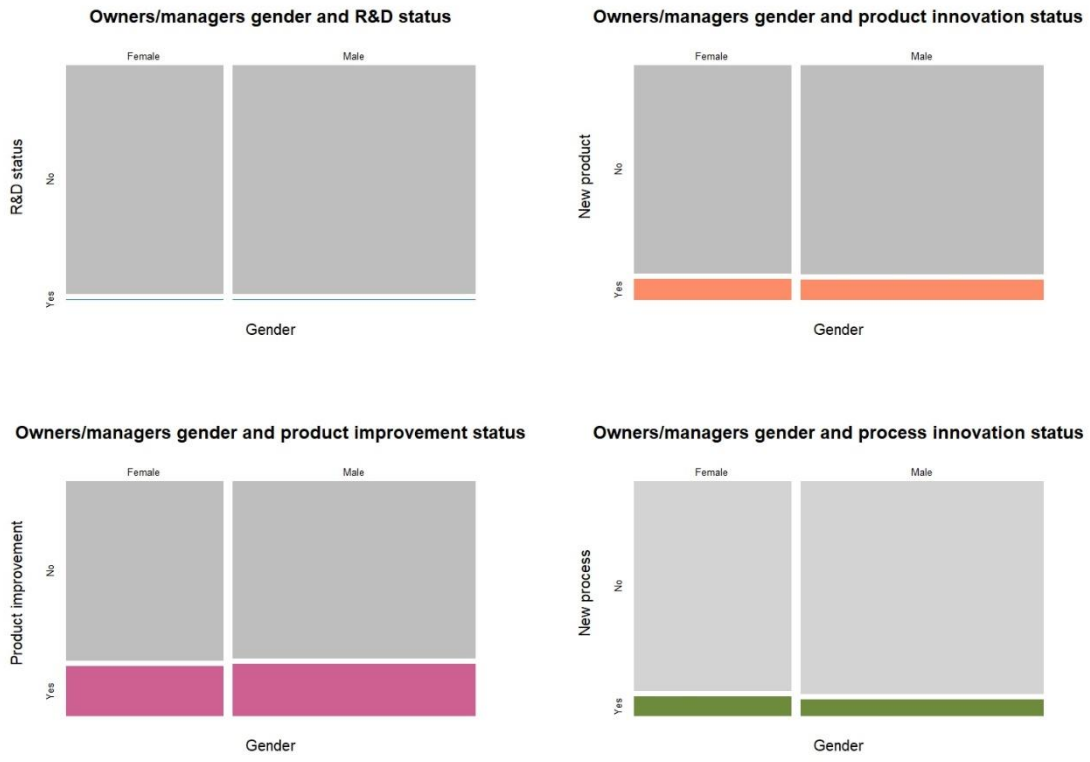

Figure 5.10. SME owners/managers' gender and innovation status

Figure 5.11 plots the proportions of each combination of SME owners/managers' education level and their innovation status, including R&D investment, new product introduction, product

improvement and new processes/technologies adoption. As illustrated in the figure, firms with the owner/manager obtaining upper secondary education or above have higher frequencies of engaging in all four types of innovation. The Chi-square statistics in Table 5.9 confirm that these differences are statistically significant, suggesting that the education level of SME owners/managers and innovation status are not independent.

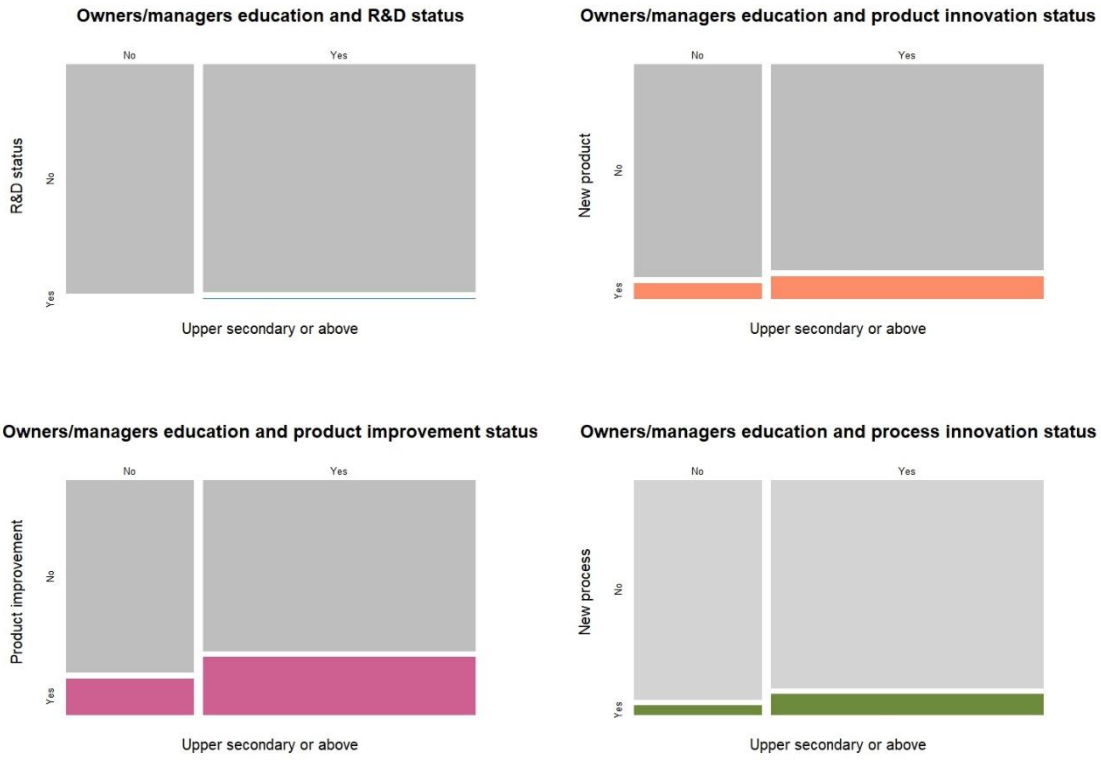

Figure 5.11. SME owners/managers' human capital and innovation status

Figure 5.12 plots the proportions of each combination of SMEs' export and innovation status. The figure suggests that exporters have higher frequencies of conducting R&D investment, introducing new products, improving existing products and adopting new processes/technologies than non-exporters. The Chi-square statistics for export are statistically significant in all columns in Table 5.9, indicating that SMEs' export participation is associated with their innovation status.

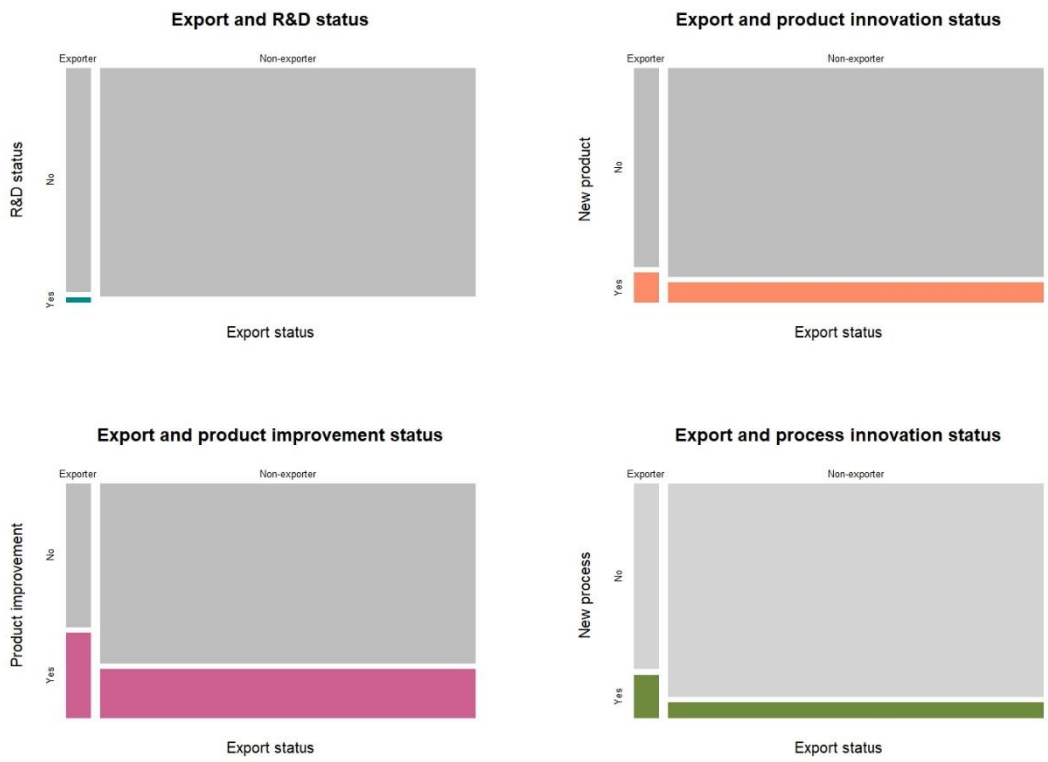

Figure 5.12. Export participation and innovation status of domestic SMEs

Figure 5.13 plots the proportions of each combination of SMEs' location, that is, inside or outside an industrial zone, and their innovation status. As shown in the figure, firms located in an industrial zone have higher frequencies of conducting R&D investment, introducing new products, improving existing products and adopting new processes/technologies than those that do not. The Chi-square statistics in Table 5.9 confirm the statistical significance of these differences, indicating that SMEs' location in an industrial zone is associated with their innovation status.

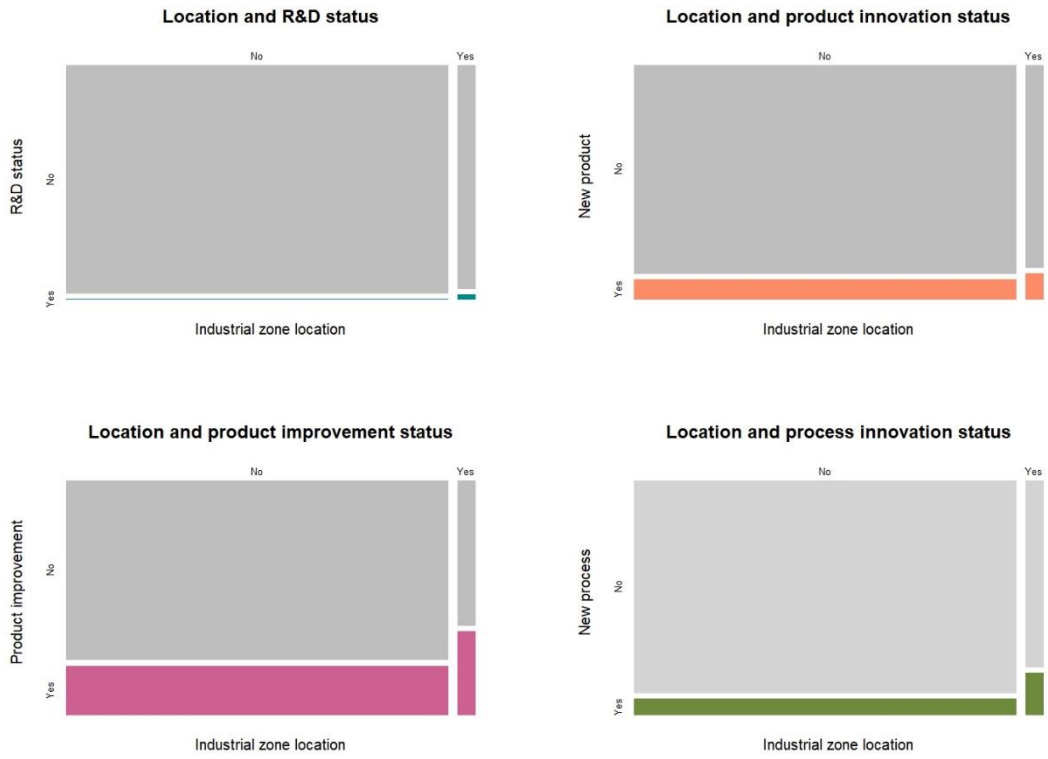

Figure 5.13. Location in an industrial zone and innovation status of domestic SMEs

Table 5.9. Summary of Chi-square contingency test statistics

Variables	*RD*	*NPD*	*IMPD*	*NPC*
GENDER	0.5721	0.075	1.249	3.973**
HUMANCAP	7.833***	16.964***	80.018***	52.91***
EXPORT	26.316***	9.206***	63.854***	84.428***
ZONE	20.215***	2.382	42.637***	56.946***

Note. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.

The test results should be interpreted with caution. Both the t-test and the Chi-square contingency test require that the samples being compared are separate and independent. This assumption may be violated given the nature of panel data, that is, a firm is likely to appear more than once in the sample. Another strong assumption under the t-test is that the values of each sample are normally distributed. Bivariate analysis examines each independent variable separately, therefore failing to account for the interaction between FDI presence and institutions. This partly explains the inconsistent and insignificant relationship between FDI presence and the innovation variables, as suggested by the above analysis. The conclusion on the impacts of each

explanatory variable on the dependent variables should be drawn from the results of more rigorous econometric models, which are reported in the subsequent three chapters.

5.7 Summary

This chapter describes the data used in the empirical analysis. A panel dataset of 2,690 manufacturing SMEs in 2011, 2013 and 2015 is employed to estimate the econometric models. The main data source comes from the SME survey provided by the United Nations University World Institute for Development Economics Research. Data on SMEs are then combined with FDI data extracted from the Enterprise Survey of the General Statistics Office of Vietnam and data on provincial institutional quality from the Provincial Competitiveness Index constructed by the Vietnam Chamber of Commerce and Industry (VCCI). Data preprocessing involves dealing with missing values, unrealistic values, variable construction and recording, and merging the three distinct data sources to create panel data usable for the estimation.

Summary statistics indicate sufficient variation in data, while the correlation matrix shows no serious concern about multicollinearity. Descriptive statistics of the key dependent variables show heterogeneity in the distribution of innovation of domestic SMEs across regions and industries. FDI presence also varies significantly across regions and industries. The bivariate analysis confirms the relevance of FDI presence, institutional quality and other control variables in explaining the innovation decisions of domestic SMEs. It is important to note that the analysis conducted here shows the correlation, not necessarily causality, between two variables. The causal impacts of FDI and institutions established using rigorous econometric methods shall be presented in the following three chapters.

Chapter 6: The Effects of FDI and Institutions on R&D Investments of Domestic SMEs

6.1 Introduction

This chapter presents the empirical results on how institutions moderate FDI impact on the R&D investment of domestic SMEs. The estimation results are based on Equations (1) and (2) specified in *Subsection 4.3.1,* which captures the two-stage decision-making process regarding R&D investment by domestic firms, that is, whether to engage in R&D investment and the extent of the investment, as follows:

$$Pr\left(RDD_{ijdt} = 1 \middle| RDD_{ijdt-1}, FDI_{jdt}, INST_{kt}, X_{ijdt}, dregion_d, dyear_t, dindustry_j\right) = \Phi\left(\eta_0 + \eta_1 FDI_{jdt} + \eta_2 INST_{kt} + \eta_3 FDI_{jdt} \times INST_{kt} + \eta_4 RDD_{ijdt-1} + \eta_5 dregion_d + \eta_6 dyear_t + \eta_7 dindustry_j + \eta' X_{ijdt}\right) \quad (1)$$

$$RDE_{ijdt} = \vartheta_0 + \vartheta_1 FDI_{jdt} + \vartheta_2 INST_{kt} + \vartheta_3 FDI_{jdt} \times INST_{kt} + \vartheta_4 RDD_{ijdt-1} + \vartheta_5 dregion_d + \vartheta_6 dyear_t + \vartheta_7 dindustry_j + \vartheta' X_{ijdt} + \varepsilon_{ijdt} \quad (2)$$

where *i*, *j*, *k*, *d*, and *t* denote firm, industry, province, economic region, and year, respectively; RDD is a dummy variable taking the value of 1 if the firm engages in R&D investment, and 0 otherwise; RDE represents real R&D expenditure in natural logarithm form; FDI_{jdt} is FDI presence in industry *j* in region *d* and year *t*; $INST_{kt}$ represents institutional quality in province *k* in year *t*; X_{ijdt} is the vector of control variables that capture firm-specific and industry-specific characteristics; there are regional dummies ($dregion_d$), industry dummies ($dindustry_j$), and year dummies ($dyear_t$); and ε_{ijdt} is the error term.

Section 6.2 presents the estimation results on the direct effects of FDI on the R&D investment of domestic firms without taking into account the moderating role of institutions. Sections 6.3 and 6.4 report the baseline results obtained from estimating Equations (1) and (2), respectively. Section 6.3 provides empirical evidence on the moderating effect of institutions on the relationship between FDI presence and the probability of engaging in R&D investments. Section 6.4 focuses on how institutions moderate the impact of FDI on the amount of R&D expenditure.

Section 6.5 presents additional analyses regarding FDI origin and alternative measures of FDI. Specifically, *Subsection 6.5.1* distinguishes the institutional moderating effect of FDI from countries with higher institutional quality and FDI from countries with lower institutional quality compared to Vietnam. *Subsection 6.5.2* re-estimates the baseline models using alternative measures of FDI presence, including forward FDI, backward FDI and a composite FDI index that captures both horizontal and vertical channels. This section aims to check the robustness of the main results and detect any heterogeneity due to the different dimensions of FDI spillovers. Finally, Section 6.6 summarises the chapter.

6.2 FDI and R&D Investment: Assuming no Moderating Effect of Institutions

I first estimate the direct effect of FDI presence on the R&D investment of domestic SMEs before taking into account the moderating effects of institutions. Table 6.1 presents the estimation results of Equations (1) and (2) without the interaction term between the institutional variable and FDI ($INST \times FDI$). FDI presence is proxied by the output share of horizontal FDI in a given industry. Columns 1-3 examine the effect of FDI on SMEs' probability of conducting R&D based on Equation (1). Column 1 reports the result of the Probit model, which assumes the exogeneity of all explanatory variables, while the IV-Probit model is used in Column 2 and IV-Two-stage least squares (IV-2SLS) in Column 3 to address the endogeneity issue of FDI. It is worth noting that the use of industry fixed effects in the Probit and IV-Probit models drops all observations with no within-industry variation in R&D status (*RDD*), leading to a considerably smaller sample size. To ensure the results are comparable across different estimation methods, a sub-sample is created by excluding industries with values of all 0 or all 1 for *RDD*. This subsample is used to estimate the IV-2SLS model in Column 3.

Significant endogeneity tests in Columns 2 and 3 reject the null hypothesis that regressors are exogenous, meaning that the OLS estimator is inconsistent. In this case, IV regression is preferred over the Probit model which assumes exogeneity of all right-hand-side variables. An IV-probit model provides a better fit given the binary dependent variable. However, an IV-2SLS model provides a more straightforward interpretation of coefficients and has been suggested to be more reliable in dealing with the endogeneity problem (see, for example, Crescenzi et al., 2015). Therefore, I focus on interpreting the results of IV-2SLS model.

As shown in Table 6.1, the coefficients of FDI are negative and statistically significant throughout Columns 1 to 3, indicating that FDI adversely affects the R&D probability of domestic SMEs. The use of IV-2SLS in Column 3 enables a more straightforward interpretation of the coefficients. All other things being equal, a 1% increase in FDI presence lowers the probability of domestic SMEs' R&D investment by 0.153%.

Table 6.1. FDI presence and the probability of R&D investment of domestic SMEs: assuming no moderating effect of institutions

Variables	Probit (1)	IV-Probit (2)	IV-2SLS (3)	IV-GMM (4)
FDI	**-1.506*** **	**-5.372*** **	**-0.153*** **	**-0.260** **
	(0.503)	**(1.427)**	**(0.0444)**	**(0.110)**
INST	0.098**	-0.235	-0.003	-0.026**
	(0.043)	(0.202)	(0.006)	(0.011)
Lag RDD	0.490*	0.376	0.074*	-0.000
	(0.288)	(0.252)	(0.044)	(0.023)
ROA	-0.166	0.046	0.002	0.017
	(0.264)	(0.180)	(0.004)	(0.010)
FIRMSIZE	0.204***	0.148***	0.004**	0.021***
	(0.066)	(0.047)	(0.002)	(0.008)
FIRMAGE	-0.029**	-0.018	-0.0003	-0.001*
	(0.015)	(0.011)	(0.0002)	(0.001)
GENDER	0.102	0.015	-0.0006	0.006
	(0.168)	(0.117)	(0.005)	(0.013)
AGE	-0.006	-0.001	-0.0002	-0.000
	(0.007)	(0.005)	(0.0002)	(0.001)
HUMANCAP	0.036	0.081	0.0008	-0.001
	(0.222)	(0.148)	(0.003)	(0.010)
LSKILL	2.582***	2.578***	0.203**	-0.012
	(0.725)	(0.663)	(0.081)	(0.171)
EXPORT	0.577**	0.251	0.030*	0.114*
	(0.236)	(0.173)	(0.016)	(0.060)
ZONE	-0.042	-0.050	0.0003	-0.069*
	(0.251)	(0.174)	(0.015)	(0.036)
HERFINDAHL	-18.695*	8.796	0.005	0.004
	(10.053)	(8.887)	(0.075)	(0.200)
TECHGAP	-0.075	-0.171**	-0.006	-0.012
	(0.113)	(0.081)	(0.006)	(0.032)
Year dummies	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y
Cragg-Donald Wald F statistic	-	31.532	31.532	35.737
Stock-Yogo critical value at 10%	-	7.56	7.56	7.56
Underidentification test	-	85.153***	85.153***	120.937***
Overidentification test	-	1.346	1.346	2.000
Endogeneity test	-	26.72***	11.232***	4.976*
Observations	3,107	3,101	3,228	3,278

Note. This table reports the estimation results of the impact of FDI presence on the R&D investment of domestic SMEs. Columns 1-3 are based on Equation (1), which examines the probability of conducting R&D. Robust standard errors in parentheses. Column 4 reports the estimation results of Equation (2) to examine the impacts of FDI presence on R&D expenditure (in natural logarithm) using IV-GMM estimation. *Lag RDD* is replaced by its predicted value obtained from Equation (1), and the standard errors are bootstrapped. Constants are excluded for brevity. *, ** and *** denote significant levels at 10%, 5% and 1%, respectively.

Finally, Column (4) presents the estimation results of Equation (2) using IV-GMM estimation. The coefficient of FDI is negative and statistically significant, suggesting a negative impact on the R&D expenditure of domestic SMEs. All other things being equal, a 1% increase in FDI presence leads to a decrease of approximately 0.26% in domestic SMEs' R&D expenditure.

The results from Table 6.1 are in line with prior studies that confirm the negative crowding-out effects of FDI on domestic firms' R&D activities (see, e.g., Anwar & Sun, 2014; Cheung & Lin, 2004; Huang & Zhang, 2020), although alternative explanations exist. The low absorptive capacity of SMEs may prevent them from efficiently exploiting FDI technological spillovers, while the intensified foreign competition may also reduce their incentive to launch R&D projects due to a large innovation gap. In addition, SMEs with disadvantages in economies of scale and low market power may easily be crowded out by foreign firms in the product, labour and financial markets, leading to the depletion of resources necessary for R&D investment.

6.3 FDI, Institutions and the Probability of R&D Investment

Table 6.2 presents the estimation results of Equation (1) to estimate the moderating effect of institutions on the relationship between FDI and the probability of R&D investment of domestic SMEs. FDI presence is proxied by the output share of horizontal FDI in a given industry. Columns 1-2 report the results of the Probit model, which assumes the exogeneity of all explanatory variables, while the two specifications of the IV-Probit model in Columns 3-4 and the two specifications of the IV-Two-stage least squares (IV-2SLS) model in Columns 5-6 are used to address the endogeneity issue of FDI and institutions. In each set of estimations, a minimum specification is first presented, and then the control variables are added to check the sensitivity to different specifications.

As shown in Table 6.2, the coefficients of the interaction term $FDI \times INST$ are positive and statistically significant (except for Column (1)), indicating a complementarity between FDI and $INST$ in influencing an SME's likelihood of conducting R&D. That is, at a given level of FDI presence, SMEs in provinces with higher institutional quality have a higher probability of engaging in R&D investment, and *vice versa*.

This result supports the proposition that institutions positively moderate the impact of FDI on SMEs' R&D investment. Arguably, more developed institutions may promote the foreign investors' incentive and ability to create technological spillovers, leading to a higher possibility

of technological spillovers in the local market. Regarding domestic SMEs, strong institutions allow these firms to spend their resources on developing the absorptive capacity for foreign technologies rather than coping with institutional constraints. In addition, the vertical linkages between foreign firms and domestic SMEs are strengthened in a better institutional environment, which fosters technological transfer and knowledge sharing.

From Column 6 of Table 6.2, the marginal impact of FDI can be derived as $\frac{\partial Pr(RDD=1)}{\partial (FDI)} = -0.539 + 0.068 \times INST$, which is positive if $INST$ is greater than 7.926. In other words, *ceteris paribus*, the impact of FDI on the R&D probability of domestic SMEs is positive if the quality of institutions is higher than 7.926 points. Below this threshold, FDI reduces the probability of domestic SMEs engaging in R&D investment. Figure 6.1a (IV-probit) and Figure 6.1b (IV-2SLS) illustrate this point by plotting the probability of R&D investment against FDI presence at different levels of institutional quality. Further differentiating the marginal impact of FDI with respect to institutions, the moderating effect of institutions is obtained as $\frac{\partial^2 Pr(RDD=1)}{\partial (FDI)\partial (INST)} = 0.068$, namely a one-unit increase in institutional quality raises the marginal impact of FDI on an SME's R&D probability by 6.8%.

Table 6.2. FDI presence and the probability of R&D investment: the role of institutions

Variables	Probit		IV-Probit		IV-2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	-1.689*	-3.220***	-11.529***	-12.296***	-0.647***	-0.539***
	(0.926)	(1.081)	(1.672)	(1.934)	(0.198)	(0.174)
FDI×INST	**0.171**	**0.337****	**1.380*****	**1.557*****	**0.070****	**0.068****
	(0.136)	**(0.154)**	**(0.497)**	**(0.569)**	**(0.029)**	**(0.027)**
INST	0.012	0.034	-0.404**	-0.478**	-0.024**	-0.024**
	(0.050)	(0.055)	(0.205)	(0.219)	(0.011)	(0.012)
Lag RDD	0.818***	0.509*	0.520**	0.336	0.093**	0.072
	(0.271)	(0.282)	(0.255)	(0.263)	(0.046)	(0.045)
ROA		-0.154		0.029		0.004
		(0.262)		(0.174)		(0.005)
FIRMSIZE		0.212***		0.153***		0.005**
		(0.068)		(0.052)		(0.002)
FIRMAGE		-0.028*		-0.022**		-0.0005**
		(0.014)		(0.011)		(0.0002)
GENDER		0.097		-0.033		-0.004
		(0.168)		(0.115)		(0.005)
AGE		-0.006		-0.001		-0.0001
		(0.007)		(0.005)		(0.0002)
HUMANCAP		0.058		0.132		0.0031
		(0.219)		(0.143)		(0.004)
LSKILL		2.463***		2.152***		0.205**
		(0.722)		(0.816)		(0.080)
EXPORT		0.566**		0.221		0.027*
		(0.237)		(0.195)		(0.016)
ZONE		-0.017		0.027		0.0002
		(0.248)		(0.169)		(0.015)
HERFINDAHL		-19.855**		4.419		0.097
		(9.806)		(8.645)		(0.098)
TECHGAP		-0.074		-0.287***		-0.015**
		(0.109)		(0.083)		(0.007)
Year dummies	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald F statistic			9.705	10.710	10.196	10.710
Stock-Yogo critical value at 10%			7.77	7.77	7.77	7.77
Underidentification test			53.362***	58.776***	63.685***	58.776***
Overidentification test			0.920	1.125	0.432	1.125
Endogeneity test			34.25***	28.51***	19.728***	14.845***
Observations	3,115	3,101	3,115	3,101	3,244	3,228

Note. This table reports the estimation results of the impact of FDI presence on the probability of R&D investment by SMEs, taking into account the moderating role of institutions. FDI presence in a given manufacturing industry is instrumented by the FDI presence in two service industries in a non-neighbouring region. Institutions are instrumented by *TENURE* and *SWITCH*. Robust standard errors are in parentheses. The marginal effects of the IV-Probit model (Column 4) are reported in Column 1 of Table A5 of the Appendix. The first-stage regression results are reported in Table A6 of the Appendix. Constants are excluded for brevity. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

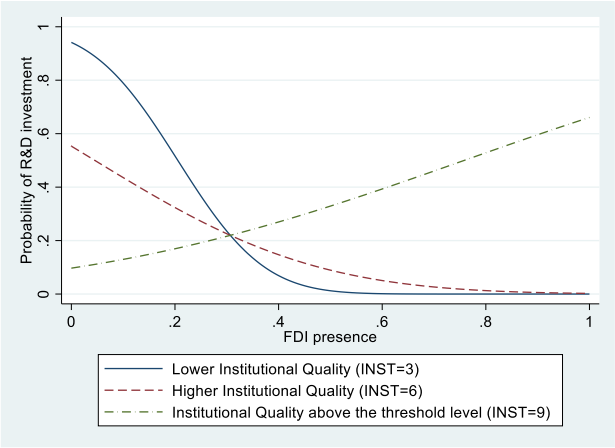

Fig 5.1a. Visualising the result of the IV-Probit model

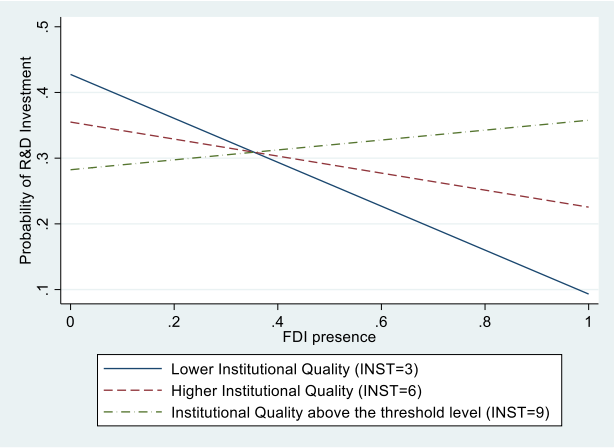

Fig 5.1b. Visualising the result of the IV-2SLS model

Figure 6.1**.** Relationship between FDI presence and the probability of R&D investment of SMEs at different levels of institutional quality

6.4 FDI, Institutions and R&D Expenditure

Table 6.3 presents the estimation results of Equation (2) using IV-GMM estimation to examine how institutions moderate the impact of FDI on the R&D expenditure of domestic SMEs. Similar to the previous tables, horizontal FDI is employed to measure FDI presence in a given industry. The results of both minimum and full specifications are reported in Columns 1 and 2, respectively. The coefficients of $FDI \times INST$ are positive and statistically significant in both Columns, which confirms the positive moderating effect of institutions on the relationship between FDI and R&D expenditure of domestic firms. That is, at a given level of FDI presence, SMEs in provinces with higher (lower) institutional quality have a higher (lower) level of R&D expenditure.

From Column 2 of Table 6.3, the marginal impact of FDI is $\frac{\partial(RDE)}{\partial(FDI)} = -0.334 + 0.099 \times INST$, which is positive if $INST$ is greater than 3.374. That is, if the quality of institutions is higher than 3.374, FDI begins to exert a positive impact on the R&D expenditure of domestic SMEs, *ceteris paribus*.

Figure 6.2 illustrates this point by plotting the R&D expenditure (in natural logarithm) against FDI presence at different levels of institutional quality. Further differentiating the marginal effect with respect to institutions, its moderation effect is obtained as $\frac{\partial^2(RDE)}{\partial(FDI)\partial(INST)} = 0.099$.

Specifically, a one-unit increase in the quality of institutions leads to a 9.9% increase in the marginal impact of FDI on SMEs' R&D expenditure.

Taken all together, the results of Table 6.2 and Table 6.3 support Hypothesis 1 and corroborate the findings of previous literature that institutional development plays an important role in facilitating FDI technological spillovers in the host economy (Gorodnichenko et al., 2014; Krammer, 2015; Wang et al., 2013; Yi et al., 2015; Zhang, 2019), despite these studies not explicitly exploring FDI impact on domestic firms' innovation. Better institutions can promote the foreign investors' incentive and ability to create technological spillovers, mitigate FDI crowding-out effects, enhance domestic SMEs' absorptive capacity, and facilitate interaction and knowledge sharing in the local business environment.

The coefficient estimates for control variables are consistent with previous literature. Firms engaging in R&D in the prior period have a higher probability of investing in the current period, which confirms a persistent pattern in R&D investment of small firms, as suggested by Manez et al. (2015). Firm size and export participation are positively associated with both R&D probability and R&D expenditure (as in Anwar and Sun (2014)). The skill level of the labour force promotes the probability of firms conducting R&D (as suggested by Lai et al. (2015)), while older firms tend to engage less in the activity (as in Lee & Sung, 2005).[29] In addition, profitability measured by ROA is important to the expansion of R&D spending. Some evidence of the negative effect of a technological gap on the R&D investment of SMEs is also found.

[29] I also include the square of firm age in the specifications to test for the possibility of an inverted-U shape relationship between firm age and R&D investment as suggested by Fan & Wang (2021). The results do not confirm this proposition hence are not reported here.

Table 6.3. FDI and R&D expenditure of domestic SMEs: the role of institutions

Variables	No controls (1)	Controls included (2)
FDI	-0.311*	-0.334**
	(0.167)	(0.164)
FDI×INST	**0.136****	**0.099****
	(0.053)	**(0.048)**
INST	-0.060***	-0.051**
	(0.019)	(0.020)
Lag RDD	0.062*	0.036
	(0.035)	(0.038)
ROA		0.017*
		(0.009)
FIRMSIZE		0.021***
		(0.008)
FIRMAGE		-0.0008*
		(0.0005)
GENDER		0.014
		(0.015)
AGE		-0.0002
		(0.0005)
HUMANCAP		0.003
		(0.010)
LSKILL		0.005
		(0.205)
EXPORT		0.128***
		(0.050)
ZONE		-0.061
		(0.037)
HERFINDAHL		-0.090
		(0.199)
TECHGAP		-0.007
		(0.032)
Year dummies	Y	Y
Industry dummies	Y	Y
Region dummies	Y	Y
Cragg-Donald Wald F statistic	8.721	8.618
Stock-Yogo critical value at 10%	7.77	7.77
Underidentification test	52.342***	51.937***
Overidentification test	0.142	0.362
Endogeneity test	8.850**	7.082*
Observations	3,300	3,278

Note. This table estimates the impact of FDI presence on R&D expenditure (in natural logarithm) of SMEs, taking into account the moderating role of institutions. Endogeneity bias is addressed by instrumenting FDI presence in a given manufacturing industry by FDI presence in two service industries in a non-neighbouring region. *Lag RDD* is replaced by its predicted value obtained from equation (1). Institutions are instrumented by *HIGHEDU* and *NONLOCAL*. The first-stage regression results are reported in Table A7 of the Appendix. Bootstrapped standard errors are in parentheses. Constants are excluded for brevity. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

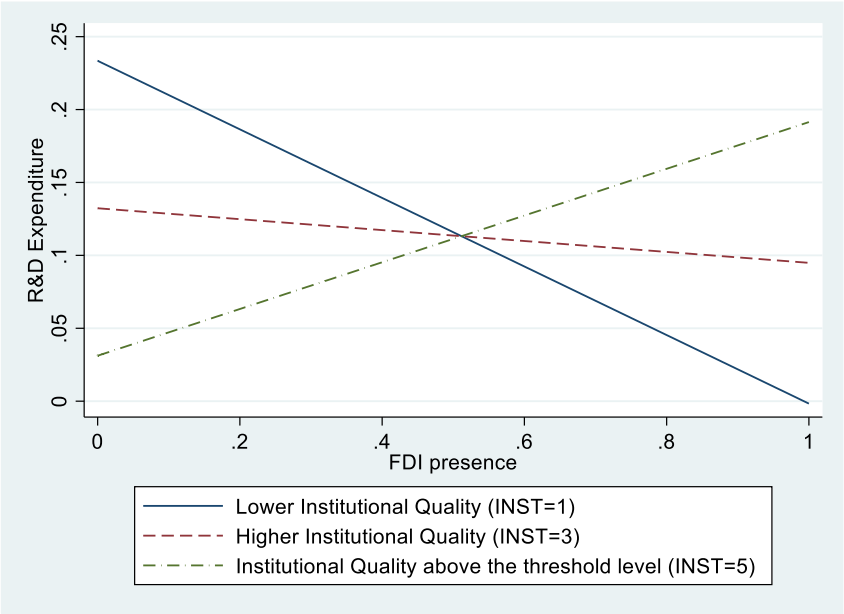

Figure 6.2. Relationship between FDI presence and R&D expenditure of SMEs at different levels of institutional quality

6.5 Additional Analyses

6.5.1 FDI Origin

To test for Hypothesis 2 which distinguishes FDI inflows from countries with different levels of institutional development, FDI origin is classified into two groups: countries with higher institutional quality and those with lower institutional quality compared to Vietnam. The list of home countries is provided in Table A4 of the Appendix. The country-level institutional measure comes from the Worldwide Governance Indicators provided by the World Bank. This data source has a large country coverage and has been widely used in literature to measure the variation in institutional quality across countries (see, e.g., Godinez & Liu, 2015; Krammer, 2015; Law et al., 2018). The baseline models for FDI from the two groups of countries are re-estimated, and the results are presented in Columns 1-4 in Table 6.4. Specifically, Columns 1-2 report the results of Equation (1) using the IV-Probit model to estimate the impacts on the probability of R&D engagement (*RDD*), whereas Columns 3-4 present the results of Equation (2) using the IV-GMM estimation and the natural logarithm of R&D expenditure (*RDE*) as the dependent variable.

The coefficients of $FDI \times INST$ are not statistically significant in Columns 1 and 3, but positive and significant in Columns 2 and 4. This indicates that the institutional impacts are less

pronounced for FDI from countries with lower institutional quality compared to that from countries with higher institutional quality, thereby confirming Hypothesis 2. The finding reinforces the proposition that FDI donors experiencing low institutional quality at home are familiar with institutional weakness and, therefore, less susceptible to institutional deficiencies in the host economies (Cuervo-Cazurra, 2006a; Godinez & Liu, 2015).

Table 6.4. The role of institutional moderating effect and FDI origins

Variables	Dependent variable: *RDD*		Dependent variable: *RDE*	
	FDI from countries with low institutional quality (1)	FDI from countries with high institutional quality (2)	FDI from countries with low institutional quality (3)	FDI from countries with high institutional quality (4)
FDI	-52.433**	-11.000***	2.706	-1.009**
	(20.886)	(1.557)	(1.661)	(0.461)
FDI×INST	**7.453**	**1.729*** **	**-0.392**	**0.146** **
	(5.619)	**(0.467)**	**(0.434)**	**(0.065)**
INST	-0.143	-0.498**	-0.020**	-0.053**
	(0.188)	(0.212)	(0.008)	(0.022)
Lag RDD	0.351	0.364	0.023	0.001
	(0.294)	(0.265)	(0.018)	(0.031)
ROA	-0.090	-0.075	0.007	0.021*
	(0.209)	(0.199)	(0.015)	(0.013)
FIRMSIZE	0.165***	0.169***	0.020*	0.021**
	(0.050)	(0.061)	(0.011)	(0.009)
FIRMAGE	-0.024*	-0.024*	-0.001	-0.001*
	(0.012)	(0.012)	(0.001)	(0.001)
GENDER	0.110	0.019	-0.006	0.011
	(0.135)	(0.129)	(0.012)	(0.011)
AGE	-0.005	-0.002	0.00002	0.001
	(0.006)	(0.006)	(0.001)	(0.001)
HUMANCAP	-0.000	0.103	0.003	0.013
	(0.173)	(0.164)	(0.010)	(0.011)
LSKILL	2.148***	1.891**	-0.154	0.002
	(0.692)	(0.923)	(0.149)	(0.161)
EXPORT	0.388*	0.339	0.081*	0.116**
	(0.203)	(0.215)	(0.046)	(0.053)
ZONE	-0.094	0.020	-0.079**	-0.060*
	(0.206)	(0.198)	(0.037)	(0.034)
HERFINDAHL	-16.813**	-4.638	-0.353	0.009
	(8.407)	(9.938)	(0.276)	(0.219)
TECHGAP	-0.174*	-0.248***	0.017	0.035
	(0.089)	(0.094)	(0.028)	(0.030)
Year dummies	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y
Cragg-Donald Wald F statistic	8.460	10.839	7.865	8.349
Stock-Yogo critical value at 10%	7.77	7.77	7.77	7.77
Underidentification test	43.372***	58.927***	47.021***	49.396***
Overidentification test	4.096	4.975	6.151	3.931
Endogeneity test	9.67**	19.51***	6.292*	6.439*
Observations	3,101	3,101	3,278	3,278

Note. This table reports the estimation results on how institutions moderate the impact of FDI on R&D investments of domestic firms, taking into account FDI origins. In Columns 1-2, the IV-probit model is used to estimate the impacts on the probability of R&D engagement, and institutions are instrumented by *HIGHEDU* and *NONLOCAL*. In Columns 3-4, GMM is used to estimate the impacts for R&D expenditure (in natural logarithm), and institutions are instrumented by *TENURE* and *SWITCH*. FDI presence in a given manufacturing industry is instrumented by the FDI presence in two service industries in a non-neighbouring region. The marginal effects of the IV-Probit model (Columns 1 and 2) are reported in Columns 2 and 3 of Table A5 of the Appendix. The first-stage regression results are reported in

Table A8 of the Appendix. Robust standard errors are in parentheses. Constants are excluded for brevity. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

6.5.2 Alternative Measures of FDI

In the baseline results presented in Table 6.2 and Table 6.3, FDI presence is proxied by the output share of horizontal FDI in a given industry in a given region. The technological spillovers between FDI and domestic SMEs may also occur via vertical linkages. Therefore, this subsection checks the sensitivity of the main results by using alternative measures of FDI presence, including forward FDI, backward FDI and a composite FDI index that captures both horizontal and vertical channels. The calculation of forward FDI and backward FDI is presented in *Subsection 5.3.1. FDI measures*. The composite FDI index is constructed by using principal component analysis.

The estimation results are presented in Table 6.5. Specifically, Columns 1-3 report the results of Equation (1) using the IV-Probit model to estimate the impacts on the probability of R&D engagement (*RDD*), whereas Columns 4-6 present the results of Equation (2) using the IV-GMM estimation and the natural logarithm of R&D expenditure (*RDE*) as the dependent variable. The negative and statistically significant coefficients of *FDI* throughout columns 1-6 indicate that FDI presence negatively affects both the probability of engaging in R&D and the amount of R&D expenditure of domestic SMEs. However, the coefficients of $FDI \times INST$ are positive and statistically significant in all columns, suggesting that the main results are robust to alternative measures of FDI presence.

Table 6.5. Alternative measures of FDI

Variables	Dependent variable: *RDD*			Dependent variable: *RDE*		
	Forward FDI	Backward FDI	FDI index	Forward FDI	Backward FDI	FDI index
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	-19.913***	-24.246***	-15.046***	-1.756**	-1.555*	-1.098***
	(4.402)	(6.544)	(3.171)	(0.761)	(0.872)	(0.399)
FDI×INST	**2.042*** **	**2.478*** **	**2.842*** **	**0.368*** **	**0.314** **	**0.188** **
	(0.619)	**(0.627)**	**(0.553)**	**(0.131)**	**(0.133)**	**(0.092)**
INST	0.059	-0.472***	-0.558**	-0.081***	-0.082***	-0.064***
	(0.232)	(0.170)	(0.261)	(0.023)	(0.026)	(0.024)
Lag RDD	0.373	0.320	0.416	0.042	0.033*	0.021
	(0.259)	(0.283)	(0.262)	(0.027)	(0.020)	(0.025)
ROA	-0.160	-0.077	-0.091	0.020**	0.018	0.022**
	(0.193)	(0.233)	(0.206)	(0.010)	(0.011)	(0.011)
FIRMSIZE	0.142**	0.162***	0.180***	0.025***	0.024***	0.025***
	(0.060)	(0.055)	(0.051)	(0.008)	(0.007)	(0.009)
FIRMAGE	-0.022*	-0.018	-0.025**	-0.0003	-0.0004	-0.001*
	(0.011)	(0.013)	(0.013)	(0.000)	(0.001)	(0.0005)
GENDER	-0.004	0.047	0.045	0.007	0.006	0.010
	(0.145)	(0.141)	(0.136)	(0.015)	(0.013)	(0.013)
AGE	-0.002	-0.004	-0.002	-0.0001	-0.0002	-0.0003
	(0.005)	(0.006)	(0.005)	(0.001)	(0.001)	(0.001)
HUMANCAP	0.013	0.031	0.076	-0.001	-0.001	0.0002
	(0.158)	(0.181)	(0.172)	(0.008)	(0.010)	(0.010)
LSKILL	1.462	1.945**	1.705**	0.057	0.032	0.008
	(0.936)	(0.841)	(0.727)	(0.180)	(0.189)	(0.154)
EXPORT	0.448**	0.496**	0.355	0.117**	0.104**	0.116**
	(0.207)	(0.222)	(0.217)	(0.059)	(0.049)	(0.054)
ZONE	-0.124	-0.115	-0.086	-0.054	-0.050	-0.063*
	(0.192)	(0.211)	(0.209)	(0.050)	(0.041)	(0.036)
HERFINDAHL	-32.621***	-25.893***	-16.372*	-0.004	0.051	0.014
	(7.168)	(8.464)	(9.149)	(0.240)	(0.197)	(0.203)
TECHGAP	0.078	0.116	-0.197**	-0.020	-0.012	-0.010
	(0.105)	(0.114)	(0.090)	(0.034)	(0.030)	(0.034)
Year dummies	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald F statistic	14.602	17.393	14.602	18.448	14.619	19.797
Stock-Yogo critical value at 10%	7.77	7.77	7.77	7.77	7.77	7.77
Underidentification test	95.880***	104.563***	95.880***	105.402***	81.210***	119.393***
Overidentification test	2.954	3.687	2.954	0.710	0.599	0.184
Endogeneity test	16.86***	8.39**	15.21***	9.874**	8.860**	6.982*
Observations	3,101	3,101	3,101	3,278	3,278	3,278

Note. This table reports the estimation results on how institutions moderate the impact of FDI on the R&D engagement of domestic firms using alternative measures of FDI. In Columns 1-3, an IV-probit model is used to estimate the impacts on the probability of R&D investment, and institutions are instrumented by *HIGHEDU* and *NONLOCAL*. In Columns 4-6, GMM is used to estimate the impacts on R&D expenditure (in natural logarithm), and institutions are instrumented by *TENURE* and *SWITCH*. FDI presence in a given manufacturing industry is instrumented by FDI presence in two service industries in a non-neighbouring region. The marginal effects of the IV-Probit model (Columns 1-3) are reported in Columns 4-6 of Table A5 of the Appendix. The first-stage regression results are reported in Table A9 of the Appendix. Robust standard errors are in parentheses. Constants are excluded for brevity. *, ** and *** denote significant levels at 10%, 5% and 1%, respectively.

6.6 Summary

This chapter reports and discusses the empirical findings regarding the moderating effect of institutions on the relationship between FDI and R&D investment of domestic SMEs. The marginal effects of FDI presence on domestic SMEs' R&D activities are negative. All other things being equal, a 1% increase in FDI presence lowers the probability of SMEs' R&D engagement by 0.153% and reduces SMEs' R&D expenditure by approximately 0.26%. However, institutions positively moderate the effect of FDI on R&D engagement and R&D expenditure of domestic SMEs. As institutional quality increases, the negative impacts of FDI decrease, and if institutional quality reaches a threshold level, FDI promotes R&D investment of domestic SMEs. Specifically, a one-unit increase in institutional quality raises the marginal impact of FDI on an SME's R&D engagement by 6.8% and the marginal impact of FDI on SMEs' R&D expenditure by 9.9%, *ceteris paribus*. The impact of FDI on R&D engagement of domestic SMEs turns from negative to positive if the institutional score exceeds 7.926 points. The institutional threshold for positive FDI impact on R&D expenditure is 3.374 points.

The additional analyses indicate that the institutional moderating effects are only significant for FDI from countries with higher institutional quality than Vietnam, not from countries with lower institutional quality. This corroborates the proposition that MNEs from institutionally developed countries are more vulnerable to institutional deficiencies due to their unfamiliarity with institutional hurdles. The use of alternative measures of FDI presence confirms the robustness of the main results, that is, although both vertical and horizontal FDI exert direct negative impacts on the R&D investment of domestic SMEs, institutions positively moderate these FDI spillovers via both directions.

Chapter 7: FDI, Institutions and Product and Process Innovations of Domestic SMEs

7.1 Introduction

This chapter presents empirical results on how institutions moderate FDI's impact on product and process innovations of domestic SMEs. The estimation results are based on Equations (3) and (4) specified in *Subsection 4.3.2* to demonstrate the two-stage decision-making process of firms regarding product/process innovation, that is, whether to engage in product/process innovation and subsequently the extent of the innovation if firms decide to innovate, as follows:

$$Pr\left(INNOD_{ijdt} = 1 \middle| INNOD_{ijd,t-1}, FDI_{jdt}, X_{ijdt}, dregion_d, dindustry_j, dyear_t\right) = \Phi(\tau_0 + \tau_1 INNOD_{ijd,t-1} + \tau_2 FDI_{jdt} + \tau_3 FDI_{jdt} \times INST_{kt} + \tau_4 INST_{kt} + \tau' X_{ijdt} + dregion_d + dindustry_j + dyear_t) \quad (3)$$

where *i*, *j*, *k*, *d*, and *t* denote firm, 4-digit industry, province, economic region, and year, respectively. $INNOD_{ijdt}$ is a set of dummy variables equal to 1 if firm *i* in industry *j* in region *d* engaged in a particular innovation activity at time *t*, and 0 otherwise. Since the interest is in product and process innovations, $INNOD_{ijdt} \in \{NPD_{ijdt}, NPC_{ijdt}\}$, where *NPD* indicates whether a firm introduces new products in the survey year or not, and *NPC* refers to the adoption of new processes/technologies. $INNOD_{ijd,t-1}$ is one-year lag innovation variable. FDI_{jdt} is FDI presence in industry *j* in region *d* and year *t*; $INST_{kt}$ represents institutional quality in province *k* in year *t*; X_{ijdt} is the vector of control variables that capture firm-specific and industry-specific characteristics; $dregion_d$, $dindustry_j$, $dyear_t$ are regional, industry and year dummies, respectively; and ε_{ijdt} is the error term.

$$E\left(INNO_{ijdt} \middle| INNOD_{ijd,t-1}, FDI_{jdt}, X_{ijdt}, dregion_d, dindustry_j, dyear_t\right) = exp(\varphi_0 + \varphi_1 INNOD_{ijd,t-1} + \varphi_2 FDI_{jdt} + \varphi_3 FDI_{jdt} \times INST_{kt} + \varphi_4 INST_{kt} + \varphi' X_{ijdt} + dregion_d + dindustry_j + dyear_t) \quad (4)$$

where, $INNO_{ijdt}$ is the number of new products or processes/technologies of SME *i* in industry *j* in region *d* during year *t*. That is, $INNO_{ijdt} \in \{NPDN_{ijdt}, NPCN_{ijdt}\}$, where $NPDN_{ijdt}$ denotes

the number of new products, and $NPCN_{ijdt}$ refers to the number of new processes/technologies. The other variables are defined as above.

Section 7.2 reports the estimation results on product innovation, while Section 7.3 focuses on process innovation. In each section, the estimation results on the direct effects of FDI on product/process innovation of domestic SMEs without considering the moderating role of institutions are first reported, followed by the institutional moderating effects obtained from estimating Equations (3) and (4):

Section 7.4 presents additional analyses regarding FDI origin, institutional sub-indices, alternative measures of FDI, and other sensitivity analyses. Specifically, *Subsection 7.4.1* distinguishes the institutional moderating effect between FDI from developed and developing countries. *Subsection 7.4.2* examines each of the nine institutional sub-indices separately to evaluate the relative importance of these components in moderating FDI spillovers. *Subsection 7.4.3* re-estimates the baseline models using alternative measures of FDI presence, including forward FDI, backward FDI and a composite FDI index that captures both horizontal and vertical channels. *Subsection 7.4.4* checks the sensitivity of the baseline results. First, an alternative dependent variable that captures both product and process innovations is employed. Second, the extensive and intensive measures of R&D activities are incorporated as an explanatory variable in the main models. Finally, the analysis examines whether the moderating effect of institutions on FDI innovation spillovers may differ due to the heterogeneity of domestic SMEs regarding labour productivity, firm size and the technological intensity level of the industry. Section 7.5 concludes the chapter.

7.2. Product Innovation

7.2.1 FDI and Product Innovation: Assuming no Moderating Effect of Institutions

The direct effect of FDI presence on product innovation of domestic SMEs is estimated before taking into account the moderating effects of institutions. Table 7.1 presents the estimation results of Equations (3) and (4) without the interaction term between the institutional variable and FDI ($INST \times FDI$). FDI presence is proxied by the output share of horizontal FDI in a given industry. Columns 1-2 examine the effect of FDI on SMEs' probability of introducing new products based on Equation (3). Column 1 reports the result of the IV-Probit model and Column 2 reports the result of the IV-2SLS model to address the endogeneity concern of FDI. Significant endogeneity tests in Columns 1 and 2 reject the null hypothesis that regressors are exogenous, and suggest that IV regression is preferred over the Probit model which assumes exogeneity of all right-hand-side variables. The marginal effect of FDI will be derived from the IV-2SLS model rather than IV-Probit for the ease of interpretation. As shown in Table 7.1, the coefficients of FDI are negative and statistically significant in Column 1, indicating that FDI adversely affects the probability of domestic SMEs conducting product innovation. The coefficient of FDI is negative but not statistically significant in Column 2.

Column 3 presents the estimation results of Equation (4) using GMM-Poisson estimation. The coefficients of FDI are negative and statistically significant, suggesting a negative impact on the number of new products introduced by domestic SMEs. The results from Table 7.1 align with prior studies confirming the negative crowding-out effects of FDI on domestic firms' product innovation (see, e.g., García et al., 2013; Girma, Gong, et al., 2008). SMEs may face challenges in effectively leveraging FDI technological spillovers due to their limited absorptive capacity. In addition, heightened foreign competition can diminish the motivation of SMEs to introduce new products, primarily because of substantial innovation capacity disparities. Furthermore, SMEs lacking scale and market power are susceptible to displacement by foreign enterprises in product, labour, and financial markets. Consequently, this displacement can deplete the resources necessary for product innovation.

Table 7.1. The direct effect of FDI on product innovation of domestic SMEs: assuming no moderating effect of institutions

Variables	IV-Probit (1)	IV-2SLS (2)	GMM-Poisson (3)
FDI	**-1.462***	**-0.199**	**-1.968*****
	(0.858)	**(0.131)**	**(0.003)**
INST	-0.162*	-0.027	-0.090***
	(0.095)	(0.018)	(0.0001)
NPD_{t-1}	0.120	0.010	-0.403***
	(0.219)	(0.023)	(0.005)
ROA	0.026	0.007	0.127***
	(0.070)	(0.013)	(0.001)
FIRMSIZE	0.003	0.002	0.110***
	(0.023)	(0.004)	(0.001)
FIRMAGE	0.001	0.000	-0.002***
	(0.003)	(0.000)	(0.0001)
GENDER	-0.053	-0.006	-0.006***
	(0.053)	(0.009)	(0.001)
AGE	-0.000	-0.000	-0.003***
	(0.002)	(0.000)	(0.00004)
HUMANCAP	0.123**	0.015*	0.128***
	(0.055)	(0.009)	(0.001)
LSKILL	0.471	0.102	0.707***
	(0.413)	(0.088)	(0.001)
EXPORT	0.147	0.025	0.393***
	(0.100)	(0.018)	(0.002)
ZONE	0.175	0.028	-0.109***
	(0.118)	(0.021)	(0.002)
HERFINDAHL	-0.091	0.017	-0.110***
	(0.462)	(0.082)	(0.003)
TECHGAP	0.063*	0.009*	0.063***
	(0.034)	(0.005)	(0.0003)
Year dummies	Y	Y	Y
Industry dummies	Y	Y	Y
Region dummies	Y	Y	Y
Weak instrument test			
- Cragg-Donald Wald F statistic	36.930	36.930	109.720
- Stock-Yogo critical value at 10%	19.93	19.93	19.93
Underidentification test	100.570***	100.570***	182.579***
Overidentification test[a]	1.278	1.278	0.355
Endogeneity test	12.51***	3.163*	8.246***
Observations	6,088	6092	4063

Note. This table reports the estimation results of the impact of FDI presence on product innovation of domestic SMEs. Columns 1-2 are based on Equation (3), which examines the probability of introducing new products. Robust standard errors are in parentheses. Column 3 reports the estimation results of Equation (4) to examine the impacts of FDI presence on the number of new products using GMM estimation. In Column 3, NPD_{t-1} is replaced by its predicted value obtained from Equation (3) and the standard errors are bootstrapped. Constants are excluded for brevity. *, ** and *** denote significant levels at 10%, 5% and 1%, respectively.

FDI is instrumented by the output shares of foreign firms in two service industries. *INST* is instrumented by *TENURE* which is the month in position of the provincial leader.

[a] Hansen J statistics

7.2.2 FDI, Institutions and Product Innovation

Table 7.2 presents the estimation results of the impacts of FDI and institutional moderation on product innovation of domestic SMEs. Columns 1-2 report the results of the IV-Probit model based on Equation (3), which addresses the endogeneity of FDI and institutional variables. In Columns 3-4, a linear probability model using the 2SLS estimation is estimated for robustness check. In both sets of estimations, I report the results of both minimum and full specifications. The coefficients of the interaction terms between FDI and institutional variables are positive but statistically insignificant at the 5% level, suggesting that institutions do not moderate the impact of FDI presence on the probability of SMEs introducing a new product.

The estimation results of Equation (4) are presented in Columns 5-6. The statistically significant and positive coefficients of $FDI \times INST$ in both columns indicate that institutions positively moderate the impact of FDI on the number of new products. That is, when institutional quality is higher, SMEs launch more new products at a given level of FDI presence, and vice versa.

From the full specification in Column (6), the marginal impact of FDI can be derived as $\frac{\partial E(NPDN)}{\partial (FDI)} = (-19.831 + 2.521 \times INST) \times exp\,(\varphi' X)$, which is positive only if $INST$ is greater than 7.866. This suggests that FDI improves the product innovation performance of domestic SMEs, provided that institutional quality reaches a certain level. Below this level, that is, without adequate institutional support, SMEs' innovative performance may suffer from negative FDI crowding-out effects, probably due to their low market power and low absorptive capacity.

For other control variables, firm size, profitability, a higher educational level of firms' owners/managers, labour skill, exporting activity, and the location in an industrial zone are all positively associated with product innovation, consistent with the findings of prior research (see, for example, Fassio, 2018; Radas & Božić, 2009). A technological gap appears to promote both the probability of product innovation and the number of new products, suggesting that some

technological distance is necessary to develop the scope for FDI spillovers, and greater pressure on more backward firms may lead to higher incentives for innovation (Khachoo et al., 2018).

Table 7.2. FDI impact on product innovation of domestic SMEs – the role of institutions

Variables	IV-Probit	IV-Probit	IV-2SLS	IV-2SLS	GMM-Poisson	GMM-Poisson
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	-2.052	-3.071	-0.453	-0.625	-12.129***	-19.831***
	(1.895)	(1.968)	(0.375)	(0.432)	(1.682)	(1.805)
FDI×INST	**0.036**	**0.204**	**0.035**	**0.064**	**2.044*** **	**2.521*** **
	(0.357)	**(0.365)**	**(0.068)**	**(0.075)**	**(0.236)**	**(0.249)**
INST	-0.078	-0.177	-0.026	-0.043	-0.201***	-0.247***
	(0.172)	(0.169)	(0.031)	(0.034)	(0.014)	(0.018)
NPD_{t-1}	0.076	0.092	0.008	0.009	0.379***	-0.282**
	(0.214)	(0.208)	(0.022)	(0.023)	(0.040)	(0.119)
ROA		0.022		0.007		0.086***
		(0.067)		(0.013)		(0.014)
FIRMSIZE		-0.000		0.002		0.051***
		(0.022)		(0.004)		(0.014)
FIRMAGE		0.001		0.000		-0.007***
		(0.003)		(0.000)		(0.001)
GENDER		-0.067		-0.010		-0.101***
		(0.052)		(0.009)		(0.007)
AGE		-0.000		-0.000		-0.002***
		(0.002)		(0.000)		(0.001)
HUMANCAP		0.128**		0.018*		0.154***
		(0.053)		(0.009)		(0.026)
LSKILL		0.512		0.107		1.079***
		(0.402)		(0.090)		(0.028)
EXPORT		0.117		0.020		0.817***
		(0.102)		(0.019)		(0.026)
ZONE		0.181		0.030		0.216***
		(0.114)		(0.021)		(0.037)
HERFINDAHL		-0.345		-0.029		-2.904***
		(0.421)		(0.084)		(0.115)
TECHGAP		0.081***		0.013**		0.266***
		(0.030)		(0.006)		(0.006)
Year dummies	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y
Weak instrument test						
- Cragg-Donald Wald F statistic	14.060	11.213	14.060	11.213	12.452	84.511
- Stock-Yogo critical value at 10%	6.61	6.61	6.61	6.61	6.61	13.43
Underidentification test	73.631 ***	57.543 ***	73.631 ***	57.543 ***	73.408***	188.639***
Overidentification test[a]	2.748	1.932	2.748	1.932	1.503	2.086
Endogeneity test	14.44***	18.80***	17.024***	17.546***	15.156***	4.089**
Observations	6,134	6,088	6,140	6092	4082	4072

Note. This table reports the estimation results of the impacts of FDI presence on product innovation of domestic SMEs, taking into account the moderating role of institutions. *FDI* is instrumented by the output shares of foreign firms in two service industries. *INST* is instrumented by *TENURE*, which is the months in position of the provincial leader. Constants are excluded for brevity. Robust standard errors are in parentheses in Columns 1-4. Bootstrap standard errors are in parentheses in Columns 5-6. The first-stage regression results are presented in Table A10 of the Appendix. *, ** and *** denote significant levels at 10%, 5% and 1%, respectively.

[a] Hansen J statistics

7.3. Process Innovation

7.3.1 FDI and Process Innovation: Assuming no Moderating Effect of Institutions

The effect of FDI presence on process innovation of domestic SMEs is estimated prior to considering the moderating effects of institutions. Table 7.3 presents the estimation results of Equations (3) and (4) without the interaction term between the institutional variable and FDI ($INST \times FDI$). FDI presence is proxied by the output share of horizontal FDI in a given industry. Columns 1-2 examine the effect of FDI on SMEs' probability of adopting new processes/technologies based on Equation (3). Column 1 reports the result of the IV-Probit model, and Column 2 reports the result of the IV-2SLS model to address the endogeneity concern of FDI. As shown in Table 7.3, the coefficients of FDI are positive and statistically significant in Columns 1-2, indicating that FDI presence increases the probability of domestic SMEs engaging in process innovation. From Column 2, a 1% increase in FDI presence leads to a 0.331% increase in the probability of domestic SMEs engaging in process innovation.

Column 3 presents the estimation results of Equation (4) using a GMM-Poisson estimation. The coefficient of FDI is positive and statistically significant, suggesting a positive impact on the number of new processes/technologies introduced by domestic SMEs.

The results from Table 7.3 provide contrasting findings to the results shown in Table 7.1, which resonates with the mixed findings in the existing literature on FDI innovation spillovers (see, e.g., García et al., 2013; Girma, Gong, et al., 2008; Huang & Zhang, 2020; Sun & Du, 2010). The results, which assume no moderating effect of institutions, show that although FDI exerts positive spillovers to process innovation of domestic SMEs, the impact on product innovation is negative. This prompts further investigation to incorporate the institutional environment in which these spillovers occur.

It is worth noting that a negative effect of institutions on product innovation is found on Columns 1 and 3 of Table 7.1. In contrast, the results in Table 7.3 suggest a generally positive effect of institutions on process innovation with a statistically significant coefficient in Column

3. This corroborates the preliminary findings of the bivariate analysis in Figure 5.2 and Table 5.8, Section 5.6, Chapter 5. Thus, institutions seem to have different effects on different types of innovation, that is, while a better institutional environment fosters the adoption of new processes, it reduces the incentives for SMEs to produce new products. Strong institutions often foster market competition by reducing barriers to entry and preventing monopolistic practices. Although Schumpeter (1942)'s view argues that firms in concentrated markets have the resources and stability needed to focus on long-term technological advancements, small firms with limited resources may find it difficult to maintain profitability and invest in innovation when the competition is high. In a highly competitive market, firms may prefer process innovation which is internally driven and harder for competitors to replicate (Damanpour & Aravind, 2006).

Table 7.3. The direct effect of FDI on process innovation of domestic SMEs: assuming no institutional moderating effect

Variables	IV-Probit (1)	IV-2SLS (2)	GMM-Poisson (3)
FDI	**1.993*** **	**0.331*** **	**9.165*** **
	(0.671)	**(0.126)**	**(0.048)**
INST	0.028	0.005	0.206***
	(0.101)	(0.013)	(0.005)
NPC_{t-1}	0.145**	0.037***	-1.544***
	(0.068)	(0.014)	(0.061)
ROA	0.224***	0.040***	0.626***
	(0.067)	(0.011)	(0.011)
FIRMSIZE	0.168***	0.026***	0.574***
	(0.021)	(0.003)	(0.009)
FIRMAGE	-0.005	-0.000	-0.018***
	(0.003)	(0.000)	(0.0005)
GENDER	0.115**	0.016**	0.506***
	(0.052)	(0.008)	(0.007)
AGE	-0.004*	-0.001*	-0.028***
	(0.002)	(0.000)	(0.0004)
HUMANCAP	0.151**	0.018**	0.729***
	(0.062)	(0.007)	(0.010)
LSKILL	0.780**	0.226**	-0.424***
	(0.395)	(0.089)	(0.040)
EXPORT	0.318***	0.072***	0.672***
	(0.085)	(0.020)	(0.047)
ZONE	0.150	0.044*	-0.246***
	(0.099)	(0.024)	(0.016)
HERFINDAHL	1.019***	0.150**	-0.084*
	(0.359)	(0.061)	(0.049)
TECHGAP	-0.041	-0.006	0.144***
	(0.028)	(0.005)	(0.003)
Year dummies	Y	Y	Y
Industry dummies	Y	Y	Y
Region dummies	Y	Y	Y
Weak instrument test			
- Cragg-Donald Wald F statistic	40.671	40.671	68.467
- Stock-Yogo critical value at 10%	13.43	13.43	13.43
Underidentification test	112.399***	112.399***	174.929***
Overidentification test[a]	0.389	0.389	0.324
Endogeneity test	6.83**	5.713**	7.962***
Observations	6,061	6089	4052

Note. This table reports the estimation results of the impact of FDI presence on the process innovation of domestic SMEs. Columns 1-2 are based on Equation (3), which examines the probability of introducing new processes/technologies. Robust standard errors are in parentheses. Column 3 reports the estimation results of Equation (4) to examine the impacts of FDI presence on the number of processes/technologies, using GMM estimation. In Column 3, NPD_{t-1} is replaced by its predicted value obtained from Equation (3) and the standard errors are bootstrapped. Constants are excluded for brevity. *, ** and *** denote significant levels at 10%, 5% and 1%, respectively.

FDI is instrumented by the output shares of foreign firms in two service industries. *INST* is instrumented by *TENURE*, which is the month in position of the provincial leader.

[a] Hansen J statistics

7.3.2 FDI, Institutions and Process Innovation

Table 7.4 presents the estimation results on how institutions moderate FDI impact on process innovation of domestic SMEs, where Columns 1-4 report the estimation results for the probability of SMEs adopting new processes/technologies as specified in Equation (3), while Columns 5-6 report the estimation results for the count measure in Equation (4).

The coefficients of the interaction term *FDI*×*INST* are positive and significant throughout Columns 1 to 4, indicating that institutions enhance the impact of FDI technological spillovers on the probability of process innovation by domestic SMEs. In other words, given a level of FDI presence, SMEs operating in a better institutional environment are more likely to adopt new processes/technologies. The marginal effect of *FDI* can be computed from Column 4 as $\frac{\partial Pr(NPC=1)}{\partial (FDI)} = -0.636 + 0.138 \times INST$, which is positive if *INST* is greater than 4.609. This implies that FDI encourages (impedes) process innovation of domestic SMEs if institutional quality is higher (lower) than the 4.609-point threshold. Further differentiating the marginal impact of *FDI* with respect to institutions gives $\frac{\partial^2 Pr(NPC=1)}{\partial (FDI)\,\partial (INST)} = 0.138$, that is, a one-unit increase in the level of institutional quality leads to a 13.8% increase in the marginal impact of FDI on the probability of process innovation by domestic SMEs.

As can be seen from Columns 5-6, the positive and statistically significant coefficients of *FDI*×*INST* reinforce the findings on the positive moderating impact of institutional quality on the relationship between FDI and domestic SMEs' innovation. Higher institutional quality not only increases the probability of SMEs' process innovation but also encourages them to adopt more new processes/technologies, for a given level of FDI presence. From Column (6), the marginal impact of FDI can be derived as $\frac{\partial E(NPCN)}{\partial (FDI)} = (-4.144 + 1.407 \times INST) \times exp\,(\varphi' X)$, suggesting that the impact of FDI on the expected number of newly adopted processes/technologies is positive if institutional quality exceeds the level of 2.945 points and *vice versa*.

With regards to the control variables, the coefficients of NPC_{t-1} are positive and significant, consistent with the proposition by Antonelli et al. (2012) and Hecker and Ganter (2014), among others, that firms that innovated in the previous period are more likely to innovate in the current period. I also find that profitability, firm size, the human capital of owners/managers, labour qualifications, export activity, and the location in an industrial zone all play an important role in promoting process innovation of SMEs. The findings are in line with extant research on the organisational determinants of innovation, such as Fassio (2018), Nam and Bao Tram (2021) and Radas and Božić (2009). In contrast, older SMEs are less likely to engage in the activity, as suggested by Huergo and Jaumandreu (2004).[30]

[30] Huergo and Jaumandreu (2004) also suggest that the relationship between firm age and SMEs' product/process innovation may be non-linear. To test for this proposition, I add the square term of firm age to the model specification and re-estimate Equations (3) and (4) accordingly. The results do not confirm non-linearity and therefore, are not reported here.

Table 7.4. FDI impact on process innovation of domestic SMEs – the role of institutions

Variables	IV-Probit	IV-Probit	IV-2SLS	IV-2SLS	GMM-Poisson	GMM-Poisson
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	-3.600*	-3.406**	-0.588	-0.636**	-9.825***	-4.144***
	(2.064)	(1.376)	(0.377)	(0.251)	(0.178)	(0.307)
FDI×INST	**0.795****	**0.751*****	**0.134****	**0.138*****	**1.840*****	**1.407*****
	(0.336)	**(0.261)**	**(0.067)**	**(0.051)**	**(0.029)**	**(0.030)**
INST	-0.292*	9.452***	-0.047	-0.042*	-0.108***	0.042**
	(0.176)	(3.520)	(0.030)	(0.024)	(0.013)	(0.019)
NPC_{t-1}	0.363***	0.167***	0.075***	0.042***	0.432***	-0.778***
	(0.067)	(0.064)	(0.014)	(0.014)	(0.057)	(0.037)
ROA		0.216***		0.040***		0.455***
		(0.068)		(0.011)		(0.009)
FIRMSIZE		0.157***		0.024***		0.403***
		(0.023)		(0.004)		(0.006)
FIRMAGE		-0.004		-0.000		-0.017***
		(0.003)		(0.000)		(0.000)
GENDER		0.064		0.008		-0.356***
		(0.053)		(0.008)		(0.004)
AGE		-0.004*		-0.001*		-0.027***
		(0.002)		(0.000)		(0.000)
HUMANCAP		0.186***		0.025***		0.653***
		(0.060)		(0.008)		(0.006)
LSKILL		0.905**		0.250***		0.533***
		(0.378)		(0.089)		(0.029)
EXPORT		0.236***		0.059***		0.599**
		(0.088)		(0.020)		(0.010)
ZONE		0.155		0.046*		0.309***
		(0.098)		(0.024)		(0.008)
HERFINDAHL		0.255		0.029		1.861***
		(0.336)		(0.048)		(0.116)
TECHGAP		0.018		0.005		0.135***
		(0.025)		(0.004)		(0.004)
Year dummies	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y
Weak instrument test						
- Cragg-Donald Wald F statistic	6.676	15.707	6.676	15.707	9.626	7.420
- Stock-Yogo critical value at 10%	6.61	6.61	6.61	6.61	6.61	6.61
Underidentification test	35.693***	75.471***	35.693***	75.471***	40.414 ***	30.771 ***
Overidentification test[a]	0.2069	0.257	0.2069	0.257	2.032	1.430
Endogeneity test	7.45*	9.44**	6.325*	8.224**	5.959	7.605 *
Observations	6,108	6,061	6,137	6,089	4,069	4,052

Note. This table reports the estimation results of the impacts of horizontal FDI on process innovations of domestic SMEs, taking into account the moderating role of institutions. *FDI* is instrumented by the output shares of foreign firms in two service industries. *INST* is instrumented by *TENURE*, which is the month in position of the provincial leader. Constants are excluded for brevity. Robust standard errors are in parentheses in Columns 1-4. Bootstrap standard errors are in parentheses in Columns 5-6. The first-stage regression results are presented in Table A11 of the Appendix. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.

[a] Hansen J statistics

The results presented in Table 7.3 and Table 7.4 imply that the institutional moderating impacts are not homogenous between product innovation and process innovation. In the previous section, the analysis did not show a significant moderating effect of institutions on the relation

between FDI and the probability of introducing a new product. Accordingly, institutional quality appears to be more important in promoting positive FDI spillovers on process innovation than on product innovation of domestic SMEs.

Conceptually, FDI can influence the innovation of indigenous firms through four channels: the demonstration and competition effects, labour mobility, and the supplier-customer relationship (Blomström & Kokko, 1998). It is important to note that these channels may have different implications for product innovation and process innovation. For example, the demonstration effect may hold greater significance for domestic firms' product innovation because new products introduced by foreign firms can educate local consumers and stimulate demand in related industries (Kim & Li, 2014). Additionally, given the successful launch of these new products in foreign markets, FDI presence can guide domestic firms in their innovation path, alleviating perceived risks associated with developing similar products (Cheung & Ping, 2004). Conversely, labour mobility may exert a stronger influence on process innovation, as firms often require tacit knowledge to effectively adopt new technologies – a knowledge transfer facilitated by the movement of human capital. Lastly, the competition effect (the third channel) may impact both product and process innovations depending on the response strategy of domestic firms. If the objective is to regain monopolistic power, there is a greater incentive to introduce new products. Alternatively, if the aim is to compete by lowering production costs, the focus may shift towards adopting new processes or technologies for enhanced efficiency. Consequently, the overall impact of FDI on domestic firms' innovation can vary between product innovation and process innovation, contingent upon the relative importance of channels at play.

Thus, FDI can affect product and process innovations through different channels. While the demonstration effect may be more pronounced for domestic firms' product innovation, labour mobility may have a stronger effect on process innovation, and the competition effect can affect both types of innovation. These channels can help explain the difference in the moderating effect of institutions between product innovation and process innovation. For example, institutions may play a more important role in promoting labour mobility that facilitates the transfer of tacit

knowledge from FDI firms to domestic firms rather than the demonstration effect, making it more prominent for process innovation than for product innovation.

Equations (3) and (4) are used for estimating the FDI effect on innovation output. Since it takes time for R&D investment to translate into output, while *FDI* and *INST* affect R&D investment as suggested by Equations (1)-(2), it is worth considering the inclusion of lagged *FDI* and *INST* in Equations (3)-(4) to capture their delayed effects on innovation output. Equations (3) and (4) using one period lagged values of *FDI* and *INST* and provided the results in Tables B1 and B2 in Appendix B. In addition, negative binomial regression, which has a less restrictive assumption by allowing for overdispersion in data, is used to estimate Equations (3) and (4) and provide further robustness as shown in Table B3 in Appendix B. The results are similar to the main regressions presented in this chapter.

7.4 Additional Analyses

In this subsection, further analyses are conducted to examine whether the institutional moderating effects vary across different types of FDI origins and institutional factors. Specifically, *Subsection 7.4.1* distinguishes between FDI from developed and developing countries. *Subsection 7.4.2* expands the baseline econometric models by employing alternative measures of FDI, which capture backward FDI, forward FDI, and FDI presence in both horizontal and vertical directions. *Subsection 7.4.3* evaluates and compares the moderating effects of different institutional components. Finally, *Subsection 7.4.4* provides sensitivity analyses involving the heterogeneity of domestic SMEs.

7.4.1 FDI Origin

Prior research suggests that how FDI responds to host countries' institutions may be attributable to the characteristics of the origin country. Arguably, the development status of the home country determines the technological component incorporated in MNEs' FDI. MNEs from developed countries often possess more advanced technologies and know-how compared to those from developing countries, hence the greater possibility of technological spillovers (Anokhin &

Schulze, 2009). Therefore, under the same level of institutional support, FDI from developed countries may be able to generate more significant technological spillovers that promote the innovation of domestic SMEs.

In addition, developed countries usually exhibit higher quality institutions than their developing counterparts. This means that MNEs in the former group are generally unfamiliar with institutional weaknesses, leading to excessive costs and risks associated with the *"liability of foreignness"* when operating in a developing context (Krammer, 2015). In contrast, investors experiencing imperfect institutions at home may have developed the management skills and knowledge to cope with institutional deficiencies, thereby less vulnerable to low-quality institutions (Godinez & Liu, 2015). Empirical studies have confirmed that MNEs from countries with developed institutions are deterred more by worse institutions abroad (Aleksynska & Havrylchyk, 2013). Wang et al. (2013) further show that a better institutional setting only significantly fosters productivity spillovers from non-ethnic linked MNEs who lack prior experience in a similar business environment as opposed to ethnic-linked MNEs.

Given that Vietnam is a developing country with relatively low institutional quality, it is expected that the moderating effect of institutions on the relationship between FDI and innovation of domestic SMEs may be stronger for FDI from developed countries than from developing countries. To test this hypothesis, the sample of MNEs is split into developed and developing country groups[31] to re-calculate FDI presence and employ the 2SLS technique to re-estimate Equation (3) for each group, respectively. The results are presented in Table 7.5. As can be seen from Table 7.5, Columns 1-2 report the estimation results of the institutional moderating effect on FDI spillovers to new product innovation of domestic SMEs. The coefficient of *FDI×INST* is

[31] Country classification is compliant with the statistical annex of the annual World Economic Situation and Prospects report provided by the United Nations.

positive and statistically significant in Column 1 while insignificant in Column 2, suggesting that the institutional moderating impact is only significant for FDI from developed countries but not from developing countries. This likely explains the insignificant effects in Table 7.2, where FDI measurement is pooled over developed and developing countries. The marginal impact of developed country FDI with respect to institutions is 0.527, that is, a one-unit increase in the institutional quality results in a 52.7% increase in the probability of domestic firms conducting product innovation. The minimum required level of institutional quality for the marginal effects of developed country FDI to turn positive is 3.433 points.

Columns 3-4 report the results of the institutional moderating effect on FDI spillovers to new process innovation of domestic SMEs. The coefficients of *FDI*×*INST* are positive and statistically significant in both model specifications, confirming the importance of institutions in promoting the technological spillovers of both developed country and developing country FDI to process innovation of domestic SMEs. However, the magnitudes of the effects are different between the two groups. From columns 3-4, the marginal effects of developed country FDI can be derived as $\frac{\partial Pr(NPC=1)}{\partial (FDI)} = -1.897 + 0.310 \times INST$; whereas that of developing country FDI is $\frac{\partial Pr(NPC=1)}{\partial (FDI)} = -0.809 + 0.178 \times INST$. The minimum required levels of institutional quality for the marginal effects of developed country FDI and developing country FDI to turn positive are 6.119 points and 4.545 points, respectively. This suggests that institutional requirements for FDI from developed countries to exert positive spillover effects on SMEs' process innovation are higher than those for their developing counterparts. Taking the second derivative with respect to institutions, the moderating effect of institutions for developed country FDI is 0.310, nearly double that for developing country FDI at 0.178. Therefore, the results from Columns 3-4 reinforce the proposition that the moderating effects of institutions are stronger for developed country FDI than developing country FDI.

Table 7.5. The moderating effect of institutions and FDI origins: developed vs. developing countries

Variables	New product		New process	
	FDI from developed countries (1)	FDI from developing countries (2)	FDI from developed countries (3)	FDI from developing countries (4)
FDI	-1.809***	-0.253	-1.897***	-0.809**
	(0.653)	(0.451)	(0.608)	(0.326)
FDI×INST	**0.527*** **	**0.002**	**0.310** **	**0.178*** **
	(0.149)	**(0.089)**	**(0.123)**	**(0.066)**
INST	-0.078***	-0.026	-0.030*	-0.031
	(0.019)	(0.028)	(0.017)	(0.021)
NPD_{t-1}	-0.015	0.006		
	(0.026)	(0.024)		
NPC_{t-1}			0.040***	0.044***
			(0.014)	(0.014)
Controls	Y	Y	Y	Y
Year dummies	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y
Weak instrument test				
- Cragg-Donald Wald F statistic	17.176	15.724	11.070	17.191
- Stock-Yogo critical value at 10%	6.61	6.61	6.61	6.61
Underidentification test	88.189***	74.851***	51.423***	77.106***
Overidentification test[a]	3.569	2.293	0.754	0.628
Endogeneity test	21.245***	18.411***	11.146**	9.212**
Observations	6,092	6,092	6,089	6,089

Note. This table reports the estimation results of the institutional moderating effect on FDI spillovers on innovations of domestic SMEs, taking into account FDI origins. Constants are excluded for brevity. Robust standard errors are in parentheses. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.

[a] Hansen J statistics

7.4.2 Institutional Sub-indices

Our baseline analysis relies on the composite institutional index generated by the PCA technique to draw a general conclusion. However, since I only retain the factors with the largest eigenvalues and exclude the others, some dimensions in the institutional data exist that the composite index fails to capture. Therefore, in this subsection, Equation (3) is re-estimated for each of the nine institutional sub-indices, namely *entry cost*, *land access*, *transparency*, *control*

of corruption, *time cost*, *proactivity*, *business support*, *labour train*, and *rule of law*[32] to evaluate the relative importance of these components in moderating FDI spillovers. Since the institutional moderating effects may vary between developed country FDI and developing country FDI as demonstrated in the above subsection, I continue to conduct the analysis separately for the two groups. The results are summarised in Table 7.6, which lists all institutional factors that exert significant moderating effects on each of the following spillover categories: (*i*) developed country FDI spillovers on product innovation, (*ii*) developed country FDI spillovers on process innovation, (*iii*) developing country FDI spillovers on product innovation, and (*iv*) developing country FDI spillovers on process innovation.

Table 7.6. Components of institutions that moderate FDI innovation spillovers

	Product innovation	**Process innovation**
FDI from developed countries	Land access (+) Transparency (+) Control of corruption (+) Time cost (+) Proactivity (+) Rule of law (+) Business support (-)	Entry cost (+) Land access (+) Transparency (+) Control of corruption (+) Rule of law (+)
FDI from developing countries	Control of corruption (+) Business support (-)	Entry cost (+) Land access (+) Control of corruption (+) Time cost (+) Proactivity (+) Rule of law (+) Business support (-) Labour training (-)

Note. The regression results are presented in Table A12 – Table A15 of the Appendix.

The most important institutional aspect in fostering FDI spillovers is the control of corruption since it has statistically significant moderating effects in all four spillover quadrants. Unlike other factors, control of corruption belongs to the informal institutions that are implicit, unwritten,

[32] The definitions of the sub-indices are provided in *Subection 5.2.3. Institutional Data*.

socially embedded and self-enforced (Bu et al., 2022). Corruption refers to the misuse of public power for private gain, which commonly manifests in the form of bribery (Svensson, 2005). The bribery transactions are often kept clandestine due to their illegal nature (Rose-Ackerman, 2014) and are, therefore, difficult for FDI entrants to observe, let alone address through the development of coping strategies. Under the prevalence of corruption, foreign investors often face great uncertainty regarding who to pay, when to pay, and how much to pay (Luu et al., 2019; Rodriguez et al., 2005). The required skills and knowledge may be tacit even for foreign firms who have experienced corruption at home, making them more sensitive to corruption than other aspects of institutions. This likely explains why the control of corruption is the only institutional factor found in Table 7.6 that moderates the impact of developing country FDI on SMEs' product innovation.

Other institutional factors facilitating FDI innovative spillovers are entry cost, land access, time cost, transparency, government proactivity and rule of law. The only institutional factors that do not exert positive effects are the quality of business support and labour training services. The former indicator refers to a range of public assistance and consultancy services regarding trade promotion, technical assistance, business administration, accounting and finance; whereas the latter assesses general and vocational training together with job placement services (Malesky et al., 2016). These kinds of public services can be well substituted by private providers, thereby less important in determining the effectiveness of technological spillovers. Arguably, government intervention in these aspects may even violate the free-market mechanism and subsequently suppress FDI spillovers on the innovation of domestic firms. This may explain some negative effects found in Table 7.6.

7.4.3 Alternative Measures of FDI

In the baseline analysis presented in Table 7.2 and Table 7.4, the presence of FDI is measured using the output share of horizontal FDI within a specific industry and region. However, it is important to consider that technological spillovers between FDI and domestic SMEs can also occur through vertical linkages. Therefore, this subsection aims to test the robustness of the main findings by utilising alternative measures of FDI presence. These alternative measures include

forward FDI, backward FDI, and a composite FDI index that captures both horizontal and vertical channels. The calculation for forward FDI and backward FDI measures is provided in *Subsection 5.3.1. FDI measures*. Principal component analysis is applied to construct the composite FDI index.

Table 7.7 reports the estimation results on how institutions moderate the impact of FDI on product innovation of domestic firms using alternative measures of FDI. Specifically, Columns 1-3 report the results of Equation (3) using the IV-Probit model to estimate the impacts on the probability of introducing new products (*NPD*). The significantly negative coefficients of *FDI* in Columns 1-3 reinforce the previous findings in Table 7.1 by suggesting that both horizontal and vertical FDI dampens the probability of domestic SMEs introducing new products. The coefficients of $FDI \times INST$ are insignificant in the first three columns, implying that institutions do not significantly moderate FDI impacts on the probability of product innovation. This is consistent with the result of the baseline model shown in Table 7.2. Previous analysis of product innovation (as presented in Table 7.5) provides justifications for this insignificant result. It shows that the institutional moderating effect is only significant for the spillovers from developed country FDI, not those from developing country FDI. Table 7.6 shows that out of the nine institutional sub-indices, only corruption matters for the spillovers from developing country FDI. Therefore, pooling the two groups of FDI together may contribute to an overall insignificant institutional moderating effect.

In Table 7.7, Columns 4-6 present the estimation results of Equation (4) using the GMM-Poisson estimation and the number of new products (*NPDN*) as the dependent variable. The significantly negative coefficients of *FDI* in Columns 4-6 indicate that *FDI* presence reduces the number of new products introduced by domestic SMEs regardless of the directions of FDI spillovers. However, the coefficients of $FDI \times INST$ are positive and statistically significant in all columns, suggesting that institutions positively moderate FDI impact on the number of new products launched by domestic SMEs. This confirms the robustness of the main results found in Table 7.2 to alternative measures of FDI presence.

Table 7.7. Alternative measures of FDI presence and product innovation of domestic SMEs

Variables	Dependent variable: *NPD*			Dependent variable: *NPDN*		
	Forward FDI	Backward FDI	FDI index	Forward FDI	Backward FDI	FDI index
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	-1.979**	-1.040*	-1.118*	-17.275***	-72.193***	-15.034***
	(0.830)	(0.605)	(0.587)	(0.073)	(1.095)	(0.188)
FDI×INST	**0.175**	**0.002**	**-0.010**	**0.454*****	**8.666*****	**1.359*****
	(0.109)	**(0.113)**	**(0.110)**	**(0.017)**	**(0.147)**	**(0.024)**
INST	-0.075**	-0.019	-0.001	-0.189***	-1.458***	-0.264***
	(0.034)	(0.042)	(0.049)	(0.003)	(0.025)	(0.005)
NPD_{t-1}	0.014	-0.004	0.007	-0.178***	0.395***	-0.026
	(0.024)	(0.025)	(0.025)	(0.013)	(0.034)	(0.037)
ROA	0.005	0.015	0.013	0.104***	-0.022***	0.118***
	(0.013)	(0.014)	(0.014)	(0.001)	(0.002)	(0.002)
FIRMSIZE	0.003	0.004	0.002	0.059***	0.032***	0.097***
	(0.004)	(0.004)	(0.004)	(0.0004)	(0.001)	(0.001)
FIRMAGE	0.001	0.000	-0.000	0.002***	0.0004*	-0.007***
	(0.000)	(0.000)	(0.000)	(0.0004)	(0.0002)	(0.0002)
GENDER	-0.009	-0.006	-0.006	-0.023***	-0.164***	0.030***
	(0.009)	(0.009)	(0.009)	(0.001)	(0.003)	(0.002)
AGE	0.000	-0.000	-0.000	0.000	0.0002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.0001)	(0.00005)
HUMANCAP	0.011	0.012	0.019**	0.077***	-0.065***	0.089***
	(0.009)	(0.009)	(0.009)	(0.001)	(0.002)	(0.002)
LSKILL	0.096	0.112	0.158*	1.073***	1.153***	1.404***
	(0.087)	(0.090)	(0.094)	(0.002)	(0.005)	(0.020)
EXPORT	0.031*	0.026	0.018	0.392***	0.529***	0.316***
	(0.018)	(0.018)	(0.019)	(0.004)	(0.008)	(0.010)
ZONE	0.018	0.028	0.036	-0.238***	-0.257***	-0.086***
	(0.023)	(0.021)	(0.023)	(0.001)	(0.003)	(0.003)
HERFINDAHL	0.110	0.110*	-0.029	1.125***	0.944***	-0.544***
	(0.067)	(0.067)	(0.087)	(0.005)	(0.010)	(0.014)
TECHGAP	0.006	0.007	0.016**	0.022***	0.173***	0.136***
	(0.004)	(0.004)	(0.006)	(0.0002)	(0.001)	(0.002)
Year dummies	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y
Weak instrument test						
- Cragg-Donald Wald F statistic	15.663	8.643	7.243	17.485	13.134	18.749
- Stock-Yogo critical value at 10%	6.61	6.61	6.61	6.61	6.61	6.61
Underidentification test	106.945***	31.237***	33.096***	98.092***	44.093***	117.221***
Overidentification test[a]	1.103	3.655	2.329	0.666	3.338	1.854
Endogeneity test	15.202***	12.660***	14.664***	17.369***	18.258***	15.333***
Observations	6,092	6,092	6,092	4,063	4,063	4,063

Note. This table reports the estimation results on how institutions moderate the impact of FDI on product innovation of domestic firms using alternative measures of FDI. In Columns 1-3, the IV-probit model is used to estimate the impacts on the probability of introducing new products. Robust standard errors are in parentheses. In Columns 4-6, GMM-Poisson is used to estimate the impacts on the number of new products. Bootstrap standard errors are in parentheses. FDI presence in a given manufacturing industry is instrumented by the FDI presence in two service industries in a non-neighbouring region. Institutional variables are instrumented by *TENURE*. Constants are excluded for brevity. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

The estimation results on how institutions moderate the impact of FDI on process innovation of domestic firms using alternative measures of FDI are presented in Table 7.8. Columns 1-3 report the results of Equation (3) using the IV-Probit model to estimate the impacts on the probability of adopting new processes/technologies (*NPC*), whereas Columns 4-6 present the estimation results of Equation (4) using the GMM-Poisson estimation and the number of new processes/technologies (*NPCN*) as the dependent variable. The results presented in Columns 3-6 provide evidence of the direct adverse effect of FDI on process innovation of domestic SMEs, as illustrated by the negative and statistically significant coefficients of *FDI*. More importantly, the coefficients of $FDI \times INST$ are positive and statistically significant in Columns 2-6, indicating that the main results presented in Table 7.4 are robust to alternative measures of FDI presence. On the other hand, the insignificant coefficient in Column 1 implies that the institutional moderating effect does not happen through forward linkages.

Table 7.8. Alternative measures of FDI presence and process innovation of domestic SMEs

Variables	Dependent variable: *NPC*			Dependent variable: *NPCN*		
	Forward FDI	Backward FDI	FDI index	Forward FDI	Backward FDI	FDI index
	(1)	(2)	(3)	(4)	(5)	(6)
FDI	0.390	-0.117	-1.247***	-18.659***	-20.236***	-31.580***
	(0.635)	(0.470)	(0.483)	(1.069)	(1.313)	(3.314)
FDI×INST	**0.100**	**0.277****	**0.315****	**7.274*****	**4.623*****	**8.064*****
	(0.081)	**(0.110)**	**(0.122)**	**(0.405)**	**(0.071)**	**(0.600)**
INST	-0.022	-0.088**	-0.110**	-1.411***	-0.901***	-1.837***
	(0.026)	(0.041)	(0.053)	(0.065)	(0.007)	(0.154)
NPD_{t-1}	0.043***	0.045***	0.040***	-0.276***	-0.293***	-0.818***
	(0.014)	(0.014)	(0.014)	(0.025)	(0.028)	(0.087)
ROA	0.038***	0.028**	0.039***	0.468***	0.375***	0.442***
	(0.011)	(0.013)	(0.012)	(0.003)	(0.005)	(0.015)
FIRMSIZE	0.026***	0.024***	0.027***	0.336***	0.299***	0.415***
	(0.004)	(0.004)	(0.004)	(0.006)	(0.004)	(0.012)
FIRMAGE	-0.000	0.000	-0.000	-0.023***	-0.004***	-0.019***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
GENDER	0.013*	0.010	0.009	0.326***	0.304***	0.347***
	(0.008)	(0.008)	(0.008)	(0.002)	(0.002)	(0.011)
AGE	-0.001**	-0.000	-0.001	-0.016***	-0.022***	-0.023***
	(0.000)	(0.000)	(0.000)	(0.0005)	(0.0005)	(0.001)
HUMANCAP	0.024***	0.022***	0.023***	0.656***	0.582***	0.639***
	(0.007)	(0.008)	(0.008)	(0.007)	(0.009)	(0.020)
LSKILL	0.258***	0.212**	0.235**	0.866***	0.779***	0.935***
	(0.089)	(0.092)	(0.092)	(0.039)	(0.043)	(0.176)
EXPORT	0.063***	0.063***	0.059***	0.359***	0.497***	0.477***
	(0.020)	(0.020)	(0.020)	(0.015)	(0.006)	(0.016)
ZONE	0.042*	0.040	0.031	0.149***	0.184***	0.284***
	(0.025)	(0.025)	(0.025)	(0.010)	(0.010)	(0.023)
HERFINDAHL	0.022	0.005	0.039	0.810***	-0.147***	0.077***
	(0.039)	(0.041)	(0.047)	(0.048)	(0.027)	(0.230)
TECHGAP	0.003	0.002	0.002	-0.125***	0.100***	0.151***
	(0.004)	(0.004)	(0.004)	(0.013)	(0.014)	(0.016)
Year dummies	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y
Weak instrument test						
- Cragg-Donald Wald F statistic	15.612	8.780	7.031	22.412	11.771	9.759
- Stock-Yogo critical value at 10%	6.61	6.61	6.61	6.61	6.61	6.61
Underidentification test	106.224***	32.281***	37.043***	130.886***	55.944***	48.311***
Overidentification test[a]	1.372	0.004	0.521	0.116	0.129	1.796
Endogeneity test	6.559*	8.598**	7.742*	3.167	5.851*	4.639*
Observations	6,089	6,089	6,089	4,052	4,052	4,052

Note. This table reports the estimation results on how institutions moderate the impact of FDI on process innovation of domestic firms using alternative measures of FDI. In Columns 1-3, the IV-probit model is used to estimate the impacts on the probability of adopting new processes/technologies. Robust standard errors are in parentheses. In Columns 4-6, GMM-Poisson is used to estimate the impacts on the number of new processes/technologies. Bootstrap standard errors are in parentheses. FDI presence in each manufacturing industry is instrumented by the FDI presence in two service industries in a non-neighbouring region. Institutional variables are instrumented by *TENURE*. Constants are excluded for brevity. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

7.4.4 Sensitivity Analyses – Domestic Firm Heterogeneity

This section provides several robustness tests to examine the sensitivity of the baseline results. Table 7.9 presents some modifications of the baseline model as specified in Equation (3). First, the dependent variable *INNOD* is replaced by a dummy variable equal to 1 if the firm engages in either product or process innovation, zero otherwise. I start with a minimum specification in Column 1 and use a full specification with other control variables in Column 2. Next, since R&D is an important innovation input, a measure of SMEs' R&D effort is incorporated into Equation (3). Specifically, the measure is a dummy variable (*RDD*), taking the value of 1 if the firm conducts R&D activity in the survey year and 0 otherwise. The result is presented in Columns 3-4 of Table 7.9. Another measure of R&D effort is the natural logarithm of real R&D expenditure (*RDE*), of which the result is reported in Columns 5-6 of Table 7.9. The negative and statistically significant coefficients of *FDI* in all columns provide robustness to the negative direct effect of *FDI* on the probability of product/process innovation of domestic SMEs. In addition, the coefficients of *FDI*×*INST* are positive and statistically significant across all columns, suggesting that the baseline results regarding the positive moderating effect of institutions are robust.

Table 7.9. Sensitivity analysis to baseline results

Variables	Alternative innovation dummy (1)	Alternative innovation dummy (2)	Control for R&D dummy (3)	Control for R&D dummy (4)	Control for R&D expenditure (5)	Control for R&D expenditure (6)
FDI	-1.177**	-1.330**	-1.155**	-1.312**	-1.153**	-1.314**
	(0.462)	(0.528)	(0.461)	(0.527)	(0.460)	(0.527)
FDI×INST	**0.181****	**0.217****	**0.180****	**0.215****	**0.179****	**0.215****
	(0.086)	**(0.094)**	**(0.086)**	**(0.094)**	**(0.086)**	**(0.094)**
INST	-0.079**	-0.103**	-0.079**	-0.103**	-0.079**	-0.103**
	(0.039)	(0.041)	(0.039)	(0.041)	(0.039)	(0.041)
$INNOD_{t-1}$	0.066***	0.036**	0.063***	0.035**	0.063***	0.035**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
RDD			0.214***	0.130		
			(0.082)	(0.086)		
RDE					0.040**	0.021
					(0.017)	(0.018)
ROA		0.039**		0.038**		0.039**
		(0.016)		(0.016)		(0.016)
FIRMSIZE		0.021***		0.021***		0.021***
		(0.005)		(0.005)		(0.005)
FIRMAGE		0.000		0.000		0.000
		(0.001)		(0.001)		(0.001)
GENDER		0.002		0.002		0.002
		(0.012)		(0.012)		(0.012)
AGE		-0.001		-0.001		-0.001
		(0.001)		(0.001)		(0.001)
HUMANCAP		0.041***		0.041***		0.041***
		(0.012)		(0.012)		(0.012)
LSKILL		0.398***		0.385***		0.387***
		(0.124)		(0.124)		(0.125)
EXPORT		0.057**		0.055**		0.055**
		(0.025)		(0.025)		(0.025)
ZONE		0.056*		0.056*		0.055*
		(0.029)		(0.029)		(0.029)
HERFINDAHL		-0.010		-0.007		-0.008
		(0.099)		(0.098)		(0.098)
TECHGAP		0.017**		0.017**		0.017**
		(0.007)		(0.007)		(0.007)
Year dummies	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y
Weak instrument test						
- Cragg-Donald Wald F statistic	14.347	11.477	14.334	11.459	14.337	11.466
- Stock-Yogo critical value at 10%	6.11	6.11	6.11	6.11	6.11	6.11
Underidentification test	73.741***	57.612***	73.592***	57.438***	73.596***	57.467***
Overidentification test[a]	0.944	0.940	1.069	0.977	1.091	0.984
Endogeneity test	12.407***	11.341***	11.546***	10.868**	11.620***	10.980**
Observations	6,141	6,093	6,141	6,093	6,141	6,093

Notes. This table reports the estimation results of the institutional moderating effect on FDI spillovers on product and process innovations of domestic SMEs, with additional control for R&D input. Constants are excluded for brevity. Robust standard errors are in parentheses. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.

[a] Hansen J statistics

Second, the institutional moderating effect on FDI innovation spillovers may be influenced by the heterogeneity of domestic SMEs. Therefore, additional analyses are conducted in

Table 7.10, in which the sample of domestic SMEs is split based on different firm characteristics and Equation (3) is re-estimated for each subsample. Columns 1-2 show the institutional moderating effect on FDI innovation spillovers differentiating domestic SMEs with low and high levels of labour productivity (compared to the median). Labour productivity is calculated by the sales revenue per worker. The negative and statistically significant coefficient of *FDI* in Column 2 suggests that FDI presence has a direct adverse impact on the innovation of domestic SMEs with high productivity. The coefficients of *FDI*×*INST* are positive and statistically significant in Column 2 but insignificant in Column 1, implying that the institutional moderating effect is more pronounced for domestic SMEs with higher labour productivity (high absorptive capacity). Absorptive capacity may be important for SMEs to benefit from the institutional moderating effect. For SMEs with low absorptive capacity, better institutional quality fails to help mitigate the negative crowding out effects of FDI and, therefore, fails to promote FDI positive spillovers. SMEs can be further classified into micro enterprises with up to 10 employees, small-scale enterprises with from 11 up to 50 employees, and medium-sized enterprises with 51 up to 300 employees (CIEM et al., 2015). The estimation results of the institutional moderating effect on FDI innovation spillovers for each firm size group are presented in Columns 3-5 of

Table 7.10, respectively.[33] FDI presence directly hinders the innovation of domestic SMEs regardless of the size groups, as shown by the negative and statistically significant coefficients of

[33] In Column 5, small firms and medium-sized firms are grouped together because the number of medium-sized firms is very small (about 10% of the overall sample), which is not adequate to run regression analyses.

FDI throughout Columns 3-5. The coefficients of $FDI \times INST$ are positive and statistically significant in all columns, suggesting that the institutional moderating effect is significant for SMEs in all size groups. The point estimate, which measures the magnitude of the impact, tends to increase as the group size increases. In addition, the technological characteristics of manufacturing industries are considered. According to OECD (2011) and Eurostat (2022), SMEs are classified into low-tech industry, medium-tech industry and high-tech industry. The estimation results for each group are presented in Columns 6-8 of

Table 7.10.[34] I find that FDI exerts direct adverse impacts on the innovation of domestic SMEs in all technology categories. Institutions positively and significantly moderate FDI impacts on SMEs in all groups, regardless of the technological intensity level of the industry. The point estimates (the magnitude of the impact) are larger at higher levels of technological intensity.[35]

[34] In Column 8, SMEs in medium-tech industries and those in high-tech industries are grouped together because the number of firms in high-tech industries is very small (about 2% of the overall sample), which is not adequate to run regression analyses.

[35] The results in Columns 4, 5, 6, and 8 need to be interpreted with caution due to the possibility of weak IVs.

Table 7.10. Heterogeneity of domestic SMEs

	Productivity		Firm size			Technological intensity of the industry[b]		
	Low productivity	High productivity	Micro firms	Small firms	Small and medium firms	Low-tech industries	Medium-tech industries	Medium and high-tech industries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI	0.025	-1.347***	-1.166**	-1.725**	-2.214**	-1.117**	-1.992***	-1.938**
	(0.312)	(0.477)	(0.504)	(0.770)	(1.033)	(0.436)	(0.730)	(0.842)
FDI×INST	**-0.076**	**0.270*** **	**0.192** **	**0.289***	**0.374** **	**0.192** **	**0.327*** **	**0.346** **
	(0.047)	**(0.105)**	**(0.090)**	**(0.170)**	**(0.191)**	**(0.081)**	**(0.125)**	**(0.161)**
INST	0.027	-0.106***	-0.116**	-0.098	-0.156**	-0.115**	-0.162**	-0.167**
	(0.041)	(0.041)	(0.047)	(0.070)	(0.079)	(0.046)	(0.069)	(0.084)
$INNOD_{t-1}$	0.039*	0.022	0.011	0.063**	0.067**	0.046**	0.034	0.032
	(0.023)	(0.021)	(0.021)	(0.031)	(0.030)	(0.021)	(0.030)	(0.028)
Other control variables	Y	Y	Y	Y	Y	Y	Y	Y
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y	Y	Y
Weak instrument test								
- Cragg-Donald Wald F statistic	7.089	12.630	9.706	5.498	4.189	11.844	5.919	3.966
- Stock-Yogo critical value at 10%	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61
Underidentification test	46.492***	62.491***	55.216***	9.754**	7.765*	49.056***	15.745***	14.737***
Overidentification test[a]	1.585	7.340**	1.616	0.686	0.971	0.543	1.317	0.891
Endogeneity test	6.001	9.802**	8.881**	8.236**	8.559**	11.496***	13.570***	7.008*
Observations	3,068	3,025	4,120	1,539	1,973	4,024	1,917	2,069

Note. This table reports the estimation results of the institutional moderating effect on FDI spillovers on product and process innovations of domestic SMEs while taking into account the heterogeneity of domestic SMEs, including labour productivity (Columns 1-2), firm size (Columns 3-5) and the technological intensity of the industries (Columns 6-8). Robust standard errors are in parentheses. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.

[a] Hansen J statistics

[b] The classification of manufacturing industries according to technological intensity comes from Eurostat (2018)

7.5 Summary

This chapter reports and discusses the empirical findings regarding the institutional moderating effect on the relationship between FDI and product and process innovations of domestic SMEs. The direct effects of FDI presence on innovations of domestic SMEs differ between product innovation and process innovation. While FDI presence hinders product innovation of domestic SMEs, the impact on process innovation is positive.

Including the institutional moderating effect sheds light on the FDI-domestic innovation nexus. Institutions positively moderate FDI impacts on both product and process innovations of domestic SMEs. The marginal impacts of FDI on the intensive margin of product innovation and the extensive and intensive margins of process innovation increase as the institutional quality

score increases. It is noted that the institutional moderating effect on the relationship between FDI and the intensive margin of product innovation is insignificant. Thus, when institutional quality is lower than a certain threshold, FDI presence hinders both product and process innovations of domestic SMEs. However, if institutional quality exceeds the threshold level, these FDI impacts turn from negative to positive. The institutional threshold levels for the intensive margin of product innovation and the extensive and intensive margins of process innovation are 7.866 points, 4.609 points, and 2.945 points, respectively. These results help explain the contrasting direct FDI impacts on product and process innovations. Since process innovation has a lower threshold of institutional quality, the direct effect of FDI on process innovation turns out to be positive.

The additional analysis takes into account FDI origin and shows that the institutional moderating effects are generally stronger for FDI from developed countries than FDI from developing countries. Notably, regarding the extensive margin of product innovation, the institutional moderating effect is only significant for developed country FDI, not for developing country FDI, which may explain the overall insignificant effect found in the baseline model. In addition, by distinguishing different institutional components, the additional analysis confirms significant moderating effects of 7 out of 9 institutional sub-indices, namely *entry cost*, *land access*, *transparency*, *control of corruption*, *time cost*, *proactivity*, and *rule of law*. Among those sub-indices, the *control of corruption* exerts statistically significant moderating effects on both product and process innovations regardless of FDI origin, hence the most important institutional factor. In contrast, the quality of *business support* services and *labour training* policies exert insignificant and, in some cases, even negative effects. The use of alternative measures of FDI presence confirms the robustness of the main results, implying that the institutional moderating effects are not sensitive to the direction of FDI spillovers. Finally, by considering the heterogeneity of domestic SMEs, the analysis suggests that institutional moderating effects are more pronounced for SMEs with higher labour productivity, larger size, and operating in medium- and high-tech industries.

Chapter 8: A Structural Estimation of FDI, Institutions and the Number of New/Improved Products of Domestic SMEs

8.1 Introduction

The theoretical model constructed in *Subsection 4.3.3* demonstrates that FDI affects the number of new products introduced by domestic firms through two channels: (*i*) the productivity of domestic firms and (*ii*) the probability of successful implementation of an innovation project. This chapter reports the estimation results of the empirical exercise guided by the theoretical model. Section 8.2 presents the first-stage estimation results used to identify the impact of FDI presence and institutional quality on the productivity of domestic SMEs. Section 8.3 reports the second-stage estimation results to identify the impact of FDI presence and institutions on the probability of innovation success of domestic SMEs. Section 8.4 provides the marginal effects of FDI presence on the number of new and improved products of domestic SMEs at different levels of institutional quality. Finally, Section 8.5 summarises the chapter.

8.2 First-stage estimation

In the first stage, I make use of the log revenue of firms with no innovation to estimate the FDI productivity spillovers to domestic firms. The aim is to estimate α_1, α_2, and α_3 in Equation (15). The first stage estimation is based on the population moment conditions for firms' log revenue given in Equation (19), as follows:

$$E\left[[lnR - (\theta_0 + \theta_1\Psi + \theta_2 FDI + \theta_3 INST + \theta_4 FDI \times INST + X'\theta_5)]Z\right] = 0$$

where lnR is the natural logarithm of the total revenue of an SME without the intention to innovate. $\Psi = ln\mathrm{A} - \frac{\rho}{1-\rho} lnw$, where w is the average wage of production workers in a firm in a given year, and A is captured by real income, ρ is estimated by regressing the firm's total revenue on total variable cost. The estimation yields $\rho = 0.92108$ with a standard error of 0.036; therefore, $\Psi = ln\Phi - 11.671 \times lnw$. FDI is measured by the output share of foreign-invested firms in each 4-digit industry in each region, and $INST$ presents the institutional quality of the

local government. Their interaction term $FDI \times INST$ measures the moderating effect of institutions on FDI spillovers. X is a vector of control variables incorporated to account for firm-specific and industry-specific characteristics that may influence firms' productivity and, hence, firms' revenue. $X = \{FIRMSIZE,\ FIRMAGE,\ GENDER,\ AGE,\ HUMANCAP,\ LSKILL,\ EXPORT,\ ZONE,\ HERFINDAHL,\ TECHGAP\}$.

The generalized method of moments (GMM) estimator is employed to estimate Equations (19). The estimation results are presented in Table 8.1. The top panel reports the estimated coefficients and robust standard errors. The bottom panel reports the diagnostic test results of using IVs, namely the under-identification test, over-identification test (Hansen J statistics), endogeneity test, and the test for weak IVs by comparing first-stage F statistics with the critical value at 10% provided by Stock and Yogo (2005).

As can be seen from the table, the coefficient of *FDI* is negative and statistically significant at the 1% level, suggesting that FDI exerts negative productivity spillovers to domestic firms, leading to lower revenue, *ceteris paribus*. This finding aligns with prior studies highlighting the negative crowding-out effects of FDI on domestic firms (see, e.g., Lin & Kwan, 2016; Moralles & Moreno, 2020; Thang et al., 2016). If FDI firms become dominant in the local market, the less efficient domestic firms may have to spread their fixed costs over a shrunken market share, leading to lower productivity (Aitken & Harrison, 1999). Negative crowding-out effects may also occur in the labour market, where the relatively higher wages offered by MNCs could attract talented labour and managers away from their domestic counterparts (Spencer, 2008). In addition, MNEs often employ strategies, such as locating R&D and innovative activities close to the headquarters in the home countries or offering higher wages to employees, to safeguard their technological knowledge from being disclosed (Liang, 2017; Stiebale & Reize, 2011).

In the case of SMEs, negative FDI crowding-out effects may be more pronounced due to SMEs' lack of absorptive capacity to capitalize on FDI presence. Absorptive capacity can influence the extent to which firms can recognise, adopt, assimilate, and apply the advanced technology and managerial practices of their foreign counterparts to create internal value (Glass

& Saggi, 1998). This implies that domestic firms must have foundational knowledge, familiarity with relevant technology, and a team of qualified professionals to effectively harness the technologies introduced by foreign entrants (Cohen & Levinthal, 1990). Blalock and Gertler (2009) and Liang (2017) show that absorptive capacity – indicated by the level of in-house R&D activities and skilled labour, augments productivity spillovers from FDI to incumbent firms. In addition, the technological gap plays an important role as domestic firms at the forefront of technological advancement have higher incentives to innovate and higher productivity gains under FDI presence compared to those lagging (Aghion et al., 2005; Moralles & Moreno, 2020). Compared to large firms, SMEs often encounter a lack of financial resources, a shortage of skilled labour and managerial expertise, and a larger technological gap (Madrid-Guijarro et al., 2009). These inherent limitations diminish the absorptive capacity of SMEs for foreign technologies, meaning that they struggle to improve productivity under FDI presence.

However, institutional development positively moderates the relationship, as indicated by the positive and significant coefficients of the interaction term between *FDI* and *INST*. Given a level of FDI presence, domestic firms receive higher productivity spillovers when institutional quality is higher, and vice versa. This result corroborates existing literature that emphasises the positive moderating effect of institutions on FDI productivity spillovers to domestic firms (see, e.g., Gorodnichenko et al., 2014; Krammer, 2015; Wang et al., 2013; Yi et al., 2015; Zhang, 2019). These studies indicate that foreign firms are more inclined to introduce advanced technology, invest in R&D, and innovate locally in more developed institutional arrangements, which increases the potential for technology and knowledge spillovers (Gorodnichenko et al., 2014). A key rationale is that high-quality institutions amplify the ownership advantages of MNEs by facilitating better use of their assets and more effective access to local resources (Javorcik, 2004; Meyer & Nguyen, 2005). Furthermore, strong institutions can boost foreign entrants' productivity and innovative capacity by reducing transaction costs, uncertainties, and the "*liability of foreignness"* caused by unfamiliarity with the local ways of doing business (Chan et al., 2010; Ma et al., 2013). As a result, they are empowered to increase innovative endeavours in the host

economy, such as establishing R&D centres and undertaking technology-intensive projects, thereby expanding the scope of positive spillovers (Chen et al., 2007; Wang et al., 2013). Regarding domestic firms, high-quality institutions strengthen the free market mechanism, resulting in more efficient product, capital, and intermediate goods markets (Ma et al., 2013). Enhanced factor movement assists domestic firms in sourcing and learning technology from their foreign counterparts (Xiao & Park, 2018). In essence, the development of institutions may strengthen FDI spillovers by fostering an environment for the coordination, interactions and knowledge exchange between foreign and local firms (Yi et al., 2015).

Regarding other control variables, the results show that firms with larger sizes, higher levels of owners/managers' human capital and labour skills, export activity, and are located in an industrial zone are more productive and subsequently yield greater revenues. On the other hand, older firms and those led by older owners/managers tend to have lower revenues. The effects of the owners/managers' gender, market concentration, and technological gap are insignificant at the 5% level.

The estimation of Equation (19) allows for the calculation of the parameters of interest in the second term of Equation (15), which specifies the conditional mean of the number of new products. Specifically, dividing the vector of estimated parameters (θ) by $\frac{\rho}{1-\rho}\frac{\delta-1}{2\delta}$, I obtain $\alpha_1 = -4.234$, $\alpha_2 = -0.266$, and $\alpha_3 = 0.961$.

Table 8.1. First-stage regression results

Variables	Estimated coefficients (θ)	Standard errors	$\alpha = \theta/(\frac{\rho}{1-\rho}\frac{\delta-1}{2\delta})$	Standard errors
$\Psi = ln\mathrm{A} - \frac{\rho}{1-\rho} lnw$	0.070***	0.024		
FDI	-3.441***	1.224	-4.234***	0.029
INST	-0.217***	0.078	-0.266***	0.002
FDI×INST	0.781**	0.325	0.961***	0.007
FIRMSIZE	0.525***	0.015	0.646***	0.004
FIRMAGE	-0.009***	0.002	-0.012***	0.0001
GENDER	-0.064	0.051	-0.078***	0.001
AGE	-0.014***	0.002	-0.017***	0.0001
HUMANCAP	0.300***	0.044	0.369***	0.002
LSKILL	4.847***	0.618	5.963***	0.036
EXPORT	0.805***	0.122	0.991***	0.006
ZONE	0.803***	0.163	0.987***	0.006
HERFINDAHL	0.031	0.283	0.038***	0.004
TECHGAP	-0.015	0.015	-0.019***	0.0002
Constant	16.570***	1.896		
Weak instrument test				
- Cragg-Donald Wald F statistic	6.728			
- Stock-Yogo critical value at 10%	6.61			
Underidentification test	28.988***			
Overidentification test[a]	2.893			
Endogeneity test	15.717***			
Observations	2,893			
R-squared	0.484			

Note. This table reports the estimation results of equation (19) to estimate the moderating effect of institutions on productivity spillovers of FDI to domestic SMEs. *FDI* is instrumented by the output shares of foreign firms in two service industries. *INST* is instrumented by *TENURE*, which is the months in position of the provincial leader. ***, **, * denote significance levels at 1%, 5% and 10%, respectively. In the last column, bootstrap standard errors are calculated to account for the fact that θ, ρ and δ are estimates. Specifically, 100 random samples of the estimates of θ are drawn from $\mathcal{N}\left[\hat{\theta}, \widehat{VAR}(\hat{\theta})\right]$, ρ from $\mathcal{N}\left[\hat{\rho}, \widehat{VAR}(\hat{\rho})\right]$, δ from $\mathcal{N}\left[\hat{\delta}, \widehat{VAR}(\hat{\delta})\right]$, where $\mathcal{N}$ stands for the normal distribution, the hats represent estimates, and *VAR* denotes variance. With each sample of these estimates, I then resample the data with replacement and estimate vector α, which results in 100 estimates of α. Bootstrapped standard errors are calculated as the standard deviations of these 100 estimates.

8.3 Second-stage estimation

The second stage estimation is based on the population moment conditions given in Equation (20), as follows:

$$E\left[\left[Y-\left(\frac{1}{1+e^{-(\beta_1 FDI+\beta_2 INST+\beta_3 FDI\times INST)}}\right)^2\left(\frac{De^{\beta_4}-1}{\beta_4+lnD}-1\right)\right]Z\right]=0,$$

where D is calculated using the results from the first stage estimation, and Z is the set of instrumental variables. GMM estimator is employed to estimate Equations (20). Bootstrap standard errors are computed to account for the fact that the stage-two estimation utilises estimates from stage one.

The estimation results are presented in Table 8.2. Column 1 reports the estimation results for the number of new products, while Column 2 reports the estimation results for the number of improved products of domestic firms. The coefficients on *FDI*, *INST*, *FDI*×*INST,* and *D* correspond to β_1, β_2, β_3, and β_4, respectively.

In Column 1, $\beta_1 = -11.949$, which is negative and significant, suggesting that FDI presence lowers the probability of domestic firms successfully introducing a new product. In addition, institutional quality positively moderates this effect since $\beta_3 = 5.973 > 0$, which is positive and significant at the 1% level. In other words, higher institutional quality leads to a higher probability of successful innovation at a given level of FDI presence. Taking the partial derivative of μ with respect to FDI gives $\frac{\partial \mu}{\partial FDI} = 2(-11.949 + 5.973 \times INST)\left(\frac{1}{1+e^{-(\beta_1 FDI+\beta_2 INST+\beta_3 FDI\times INST)}}\right)^2$. This is positive only if $INST$ is greater than 2. That is, FDI presence increases the probability of successful product innovation of domestic firms when institutional quality reaches a threshold level of 2.772.

Column 2 shows similar results. Institutional development mitigates the negative effect of FDI on the probability of successful product improvement and, upon a threshold level, induces

positive FDI spillovers. Specifically, $\frac{\partial \mu}{\partial FDI} = 2(-6.523 + 5.951 \times INST)\left(\frac{1}{1+e^{-(\beta_1 FDI+\beta_2 INST+\beta_3 FDI\times INST)}}\right)^2$, which is positive if $INST$ is greater than 1.096.

Table 8.2. Second-stage regression results

Variables	(1) New product		(2) Improved product	
	Estimated coefficients	Standard errors	Estimated coefficients	Standard errors
FDI	-11.949**	5.770	-6.523**	3.111
INST	-4.311***	1.482	-5.229***	0.831
FDI×INST	5.973***	1.007	5.951***	1.095
D	-71.871***	1.819	-68.126***	2.127
Observations	3,014		3,008	

Notes. This table reports the estimation results of equation (16) to estimate the moderating effect of institutions on the relationship between FDI and the probability of successful implementation of an innovation project of domestic SMEs. Column (1) examines the introduction of new products, while Column (2) the improvements of existing products. *FDI* is instrumented by the output shares of foreign firms in two service industries. *INST* is instrumented by *TENURE*, which is the months in position of the provincial leader. Bootstrap standard errors are reported to account for the fact that the stage-two estimation utilises estimates from stage one.

$D = (1-\rho)\rho^{\frac{\rho}{1-\rho}}\mathrm{A}w^{\frac{\rho}{\rho-1}}\zeta^{\frac{\rho}{1-\rho}}e^{(\alpha_1\gamma+\alpha_2 h+\alpha_3\gamma h)\frac{\rho}{1-\rho}}$.

*, **, *** denotes significance at the 10%, 5%, and 1% levels, respectively.

8.4 Marginal effects

In Equation (15), the coefficients do not directly reflect the marginal effects of the corresponding independent variables on the dependent variable. Therefore, Table 8.3 provides the marginal effects of FDI presence on the number of new and improved products of domestic SMEs at different levels of institutional quality, which are evaluated at the sample mean of FDI and other explanatory variables. In both columns, the marginal effect of FDI increases as the institutional score increases and turns positive when the institutional score reaches a certain level.

Table 8.3. Marginal effects of FDI presence on the number of new and improved products

INST	New product	Improved product
1	-0.0101	-0.3150
2	-0.0071	-0.2265
3	-0.0044	-0.1403
4	-0.0013	-0.0429
5	0.0021	0.0667
6	0.0059	0.1896
7	0.0102	0.3270
8	0.0150	0.4803
9	0.0203	0.6509
10	0.0262	0.8402

8.5 Summary

This chapter presents the estimation results of the effect of FDI presence and the moderating role of institutional quality on the number of new/improved products created by domestic SMEs through two channels: (*i*) the productivity and cut-off innovative capability of domestic firms and (*ii*) the probability of successful implementation of an innovation project. The results show that FDI presence negatively affects the productivity of domestic SMEs and reduces the probability of successful implementation of an innovation project. This finding is not surprising in the case of SMEs because they may lack the absorptive capacity to benefit from FDI presence. Due to their large technological gap, resource constraints, and low market power, domestic SMEs may be crowded out by foreign competitors. The results are in line with existing literature showing that FDI presence adversely affects the productivity of domestic firms (see, e.g., Lin & Kwan, 2016; Moralles & Moreno, 2020; Thang et al., 2016). The results also support the studies of García et al. (2013) and Jin et al. (2019) that confirm a negative association between FDI and the number of new/improved products introduced by domestic firms.

Importantly, institutions exert positive moderating effects on both channels (raising both expected profits and probability of successful implementation of innovation) and, upon reaching a threshold level, induce positive FDI spillovers. The marginal effects calculated at the sample average indicate that the overall institutional moderating effect on the relationship between FDI

and the number of new/improved products of domestic SMEs is positive. Prior research on FDI productivity that adopts an institutional-based view provides similar findings (see, e.g., Gorodnichenko et al., 2014; Krammer, 2015; Wang et al., 2013; Yi et al., 2015; Zhang, 2019).

Chapter 9: Concluding Remarks and Policy Implications

9.1 Key Findings

This thesis sheds light on understanding the impacts of FDI on innovations of domestic SMEs in Vietnam by highlighting the moderating effects of local institutions. Previous studies have not thoroughly considered the role of institutional idiosyncrasies in emerging markets to explain FDI spillovers to innovation, nor have they focused on SMEs whose low absorptive capacity, large technological gap, lack of economies of scale and low market power may lead to greater vulnerability to FDI negative impacts compared to large firms. Therefore, this thesis contributes to the existing literature on the FDI presence-domestic innovation nexus by arguing that the characteristics of SMEs and institutional settings in emerging economies are important elements in explaining the relationship.

A conceptual framework is constructed, which suggests that FDI presence may impede the innovation activities of domestic SMEs. More importantly, institutions can positively moderate FDI spillovers to SMEs' innovation by promoting the incentive and ability of foreign investors to create technological spillovers, which will mitigate FDI crowding-out effects, enhance domestic SMEs' absorptive capacity, and facilitate interaction and knowledge sharing in the local business environment. The moderating effect of institutions may be stronger for FDI originating from developing countries/countries with lower institutional quality compared to that from developed countries/countries with higher institutional quality.

Based on the conceptual framework, the econometric models are specified. The modelling of innovation of domestic SMEs features a two-step decision-making process, where SMEs first decide whether to innovate, and if they choose to do so, determine the optimal intensity of innovation. In the first stage, firms' optimal decision on whether to innovate is a function of a set of explanatory variables, including FDI presence, institutions and their interaction term, which in turn results in the probability of innovation being a function of these variables. In the second stage, conditional on the first-stage decision to innovate, firms' optimal innovation intensity

(R&D expenditure or the number of new products or processes) depends on such explanatory variables as FDI presence, institutions, and their interaction term. The optimal decision on innovation intensity leads to a set of population moments, which address sample selection. I then utilise these moment conditions for estimations. The key measures of innovation performance include R&D investment (an input of innovation activities) and product and process innovations (outputs of innovation activities).

The intensity of product innovation is measured by count data, namely the number of new/improved products. Modelling count data can be problematic. Prior studies, such as García et al. (2013) and Jin et al. (2019), use negative binominal regression analysis without robust theoretical justifications. This thesis establishes a theoretical framework to guide the empirical estimations of structural equations, which help to address the identification challenges of modelling the count data. The estimations explicitly account for the fact that zero values of new/improved products may occur for two reasons (a firm does not intend to innovate or innovates but fails to generate any new/improved products) and differentiates both types of firm behaviour in the data.

In the theoretical model, firms optimally choose the number of experiments (trials) to develop new/improved products. Firms themselves observe this optimal number, while researchers, in contrast, do not. If a firm succeeds, one experiment results in one new/improved product, which is recorded in the data. Then, researchers can observe the total number of new/improved products in the data. Hence, the number of new/improved products is binomially distributed rather than negatively binomially distributed as assumed in the existing studies (García et al., 2013; Jin et al., 2019). In the model, FDI presence, after taking into account the moderating effect of institutions, can affect the number of new/improved products through its impacts on the expected profit of producing new/improved products and the probability of successful implementation of each innovation project.

Combining several different data sources, a unique panel dataset covering more than 2,500 SMEs in 2011, 2013 and 2015 is obtained to estimate the econometric models. Different from

prior studies that neglect the potential endogeneity of institutions and their interaction terms with FDI (see, for example, Krammer, 2015; Wang et al., 2013; Xiao & Park, 2018; Zhang, 2019), this thesis addresses the issue by using IVs for both FDI and institutional variables. Conditional maximum likelihood estimation for IV-Probit models and the IV-2SLS technique for linear probability models are employed to estimate the probability of SMEs engaging in innovation, whereas GMM is employed to estimate the number of innovative products/processes that domestic firms develop.

The estimation results first suggest that FDI presence is overall detrimental to the innovation performance of domestic SMEs. This finding is not surprising because SMEs may lack the absorptive capacity to benefit from FDI presence. Due to their large technological gap, resource constraints, and low market power, domestic SMEs may be crowded out by foreign competitors. This evidence corroborates the crowding-out proposition in the literature, that is, FDI technological transfers are not always guaranteed, particularly when the absorptive capacity of incumbents is low (see, e.g., Girma, Gong, et al., 2008; Qu & Wei, 2017; Stiebale & Reize, 2011; Sun & Du, 2010).

The estimation results generally confirm the positive moderating effects of institutions on the relationship between FDI and domestic SMEs' innovations. When institutional quality increases, the marginal effects of FDI on innovations of domestic SMEs increase. When institutional quality exceeds certain threshold levels, the marginal effects of FDI turn from negative to positive. Specifically, a one-unit increase in institutional quality raises the marginal impact of FDI on an SME's R&D probability by 6.8% and the marginal impact of FDI on an SME's R&D expenditure by 9.9%, *ceteris paribus*. The impact of FDI on the R&D probability of domestic SMEs turns from negative to positive when the institutional score exceeds 7.926 points on a scale between 1 (low) and 10 (high). Based on the latest available data in 2021, only 6 out of 63 provinces have an institutional quality score higher than this threshold. The institutional threshold for the FDI impact on R&D expenditure is 3.374 points. There are 57 out of 63 provinces in Vietnam with an institutional quality score above this threshold. Institutions do not significantly moderate FDI

impacts on SMEs' probability of introducing new products, but the effect on the number of new products is statistically significant. The institutional threshold level for FDI to positively affect the number of new products is 7.866, with 7 provinces meeting this threshold. A one-unit increase in the level of institutional quality leads to a 13.8% increase in the marginal impact of FDI on the probability of process innovation by domestic SMEs. The institutional threshold levels for FDI to positively affect the extensive and intensive margins of process innovation are 4.609 points (with 51 qualified provinces), and 2.945 points (with 59 qualified provinces), respectively.

The results indicate that strong institutions may encourage foreign firms to incorporate more advanced technologies and invest more in innovative projects in host countries, leading to a higher probability of technological spillovers. Particularly for SMEs, stronger institutions may complement their relatively low absorptive capacity and enable the adoption and assimilation of new technologies. Moreover, strong institutions may promote vertical linkages between foreign firms and domestic SMEs, which fosters technological transfer and knowledge sharing.

In addition, these moderating effects are stronger for FDI from developed countries/countries with higher institutional quality than that from developing countries/countries with lower institutional quality, suggesting that MNEs' levels of technological sophistication and familiarity with the host country's institutional context determine the sensitivity of FDI spillovers to institutions. Regarding the heterogeneity of domestic SMEs, the sensitivity analysis shows that the institutional moderating effects are more pronounced for local firms with higher labour productivity, of larger size and operating in industries with higher levels of technological intensity. I also distinguish different institutional components and find that 7 out of 9 institutional sub-indices have significant moderating effects, of which the control of corruption appears to be the most important factor, while the effects of business support and labour training policies are negligible.

9.2 Implications

9.2.1 Implications for Researchers

By confirming that institutions are significant moderators of FDI spillovers to the R&D investment of domestic firms, I argue that ignoring institutional factors may contribute to the mixed findings in past literature. Therefore, this thesis encourages future research to incorporate institutions into FDI spillover research, especially in the context of emerging economies. In addition, the theoretical model suggests that conditional on a firm's innovative capability being no less than the cut-off level, the number of new/improved products introduced by the firm has a binomial distribution. The distribution is shaped by the number of trial projects that maximizes the firm's expected profit and the probability of successful implementation of a project. Future research on the count measures of product innovation can establish the estimation based on this insight.

9.2.2 Implications for Domestic SMEs

Several policy implications can be drawn from the empirical results for local SMEs to proactively enhance their innovation capacity in the face of rapid technological change and increased foreign competition. Domestic SMEs must recognise and address the potential negative crowding-out effects of FDI, which could lower their innovation performance. Several strategies exist that SMEs can adopt to counteract potential negative spillovers of FDI.

First, it is important for SMEs to ensure the internal funds available for innovation projects. Lack of finance has been identified as a major barrier to SMEs' innovations (Madrid-Guijarro et al., 2009). SMEs can also increase production scope to enjoy the economies of scale of innovation, that is, to spread R&D expenditure or the costs of innovation efforts over larger sales (Rammer et al., 2009a).

Second, the analysis finds that SMEs with higher levels of owner/manager education and labour skills tend to have better innovation performance. As a result, SMEs should focus on improving the level of human capital of both the firm's owner/manager and workers. SMEs can

hire employees who have previously worked for foreign firms to take advantage of the labour mobility spillover mechanism. As SMEs may find it difficult to compete with foreign firms on wages, they can utilise the flexible structure to offer skilled workers non-wage compensations, such as flexible work arrangements and promotion perspectives. Apart from attracting high-quality personnel, improving the quality of existing workers through training and professional development schemes can be a solution.

Third, SMEs who are exporters or located in an industrial zone are more innovative. This suggests that SMEs can strengthen their innovation capabilities by self-selecting into exporting. Firms can gain technological knowledge from the global market through learning-by-exporting. Export allows firms to broaden the market for their new products, thereby covering the fixed costs of R&D or innovation efforts. Given the increased FDI inflow, export participation is a suitable strategy for SMEs to escape FDI-induced competition in the domestic market. In addition, SMEs can consider relocating to an industrial zone to benefit from economies of agglomeration.

Most importantly, the empirical evidence indicates that institutions enhance FDI spillovers on both product and process innovations of domestic SMEs regardless of firm size and the level of technological intensity of the industry. Therefore, SMEs should advocate for institutional reform in their local business environment or consider moving to regions with higher institutional quality levels. Meanwhile, enhancing absorptive capacity may shield SMEs from negative FDI crowding-out effects while allowing them to take advantage of the positive institutional moderating effect on FDI innovative spillovers.

9.2.3 Implications for Policymakers

The findings of this thesis provide important policy implications for the Vietnamese government to mitigate FDI negative crowding-out effects while capitalising on the positive FDI spillovers to foster innovation performance of domestic SMEs. Vietnam has actively provided incentives for foreign investors, hoping to tap into the technological advancement that FDI inflows may bring to the country. Meanwhile, the government has implemented various

supporting policies for SMEs as part of the determination to develop a robust private business community. These policies are largely ineffective given the poor performance, especially in terms of innovation of SMEs, thereby prompting the need for complementary policies. The empirical results generally confirm the positive moderating effects of institutions on the relationship between FDI and innovation of domestic SMEs. Therefore, expediting institutional reform with a focus on improving institutional quality at the provincial level is an auspicious solution. The institutional enhancing measures should be implemented hand-in-hand with policies targeting either FDI or SMEs. Stronger institutions would facilitate SMEs' access to government support while enhancing the capability of local governments to implement the existing supporting policies. High-quality institutions can also assist FDI policies aimed at attracting FDI in high-tech industries by facilitating FDI technological spillovers to innovations of domestic SMEs. The incorporation of institutional enhancing mechanisms into FDI-attracting policies and SME-supporting policies would generate complementary benefits - the synergy that allows Vietnam to fully capture the benefits of FDI inflows and achieve the SME development objectives.

The analysis has identified specific institutional aspects the Vietnamese government should focus on improving during its institutional reform. The emphasis should be placed on the fight against corruption to relieve both FDI firms and domestic SMEs from the burden of bribery. The ongoing institutional reform should also pay attention to reducing entry costs and time costs of doing business, facilitating land access, promoting transparency in the business environment, enhancing government proactivity in solving business issues, and strengthening the rule of law. Finally, given that public business support and labour training provision may be ineffective in facilitating FDI spillovers, the government can encourage private participation in providing these services.

The empirical analysis enables the Vietnamese government to identify provinces potentially vulnerable to negative FDI impacts and, therefore, should be prioritized for improvements in the institutional environment. The empirical analysis has identified different threshold levels of institutional quality that induce positive FDI spillovers for R&D investment, product innovation,

and process innovation of domestic firms. The lowest threshold level is 2.945, upon which FDI positively impacts the number of new processes adopted by domestic SMEs. Based on the PCI data in 2021, there are 4 provinces with institutional quality (composite PCI score) below this level, namely Cao Bang, Hoa Binh, Kon Tum, and Lai Chau. Among these provinces, Hoa Binh and Kon Tum received large amounts of FDI inflows, at 720.14 and 246.72 million USD in 2021, respectively. However, these figures are small compared to the rest of the country; therefore, improving institutional quality in these provinces is, even though necessary to generate positive FDI spillovers to local SMEs, not urgent from the national perspective.

The highest threshold level of institutional quality is 7.926, upon which FDI encourages all types of innovation activities for domestic SMEs, including R&D investment, product innovation, and process innovation. Unfortunately, most provinces (57 out of 63) have institutional quality scores under this threshold. Among them, 14 provinces attract a high volume of FDI inflows (higher than the country's average), namely Bac Giang, Bac Kan, Ben Tre, Binh Phuoc, Dong Nai, Ha Noi, Ha Tinh, Hai Duong, Hai Phong, Ho Chi Minh City, Long An, Tay Ninh, Thai Nguyen, and Thanh Hoa. Let us call this List 1. Priority in institutional reform, for example, resource allocation, the experimentation of institutional initiatives, and leadership talents, should be given to these provinces.

FDI inflows from developed countries with stronger institutions often incorporate more advanced technological resources (Bhaumik et al., 2016; Javorcik, 2004). These types of FDI have a higher potential for R&D spillovers. However, as suggested by the findings of this thesis, FDI from developed countries or countries with relatively higher institutional quality are more susceptible to local institutional arrangements. These FDI inflows can do more harm than good, while they can create significant spillovers in more conducive institutional environments if the institutions are less developed. In the context of Vietnam, the country's FDI policies have strongly

emphasised attracting FDI in high-tech industries through various tax and land use incentives.[36] Therefore, to encourage R&D spillovers from FDI in high-tech industries, Vietnam should promote institutional quality with a focus on provinces receiving large amounts of FDI from developed countries or countries with higher institutional quality. Specifically, 13 provinces attracting large proportions of FDI (above 50% of the FDI output share) from developed countries/countries with higher institutional quality include An Giang, Bac Ninh, Ca Mau, Da Nang, Gia Lai, Ha Noi, Ho Chi Minh City, Thua Thien – Hue, Lam Dong, Ninh Thuan, Quang Ninh, Son La, and Vinh Phuc. Among these provinces, those with high amounts of FDI inflows (higher than the country's average) include Ba Ria-Vung Tau, Ha Noi, Hai Duong, Hai Phong, Ho Chi Minh City, and Vinh Phuc. Let us call this List 2. Priority in institutional reform should also be given to these provinces. Combining List 1 and List 2, the priority list can be narrowed down to four provinces that attract large amounts of FDI inflows with the majority of the capital coming from developed countries while having institutional quality lower than the positive

[36] This is one the of main objectives specified in the Resolution No. 50-NQ/TW dated 20th August 2019 of the Politburo on improvement of regulations and policies to enhance the quality and efficiency of foreign direct investment by 2030. Specifically, the government shall take initiative to promote selective attraction and cooperation in foreign investment. Selection criteria shall be based on quality, investment efficiency, technology and environmental protection. The priority shall be given to projects that adopt advanced, emerging, or clean technologies, apply modern management methods, have high value-added, and have positive spillover effects on global supply chains. The expected percentages of enterprises that meet environmental requirements and adopt advanced technology and modern management methods compared with those in 2018 are 50% and 100% in 2025 and 2030, respectively. In addition, according to the Law on investment 2020 No. 61/2020/QH14 of the National Assembly, investment incentives given to high-tech projects include: corporate income tax incentives; exemption from import tax on goods imported to form fixed assets, raw materials, supplies and components for manufacturing purposes; exemption from and reduction of land levy and land rents; accelerated depreciation that increases the deductible expenses upon calculation of taxable income.

spillover generating threshold levels, namely Hanoi, Hai Duong, Hai Phong, and Ho Chi Minh City.

The findings have policy implications for other emerging countries that are trying to attract larger amounts of FDI inflows. Governments should be aware that FDI only positively affects the innovation of domestic SMEs when institutional quality exceeds a certain level. Given that SMEs in emerging countries account for the majority of businesses with significant contributions to the economy, these countries may want to ameliorate the institutional environment to fully capture the beneficial spillovers from FDI, especially developed country FDI.

Policy implications may also be extended to developed countries that allocate foreign aid budgets. The results obtained from this thesis support the idea that if a developed country wishes to foster economic growth in an emerging country through its foreign aid, it should focus on improving institutional quality in the emerging country in addition to encouraging FDI inflows to the country.

9.3 Limitations and Future Research

This study has several limitations, which can serve as avenues for future research. First, given that the current focus is on SMEs, future research can compare the moderating effect of institutions on FDI spillovers between small and large firms to draw relevant policy recommendations. Second, due to data constraints, the analysis was unable to differentiate between new-to-the-firm and new-to-the-market innovation. Since the level of novelty may matter for firms' competitiveness and innovation success, considering this factor may provide insights into how FDI presence affects incremental and radical innovation of domestic firms. Finally, OECD (2009) defines four types of innovation outputs, namely product innovation, process innovation, organisational innovation and marketing innovation. This research only examines the first two types of innovation while ignoring the others due to the lack of data on SMEs' organisational innovation and marketing innovation. Future research can investigate this

to compare the FDI impacts and institutional moderating effects among different types of innovation.

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Appendix A

Table A1. List of VSIC 4-digit manufacturing industries

2-digit	3-digit	4-digit	Description
10			Manufacture of food products
	101	1010	Processing and preserving of meat
	102	1020	Processing and preserving of fish, crustaceans and molluscs
	103	1030	Processing and preserving of fruit and vegetables
	104	1040	Manufacture of vegetable and animal oils and fats
	105	1050	Manufacture of dairy products
	106		Manufacture of grain mill products, starches and starch products
		1061	Manufacture of grain mill products
		1062	Manufacture of starches and starch products
	107		Manufacture of other food products
		1071	Manufacture of bakery products
		1072	Manufacture of sugar
		1073	Manufacture of cocoa, chocolate and sugar confectionery
		1074	Manufacture of macaroni, noodles, couscous and similar farinaceous products
		1075	Manufacture of prepared meals and dishes
		1079	Manufacture of other food products n.e.c.
	108	1080	Manufacture of prepared animal, fish, poultry feeds
11	110		Manufacture of beverages
		1101	Distilling, rectifying and blending of spirits
		1102	Manufacture of wines
		1103	Manufacture of malt liquors and malt
		1104	Manufacture of soft drinks; production of mineral waters and other bottled waters
12	120	1200	Manufacture of tobacco products
13			Manufacture of textiles
	131		Spinning, weaving and finishing of textiles
		1311	Preparation and spinning of textile fibres
		1312	Weaving of textiles
		1313	Finishing of textiles
	132		Manufacture of other textiles
		1321	Manufacture of knitted and crocheted fabrics
		1322	Manufacture of made-up textile articles, except apparel
		1323	Manufacture of carpets and rugs
		1324	Manufacture of cordage, rope, twine and netting
		1329	Manufacture of other textiles n.e.c
14			Manufacture of wearing apparel
	141	1410	Manufacture of wearing apparel, except fur apparel
	142	1420	Manufacture of articles of fur
	143	1430	Manufacture of knitted and crocheted apparel
15			Manufacture of leather and related products
	151		Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur
		1511	Tanning and dressing of leather; dressing and dyeing of fur
		1512	Manufacture of luggage, handbags, saddlery and harness
	152	1520	Manufacture of footwear
16			Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
	161	1610	Sawmilling and planing of wood; wood reservation
	162		Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
		1621	Manufacture of veneer sheets; manufacture of polywood, laminboard, particle board and other

2-digit	3-digit	4-digit	Description
			panels and board
		1622	Manufacture of builders' carpentry and joinery
		1623	Manufacture of wooden containers
		1629	Manufacture of other products of wood, manufacture of articles of cork, straw and plaiting materials
17			Manufacture of paper and paper products
	170		Manufacture of paper and paper products
		1701	Manufacture of pulp, paper and paperboard
		1702	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
		1709	Manufacture of other articles of paper and paperboard n.e.c
18			Printing and reproduction of recorded media
	181		Printing and service activities related to printing
		1811	Printing
		1812	Service activities related to printing
	182	1820	Reproduction of recorded media
19			Manufacture of coke and refined petroleum products
	191	1910	Manufacture of coke oven products
	192	1920	Manufacture of refined petroleum products
20			Manufacture of chemicals and chemical products
	201		Manufacture of basic chemicals, fertilizer and nitrogen compounds, plastics and synthetic rubber in primary forms
		2011	Manufacture of basic chemicals
		2012	Manufacture of fertilizer and nitrogen compounds
		2013	Manufacture of plastics and synthetic rubber in primary forms
	202		Manufacture of other chemical products
		2021	Manufacture of pesticides and other agrochemical products
		2022	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
		2023	Manufacture of soap and detergents, cleaning and polishing preparations
		2029	Manufacture of other chemical products n.e.c
	203	2030	Manufacture of man-made fibres
21			Manufacture of pharmaceuticals, medicinal chemical and botanical products
	210	2100	Manufacture of pharmaceuticals, medicinal chemical and botanical products
22			Manufacture of rubber and plastics products
	221		Manufacture of rubber products
		2211	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres
		2212	Manufacture of other rubber products
	222	2220	Manufacture of plastics products
23			Manufacture of other non-metallic mineral products
	231	2310	Manufacture of glass and glass products
	239		Manufacture of non-metallic mineral products n.e.c
		2391	Manufacture of refractory products
		2392	Manufacture of clay building materials
		2393	Manufacture of other porcelain and ceramic products
		2394	Manufacture of cement, lime and plaster
		2395	Manufacture of articles of concrete, cement and plaster
		2396	Cutting, shaping and finishing of store
		2399	Manufacture of other non-metallic mineral products n.e.c
24			Manufacture of basic metals
	241	2410	Manufacture of basic iron and steel
	242	2420	Manufacture of basic precious and other non- ferrous metals
	243		Casting of metals
		2431	Casting of iron and steel
		2432	Casting of non-ferrous metals
25			Manufacture of fabricated metal products, except machinery and equipment
	251		Manufacture of structural metal products, tanks, reservoirs and steam generators
		2511	Manufacture of structural metal products
		2512	Manufacture of tanks, reservoirs and containers of metal
		2513	Manufacture of steam generators, except central heating hot water boilers

2-digit	3-digit	4-digit	Description
	252	2520	Manufacture of weapons and ammunition
	259		Manufacture of other fabricated metal products; metalworking service activities
		2591	Forging, pressing, stamping and roll-forming of metal; powder metallurgy
		2592	Machining; treatment and coating of metals
		2593	Manufacture of cutlery, hand tools and general hardware
		2599	Manufacture of other fabricated metal products n.e.c
26			Manufacture of computer, electronic and optical products
	261	2610	Manufacture of electronic components
	262	2620	Manufacture of computers and peripheral equipment
	263	2630	Manufacture of communication equipment
	264	2640	Manufacture of consumer electronics
	265		Manufacture of measuring, testing, navigating and control equipment, watches and clocks
		2651	Manufacture of measuring, testing, navigating and control equipment
		2652	Manufacture of watches and clocks
	266	2660	Manufacture of irradiation, electromedical and electrotherapeutic equipment
	267	2670	Manufacture of optical instruments and equipment
	268	2680	Manufacture of magnetic and optical media
27			Manufacture of electrical equipment
	271	2710	Manufacture of electric motor, generators, transformers and electricity distribution and control apparatus
	272	2720	Manufacture of batteries and accumulators
	273		Manufacture of wiring and wiring devices
		2731	Manufacture of fibre optic cables
		2732	Manufacture of other electronic and electric wires and cables
		2733	Manufacture of wiring devices
	274	2740	Manufacture of electric lighting equipment
	275	2750	Manufacture of domestic appliances
	279	2790	Manufacture of other electrical equipment
28			Manufacture of machinery and equipment n.e.c
	281		Manufacture of general purpose machinery
		2811	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
		2812	Manufacture of fluid power equipment
		2813	Manufacture of other pumps, compressors, taps and valves
		2814	Manufacture of bearings, gears, gearing and driving elements
		2815	Manufacture of ovens, furnaces and furnace burners
		2816	Manufacture of lifting and handling equipment
		2817	Manufacture of office machinery and equipment except computers and peripheral equipment
		2818	Manufacture of power-driven hand tolls
		2819	Manufacture of other general-purpose machinery
	282		Manufacture of special-purpose machinery
		2821	Manufacture of agricultural and forestry machinery
		2822	Manufacture of metal-forming machinery and machine tools
		2823	Manufacture of machinery for metallurgy
		2824	Manufacture of machinery for mining, quarrying and construction
		2825	Manufacture of machinery for food, beverage and tobacco processing
		2826	Manufacture of machinery for textile, apparel and leather production
		2829	Manufacture of other special-purpose machinery
29			Manufacture of motor vehicles; trailers and semi- trailers
	291	2910	Manufacture of motor vehicles
	292	2920	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
	293	2930	Manufacture of parts and accessories for motor vehicles
30			Manufacture of other transport equipment
	301		Building of ships and boats
		3011	Building of ships and floating structures
		3012	Building of pleasure and sporting boats

2-digit	3-digit	4-digit	Description
	302	3020	Manufacture of railway locomotives and rolling stock
	303	3030	Manufacture of air and spacecraft and related machinery
	304	3040	Manufacture of military fighting vehicles
	309		Manufacture of transport equipment n.e.c
		3091	Manufacture of motorcycles
		3092	Manufacture of bicycles and invalid carriages
		3099	Manufacture of other transport equipment n.e.c
31	310	3100	Manufacture of furniture
			Manufacture of wooden furniture
			Manufacture of other furniture
32			Other manufacturing
	321		Manufacture of jewellery, bijouterie and related articles
		3211	Manufacture of jewellery and related articles
		3212	Manufacture of bijouterie and related articles
	322	3220	Manufacture of musical instruments
	323	3230	Manufacture of sports goods
	324	3240	Manufacture of games and toys
	325	3250	Manufacture of medical and dental instruments and supplies, shape- adjusted and ability recovery apparatus
	329	3290	Other manufacturing n.e.c
33			Repair and installation of machinery and equipment
	331		Repair of fabricated metal products, machinery and equipment
		3311	Repair of fabricated metal products
		3312	Repair of machinery
		3313	Repair of electronic and optical equipment
		3314	Repair of electrical equipment
		3315	Repair of transport equipment, except motor vehicles
		3319	Repair of other equipment
	332	3320	Installation of industrial machinery and equipment

Table A2. Classification of manufacturing industries based on the level of technological intensity

Technology intensity level	Industries
High-technology	Manufacture of basic pharmaceutical products and pharmaceutical preparations
	Manufacture of computer, electronic and optical products
Medium-technology	Manufacture of chemicals and chemical products
	Manufacture of electrical equipment
	Manufacture of machinery and equipment
	Manufacture of motor vehicles, trailers and semi-trailers
	Manufacture of other transport equipment
	Manufacture of coke and refined petroleum products
	Manufacture of rubber and plastic products
	Manufacture of other non-metallic mineral products
	Manufacture of basic metals
	Manufacture of fabricated metal products, except machinery and equipment
	Repair and installation of machinery and equipment
Low-technology	Manufacture of food products
	Manufacture of beverages
	Manufacture of tobacco products
	Manufacture of textiles
	Manufacture of wearing apparel
	Manufacture of leather and related products
	Manufacture of wood and of products of wood and cork, except furniture
	Manufacture of articles of straw and plaiting materials
	Manufacture of paper and paper products
	Printing and reproduction of recorded media
	Manufacture of furniture
	Other manufacturing

Notes. *Source: Eurostat (2022)*

Table A3. Definition and principal component analysis of nine institutional sub-indices

Components	Definition	Factor 1	Factor 2	Factor 3
Entry cost	low entry costs for business start-up	0.264	0.329	-0.545
Land access	easy access to land and security of business premises	0.401	-0.025	0.372
Transparency	a transparent business environment and equitable business information	-0.159	0.647	0.142
Control of corruption	low level of informal payment to local public officials	0.449	0.124	0.049
Time cost	limited time requirements for bureaucratic procedures and inspections	0.253	0.542	0.212
Proactivity	proactive and creative provincial leadership in solving problems for enterprises	0.203	-0.266	0.523
Business support	developed and high-quality business support services	-0.382	0.224	0.110
Labour training	sound labour training policies	-0.405	0.169	0.435
Rule of law	fair and effective legal procedures for dispute resolution	0.358	0.117	0.149
Percent of variance (%)		36.96	17.93	14.18
Cumulative (%)		36.96	54.89	69.07

Table A4. List of home countries

Countries with higher institutional quality compared to Vietnam	
Country name	**Country code**
American Samoa	ASM
Anguilla	AIA
Argentina	ARG
Australia	AUS
Austria	AUT
Belgium	BEL
Belize	BLZ
Bermuda	BMU
Brazil	BRA
Brunei Darussalam	BRN
Bulgaria	BGR
Canada	CAN
Cayman Islands	CYM
Cyprus	CYP
Czechia	CZE
Denmark	DNK
Dominica	DMA
Estonia	EST
Finland	FIN
France	FRA
Germany, Federal Republic of	DEU
Greenland	GRL
Hong Kong SAR, China	HKG
Hungary	HUN
Iceland	ISL
India	IND
Indonesia	IDN
Ireland	IRL
Israel	ISR
Italy	ITA
Japan	JPN
Jordan	JOR
Korea, Republic of	KOR
Liechtenstein	LIE
Luxembourg	LUX
Macau	MAC
Malaysia	MYS
Maldives	MDV
Malta	MLT
Mauritius	MUS
Mongolia	MNG
Netherlands	NLD
New Zealand	NZL
Norway	NOR
Panama	PAN
Philippines	PHL
Poland	POL
Romania	ROU
Samoa	WSM
San Marino	SMR
Saudi Arabia	SAU
Serbia and Montenegro	SRB
Seychelles	SYC
Singapore	SGP
Slovakia	SVK
Slovenia	SVN
South Africa	ZAF
Spain	ESP
Sri Lanka	LKA
Sweden	SWE
Switzerland	CHE
Taiwan	TWN
Thailand	THA
Tonga	TON
Turkey	TUR
United Arab Emirates	ARE
United Kingdom	GBR
United States of America	USA
Uruguay	URY
Virgin Islands	VIR

Countries with lower institutional quality compared to Vietnam	
Country name	**Country code**
Afghanistan	AFG
Angola	AGO
Bangladesh	BGD
Cambodia	KHM
China	CHN
Cuba	CUB
Egypt	EGY
Guatemala	GTM
Iran, Islamic Rep.	IRN
Iraq	IRQ
Kazakhstan	KAZ
Korea, Dem. People's Rep. of	PRK
Kyrgyz Republic	KGZ
Lao PDR	LAO
Nepal	NPL
Pakistan	PAK
Russian Federation	RUS
Sudan	SDN
Ukraine	UKR

Note. Cross-country data on institutional development is retrieved from the World Governance Indicators (WGI) provided by the World Bank in 2015. The WGI data reflects the diverse views on institutional quality of stakeholders worldwide regarding six indicators: (*i*) Voice and accountability, (*ii*) Political stability and absence of violence/terrorism, (*iii*) Government Effectiveness, (*iv*) Regulatory quality, (*v)* Rule of law, and (*vi*) Control of corruption. The average of these indicators is used to compare the overall institutional quality among countries, particularly countries that have FDI to Vietnam.

Table A5. Marginal effects of FDI on the probability of SMEs' R&D investment

	Horizontal FDI	FDI from countries with low institutional quality	FDI from countries with high institutional quality	Forward FDI	Backward FDI	FDI index
	(1)	(2)	(3)	(4)	(5)	(6)
INST=1	-0.012	-15.600	-0.011	-4.564	-7.427	-0.952
INST=2	-0.012	-13.114	-0.011	-2.338	-6.305	-0.556
INST=3	-0.011	-10.588	-0.010	-0.948	-5.236	-0.288
INST=4	-0.010	-8.021	-0.008	-0.303	-4.233	-0.119
INST=5	-0.009	-5.416	-0.005	-0.076	-3.302	-0.019
INST=6	-0.007	-2.773	-0.002	-0.015	-2.450	0.032
INST=7	-0.004	-0.095	0.003	-0.002	-1.683	0.054
INST=8	0.0005	2.618	0.010	0.000	-1.002	0.057
INST=9	0.006	5.365	0.018	0.000	-0.407	0.051
INST=10	0.013	8.143	0.028	0.000	0.102	0.042

Note. This table reports the marginal effects of FDI on the probability of SMEs' R&D investment at different levels of institutional quality for all IV-probit models (full specification) in the study. Other independent variables are at the sample average.

Table A6. First stage regression results of Table 6.2

	IV-Probit			IV-2SLS		
Dependent variable:	*FDI*	*FDI×INST*	*INST*	*FDI*	*FDI×INST*	*INST*
FDI_IV1	0.187***	0.900***	-0.689***	0.201***	1.035***	-0.647***
	(0.020)	(0.158)	(0.201)	(0.021)	(0.167)	(0.201)
FDI_IV2	0.022	-0.218**	-0.007	0.012	-0.291***	-0.002
	(0.015)	(0.087)	(0.109)	(0.015)	(0.087)	(0.108)
FDI_INST_IV1	-0.000	0.001	0.018***	-0.001*	0.001	0.017***
	(0.000)	(0.002)	(0.003)	(0.000)	(0.003)	(0.003)
FDI_ INST_IV2	0.014	-0.494*	-1.795***	-0.024	-0.794***	-1.957***
	(0.033)	(0.267)	(0.451)	(0.034)	(0.295)	(0.453)
TENURE	0.001***	0.001	-0.006***	0.001***	0.002	-0.005***
	(0.000)	(0.001)	(0.002)	(0.000)	(0.001)	(0.002)
SWITCH	0.030**	0.416***	0.813***	0.045***	0.559***	0.868***
	(0.012)	(0.095)	(0.145)	(0.013)	(0.101)	(0.144)
Controls	Y	Y	Y	Y	Y	Y
Observations	3,101	3,101	3,101	3228	3228	3228

Note. This table reports the estimation results of the first stage regressions of Table 6.2. *FDI_IV1* and *FDI_IV2* are FDI presence in two service industries in a non-neighbouring region. *TENURE* is the tenure of the provincial leader measured by months in position, while *SWITCH* is a dummy variable indicating whether there is a leader switch in a given province in a given year. *FDI_INST_IV1* is the interaction term between *FDI_IV1* and *TENURE*. *FDI_INST_IV2* is the interaction term between *FDI_IV2* and *SWITCH*. Robust standard errors are in parentheses. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

Table A7. First stage regression results of Table 6.3

Dependent variable:	*FDI*	*FDI×INST*	*INST*
FDI_IV1	0.086***	-0.046	-0.279
	(0.022)	(0.145)	(0.172)
FDI_IV2	-0.082***	-0.259***	0.105
	(0.017)	(0.079)	(0.106)
FDI_INST_IV1	-0.057**	-0.218	0.182
	(0.023)	(0.144)	(0.192)
FDI_ INST_IV2	0.121***	0.500***	0.239
	(0.032)	(0.140)	(0.170)
HIGHEDU	-0.035***	-0.754***	-1.364***
	(0.013)	(0.112)	(0.154)
NONLOCAL	0.032*	0.494***	-0.145
	(0.019)	(0.130)	(0.176)
Controls	Y	Y	Y
Observations	3278	3278	3278

Note. This table reports the estimation results of the first stage regressions of the full specification in Table 6.3. *FDI_IV1* and *FDI_IV2* are FDI presence in two service industries in a non-neighbouring region. *HIGHEDU* is the educational level of the provincial leader which is a dummy variable taking the value of one if the leader holds a postgraduate degree, while *NONLOCAL* is a dummy variable indicating whether the leader originated from another province. *FDI_INST_IV1* is the interaction term between *FDI_IV1* and *HIGHEDU*. *FDI_INST_IV2* is the interaction term between *FDI_IV2* and *HIGHEDU*. Bootstrapped standard errors are in parentheses. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

Table A8. First stage regression of Table 6.4

Dependent variable *FDI*	(1)	(2)	Dependent variable *FDI*	(3)	(4)
FDI_IV1	0.078***	-0.110***	*FDI_IV1*	0.033***	0.152***
	(0.016)	(0.021)		(0.008)	(0.018)
FDI_IV2	0.078***	-0.022	*FDI_IV2*	0.025***	-0.005
	(0.016)	(0.016)		(0.009)	(0.019)
FDI_INST_IV1	-0.001***	-0.000	*FDI_INST_IV1*	-0.039***	-0.003
	(0.000)	(0.000)		(0.009)	(0.020)
FDI_INST_IV2	-0.051***	0.025	*FDI_INST_IV2*	0.027**	-0.012
	(0.015)	(0.036)		(0.012)	(0.020)
TENURE	0.000**	0.000**	*HIGHEDU*	0.001	-0.032**
	(0.000)	(0.000)		(0.005)	(0.014)
SWITCH	0.002	0.023*	*NONLOCAL*	0.006	0.054***
	(0.002)	(0.013)		(0.008)	(0.016)
Control variables	Y	Y	*Control variables*	Y	Y
Observations	3,101	3,101	Observations	3,278	3,278
Dependent variable *FDI×INST*	(1)	(2)	Dependent variable *FDI×INST*	(3)	(4)
FDI_IV1	0.346***	-0.286**	*FDI_IV1*	0.225***	1.244***
	(0.064)	(0.134)		(0.057)	(0.133)
FDI_IV2	0.346***	-0.317***	*FDI_IV2*	0.134***	-0.155
	(0.064)	(0.089)		(0.039)	(0.106)
FDI_INST_IV1	-0.003***	-0.002	*FDI_INST_IV1*	-0.172***	-0.349**
	(0.001)	(0.002)		(0.059)	(0.162)
FDI_INST_IV2	-0.280***	-0.417	*FDI_INST_IV2*	0.050	0.462***
	(0.063)	(0.274)		(0.049)	(0.115)
TENURE	0.000	0.001	*HIGHEDU*	-0.012	-0.706***
	(0.000)	(0.001)		(0.021)	(0.098)
SWITCH	-0.005	0.408***	*NONLOCAL*	0.070	0.365***
	(0.011)	(0.098)		(0.044)	(0.113)
Control variables	Y	Y	*Control variables*	Y	Y
Observations	3,101	3,101	Observations	3,278	3,278
Dependent variable *INST*	(1)	(2)	Dependent variable *INST*	(3)	(4)
FDI_IV1	1.150***	1.437***	*FDI_IV1*	0.518***	0.555***
	(0.373)	(0.233)		(0.136)	(0.143)
FDI_IV2	1.150***	0.067	*FDI_IV2*	0.246***	0.028
	(0.373)	(0.108)		(0.087)	(0.102)
FDI_INST_IV1	-0.014***	-0.014***	*FDI_INST_IV1*	-0.406*	-0.615***
	(0.004)	(0.003)		(0.209)	(0.219)
FDI_INST_IV2	-2.805***	-1.725***	*FDI_INST_IV2*	-0.293*	0.366**
	(0.536)	(0.457)		(0.151)	(0.143)
TENURE	0.000	0.001	*HIGHEDU*	-1.040***	-1.225***
	(0.002)	(0.002)		(0.148)	(0.159)
SWITCH	0.998***	0.868***	*NONLOCAL*	-0.176	-0.236
	(0.156)	(0.147)		(0.159)	(0.173)
Control variables	Y	Y	*Control variables*	Y	Y
Observations	3,101	3,101	Observations	3,278	3,278

Note. This table reports the estimation results on the first stage regressions of Table 6.4. FDI_I*V1* and *FDI_IV2* are FDI presence in two service industries in a non-neighbouring region. *TENURE* is the tenure of the provincial leader measured by months in position, while *SWITCH* is a dummy variable indicating whether there is a leader switch in a given province in a given year. In Columns 1 and 2, *FDI_INSTI_IV1* is the interaction term between *FDI_IV1* and *TENURE*, and *FDI_INSTI_IV2* is the interaction term between *FDI_IV2* and *SWITCH*. In Columns 3 and 4, *FDI_INST_IV1* is the interaction term between *FDI_IV1* and *HIGHEDU*, and *FDI_INST_IV2* is the interaction term between *FDI_IV2* and *HIGHEDU*. Robust standard errors are in parentheses. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

Table A9. First stage regression of Table 6.5

Dependent variable *FDI*	(1)	(2)	(3)	Dependent variable *FDI*	(4)	(5)	(6)
FDI_IV1	0.070***	0.046***	0.200***	*FDI_IV1*	0.007	-0.034***	-0.006
	(0.010)	(0.006)	(0.018)		(0.006)	(0.008)	(0.008)
FDI_IV2	0.032***	0.022***	0.009	*FDI_IV2*	0.077***	0.032***	-0.065***
	(0.005)	(0.004)	(0.007)		(0.011)	(0.009)	(0.007)
FDI_INST_IV1	-0.000***	-0.000***	-0.003***	*FDI_INST_IV1*	-0.009	-0.002	0.011
	(0.000)	(0.000)	(0.000)		(0.006)	(0.009)	(0.009)
FDI_INST_IV2	0.006	0.053***	0.037**	*FDI_INST_IV2*	-0.019	-0.004	-0.003
	(0.008)	(0.017)	(0.016)		(0.012)	(0.011)	(0.009)
TENURE	0.012***	0.001	0.010*	*HIGHEDU*	-0.015***	-0.012*	-0.032***
	(0.004)	(0.004)	(0.005)		(0.005)	(0.006)	(0.006)
SWITCH	-0.000	0.000	0.000***	*NONLOCAL*	0.010**	-0.002	0.021***
	(0.000)	(0.000)	(0.000)		(0.005)	-0.034***	(0.007)
Control variables	Y	Y	Y	*Control variables*	Y	Y	Y
Observations	3,101	3,101	3,101	Observations	3,278	3,278	3,278
Dependent variable *FDI×INST*	(1)	(2)	(3)	Dependent variable *FDI×INST*	(4)	(5)	(6)
FDI_IV1	0.532***	0.002	1.229***	*FDI_IV1*	-0.051	-0.197***	-0.135**
	(0.080)	(0.048)	(0.120)		(0.044)	(0.047)	(0.067)
FDI_IV2	0.056*	0.491***	-0.124***	*FDI_IV2*	0.212***	0.075	-0.192***
	(0.034)	(0.035)	(0.041)		(0.045)	(0.047)	(0.044)
FDI_INST_IV1	-0.001	0.002**	-0.013***	*FDI_INST_IV1*	-0.130***	-0.117**	-0.058
	(0.001)	(0.001)	(0.001)		(0.046)	(0.053)	(0.066)
FDI_INST_IV2	-0.007	-0.504***	-0.236*	*FDI_INST_IV2*	0.093*	-0.108	-0.127**
	(0.049)	(0.073)	(0.129)		(0.056)	(0.068)	(0.053)
TENURE	-0.045*	0.066**	0.081*	*HIGHEDU*	-0.276***	-0.236***	-0.440***
	(0.026)	(0.029)	(0.044)		(0.035)	(0.049)	(0.053)
SWITCH	-0.004***	-0.004***	-0.001**	*NONLOCAL*	0.040	-0.040	0.200***
	(0.000)	(0.000)	(0.001)		(0.037)	(0.056)	(0.057)
Control variables	Y	Y	Y	*Control variables*	Y	Y	Y
Observations	3,101	3,101	3,101	Observations	3,278	3,278	3,278
Dependent variable *INST*	(1)	(2)	(3)	Dependent variable *INST*	(4)	(5)	(6)
FDI_IV1	1.182***	-0.675***	1.156***	*FDI_IV1*	-0.051	-0.176	-0.318*
	(0.272)	(0.194)	(0.269)		(0.044)	(0.167)	(0.167)
FDI_IV2	0.081	0.835***	0.087	*FDI_IV2*	0.212***	-0.172	-0.085
	(0.111)	(0.097)	(0.113)		(0.045)	(0.107)	(0.098)
FDI_INST_IV1	-0.011***	0.018***	-0.011***	*FDI_INST_IV1*	-0.130***	-0.037	0.260
	(0.003)	(0.003)	(0.003)		(0.046)	(0.182)	(0.176)
FDI_INST_IV2	-1.856***	-3.904***	-1.844***	*FDI_INST_IV2*	0.093*	0.101	0.154
	(0.457)	(0.526)	(0.458)		(0.056)	(0.169)	(0.175)
TENURE	0.839***	1.204***	0.838***	*HIGHEDU*	-0.276***	-1.294***	-1.397***
	(0.145)	(0.170)	(0.147)		(0.035)	(0.146)	(0.154)
SWITCH	-0.000	-0.004	-0.000	*NONLOCAL*	0.040	-0.306*	-0.132
	(0.002)	(0.002)	(0.002)		(0.037)	(0.163)	(0.172)
Control variables	Y	Y	Y	*Control variables*	Y	Y	Y
Observations	3,101	3,101	3,101	Observations	3,278	3,278	3,278

Note. This table reports the estimation results on the first stage regressions of Table 6.5. FD*I_IV1* and *FDI_IV2* are FDI presence in two service industries in a non-neighbouring region. *TENURE* is the tenure of the provincial leader measured by months in position, while *SWITCH* is a dummy variable indicating whether there is a leader switch in a given province in a given year. In Columns 1 and 2, *FDI_INSTI_IV1* is the interaction term between *FDI_IV1* and *TENURE*, and *FDI_INSTI_IV2* is the interaction term between *FDI_IV2* and *SWITCH*. In Columns 3 and 4, *FDI_INST_IV1* is the interaction term between *FDI_IV1* and *HIGHEDU*, and *FDI_INST_IV2* is the interaction term between *FDI_IV2* and *HIGHEDU*. Robust standard errors are in parentheses. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

Table A10. First stage regression results of Table 7.2

	IV-Probit			IV-2SLS		
Dependent variable:	*FDI*	*FDI×INST*	*INST*	*FDI*	*FDI×INST*	*INST*
FDI_IV1	0.204***	1.007***	0.001	0.202***	0.998***	-0.002
	(0.019)	(0.128)	(0.144)	(0.020)	(0.130)	(0.145)
FDI_IV2	0.078***	0.441***	0.558***	0.083***	0.463***	0.570***
	(0.014)	(0.087)	(0.100)	(0.0143)	(0.087)	(0.099)
FDI_INST_IV1	-0.001***	-0.001	0.006***	-0.001***	-0.001	0.006***
	(0.0003)	(0.002)	(0.002)	(0.0003)	(0.002)	(0.002)
FDI_ INST_IV2	-0.001***	-0.002**	-0.003**	-0.0009***	-0.003**	-0.003**
	(0.0002)	(0.001)	(0.001)	(0.0002)	(0.001)	(0.001)
TENURE	0.0002	-0.005***	-0.013***	0.0002	-0.005***	-0.012***
	(0.0001)	(0.001)	(0.001)	(0.0001)	(0.001)	(0.001)
Controls	Y	Y	Y	Y	Y	Y
Observations	6,088	6,088	6,088	6,092	6,092	6,092

Note. This table reports the estimation results of the first stage regressions of Table 7.2. *FDI_IV1* and *FDI_IV2* are FDI presence in two service industries in a non-neighbouring region. *TENURE* is the tenure of the provincial leader measured by months in position. *FDI_INSTF_IV1* is the interaction term between *FDI_IV1* and *TENURE*. *FDI_INSTF_IV2* is the interaction term between *FDI_IV2* and *TENURE*. Robust standard errors are in parentheses. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

Table A11. First stage regression results of Table 7.4

	IV-Probit			IV-2SLS		
Dependent variable:	*FDI*	*FDI×INST*	*INST*	*FDI*	*FDI×INST*	*INST*
FDI_IV1	0.217***	1.051***	0.001	0.217***	1.046***	0.004
	(0.020)	(0.129)	(0.145)	(0.020)	(0.130)	(0.145)
FDI_IV2	0.111***	0.307***	0.392**	0.109***	0.296**	0.394***
	(0.027)	(0.117)	(0.166)	(0.027)	(0.116)	(0.166)
FDI_INST_IV1	-0.002***	-0.003	0.005***	-0.002***	-0.003	0.005***
	(0.000)	(0.002)	(0.002)	(0.0003)	(0.002)	(0.002)
FDI_ INST_IV2	-0.003***	-0.013***	-0.006***	-0.003***	-0.012***	-0.006***
	(0.000)	(0.001)	(0.002)	(0.0003)	(0.001)	(0.002)
TENURE	0.001***	-0.004***	-0.012***	0.001***	-0.004***	-0.012***
	(0.000)	(0.001)	(0.001)	(0.0001)	(0.001)	(0.001)
Controls	Y	Y	Y	Y	Y	Y
Observations	6,088	6,088	6,088	6,092	6,092	6,092

Note. This table reports the estimation results of the first stage regressions of Table 7.4. F*DI_IV1* and *FDI_IV2* are FDI presence in two service industries in a non-neighbouring region. *TENURE* is the tenure of the provincial leader measured by months in position. *FDI_INSTF_IV1* is the interaction term between *FDI_IV1* and *TENURE*. *FDI_INSTF_IV2* is the interaction term between *FDI_IV2* and *TENURE*. Robust standard errors are in parentheses. *,** and *** denote significant levels at 10%, 5% and 1%, respectively.

Table A12. Developed country FDI, institutional sub-indices and product innovation of domestic SMEs

Variables	Entry cost	Land access	Transparency	Control of corruption	Time cost	Proactivity	Rule of Law	Labour Training	Business support
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FDI	-3.788	-3.600***	-10.897**	-4.822***	-15.973***	-5.558***	-12.295***	4.054	3.436**
	(4.671)	(1.183)	(5.490)	(1.605)	(5.691)	(2.077)	(4.023)	(2.529)	(1.520)
FDI×INST	**0.508**	**0.662*** **	**1.719***	**0.954*** **	**2.788*** **	**1.335*** **	**2.401*** **	**-0.665**	**-0.551** **
	(0.596)	**(0.215)**	**(0.920)**	**(0.297)**	**(1.002)**	**(0.477)**	**(0.774)**	**(0.422)**	**(0.266)**
INST	-0.126	-0.168***	-0.041	-0.191***	-0.338**	-0.204***	-0.232***	0.510***	0.062***
	(0.084)	(0.041)	(0.080)	(0.047)	(0.137)	(0.068)	(0.073)	(0.194)	(0.019)
NPC_{t-1}	-0.018	-0.009	-0.009	0.002	-0.023	-0.038	-0.043	-0.002	-0.010
	(0.023)	(0.023)	(0.022)	(0.025)	(0.037)	(0.029)	(0.029)	(0.028)	(0.021)
ROA	0.011	0.012	0.000	0.021	0.011	-0.003	0.022	0.022	0.000
	(0.013)	(0.014)	(0.013)	(0.014)	(0.016)	(0.014)	(0.015)	(0.016)	(0.013)
FIRMSIZE	0.004	0.003	0.001	0.006	0.002	-0.009	0.003	0.012**	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.004)	(0.005)	(0.004)
FIRMAGE	0.000	0.000	-0.000	0.000	0.001	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
GENDER	-0.004	-0.005	-0.003	-0.002	0.014	-0.014	-0.001	0.002	-0.008
	(0.008)	(0.009)	(0.009)	(0.009)	(0.012)	(0.010)	(0.010)	(0.010)	(0.009)
AGE	0.000	0.000	-0.000	0.000	0.000	0.001	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HUMANCAP	0.013	0.018**	0.016*	0.005	0.018	0.039***	0.012	0.002	0.018**
	(0.009)	(0.009)	(0.009)	(0.010)	(0.011)	(0.014)	(0.010)	(0.011)	(0.009)
LSKILL	0.051	0.087	0.014	0.169*	0.018	0.125	0.085	0.058	0.092
	(0.091)	(0.096)	(0.090)	(0.096)	(0.105)	(0.094)	(0.099)	(0.097)	(0.091)
EXPORT	0.027	0.026	0.028	0.020	0.021	0.023	0.011	0.029	0.032*
	(0.018)	(0.018)	(0.018)	(0.019)	(0.021)	(0.019)	(0.021)	(0.019)	(0.018)
ZONE	0.037*	0.037*	0.036*	0.018	0.041	0.076***	0.050**	0.033	0.038*
	(0.021)	(0.021)	(0.021)	(0.023)	(0.027)	(0.026)	(0.025)	(0.023)	(0.021)
HERFINDAHL	0.106	0.097	0.043	0.086	0.102	0.141**	0.064	0.153**	0.092
	(0.065)	(0.066)	(0.071)	(0.071)	(0.074)	(0.071)	(0.077)	(0.071)	(0.069)
TECHGAP	0.003	0.003	0.003	-0.001	0.005	0.004	0.001	-0.001	0.002
	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.004)
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weak instrument test									
- F statistic	10.478	8.249	7.702	12.957	6.623	9.676	7.377	7.597	14.927
- Critical value at 10%	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61
Underidentification test	63.149***	40.821***	47.262***	68.691***	33.321***	54.251***	37.277***	34.209***	50.745***
Overidentification test	12.943**	2.327	2.053	3.989	3.212	3.333	1.073	2.452	4.424
Endogeneity test	8.594**	18.927***	8.198**	19.251***	12.996***	14.635***	21.856***	15.911***	8.679**
Observations	6,092	6,092	6,092	6,092	6,092	6,092	6,092	6,092	6,092

Table A13. Developing country FDI, institutional sub-indices and product innovation of domestic SMEs

Variables	Entry cost	Land access	Transparency	Control of corruption	Time cost	Proactivity	Rule of Law	Labour Training	Business support
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FDI	1.025	0.552	0.405	-1.858**	1.962	-0.046	-0.699	-0.681	1.706*
	(2.210)	(0.804)	(1.987)	(0.873)	(1.664)	(1.620)	(1.646)	(1.136)	(0.978)
FDI×INST	**-0.157**	**-0.133**	**-0.120**	**0.289***	**-0.358**	**0.003**	**0.077**	**0.053**	**-0.365****
	(0.267)	**(0.134)**	**(0.340)**	**(0.159)**	**(0.262)**	**(0.313)**	**(0.294)**	**(0.196)**	**(0.185)**
INST	-0.144*	-0.047	0.105*	-0.180***	0.077	-0.115*	-0.062	0.500**	0.062***
	(0.087)	(0.055)	(0.061)	(0.052)	(0.083)	(0.070)	(0.057)	(0.195)	(0.021)
NPC_{t-1}	-0.000	-0.003	-0.014	0.026	-0.014	-0.005	0.004	0.017	-0.003
	(0.022)	(0.022)	(0.020)	(0.024)	(0.026)	(0.022)	(0.022)	(0.028)	(0.021)
ROA	0.014	0.008	0.005	0.015	0.009	-0.003	0.009	0.028*	0.002
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.013)	(0.017)	(0.014)
FIRMSIZE	0.003	0.002	0.002	0.007*	0.002	-0.004	0.002	0.011**	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
FIRMAGE	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
GENDER	-0.007	-0.006	-0.008	-0.004	-0.004	-0.009	-0.008	0.002	-0.012
	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)
AGE	-0.000	0.000	0.000	-0.000	-0.000	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HUMANCAP	0.016*	0.013	0.012	0.005	0.012	0.027**	0.013	0.000	0.015*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.013)	(0.009)	(0.011)	(0.009)
LSKILL	0.068	0.068	0.062	0.134	0.072	0.094	0.089	0.082	0.088
	(0.088)	(0.086)	(0.087)	(0.091)	(0.089)	(0.088)	(0.089)	(0.097)	(0.092)
EXPORT	0.026	0.029*	0.028	0.024	0.033*	0.024	0.025	0.027	0.025
	(0.019)	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
ZONE	0.037*	0.030	0.035	0.007	0.037	0.049**	0.029	0.027	0.028
	(0.022)	(0.021)	(0.021)	(0.023)	(0.022)	(0.023)	(0.022)	(0.023)	(0.022)
HERFINDAHL	0.043	0.037	0.035	0.056	0.047	0.074	0.030	0.038	0.023
	(0.073)	(0.073)	(0.071)	(0.075)	(0.073)	(0.079)	(0.071)	(0.079)	(0.077)
TECHGAP	0.006	0.005	0.006	0.006	0.005	0.004	0.007	0.002	0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weak instrument test									
- F statistic	18.515	28.437	20.345	16.538	13.363	7.362	18.264	9.278	13.527
- Critical value at 10%	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61
Underidentification test	80.700***	129.332***	95.938***	75.672***	100.681***	48.776***	91.993***	52.700***	93.708***
Overidentification test	0.117	1.263	0.246	0.260	3.212	1.708	0.663	3.919	0.244
Endogeneity test	24.485**	20.251***	15.929***	23.999***	12.996***	16.211***	23.423***	22.650***	11.994***
Observations	6,092	6,092	6,092	6,092	6,092	6,092	6,092	6,092	6,092

Table A14. Developed country FDI, institutional sub-indices and process innovation of domestic SMEs

Variables	Entry cost	Land access	Transparency	Control of Corruption	Time cost	Proactivity	Rule of Law	Labour Training	Business support
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FDI	-16.681**	-3.215**	-10.672*	-3.175**	-2.811*	4.563*	-6.837**	1.928	2.224
	(7.516)	(1.278)	(5.669)	(1.474)	(1.633)	(2.457)	(3.000)	(2.279)	(2.908)
FDI×INST	**2.289****	**0.420****	**1.770***	**0.468***	**0.339**	**-0.925**	**1.292****	**-0.434**	**-0.482**
	(0.991)	**(0.206)**	**(0.932)**	**(0.267)**	**(0.266)**	**(0.558)**	**(0.620)**	**(0.346)**	**(0.453)**
INST	-0.041	-0.048	-0.178**	-0.057	0.006	0.130**	-0.087	-0.064	0.027
	(0.036)	(0.036)	(0.078)	(0.042)	(0.100)	(0.055)	(0.053)	(0.107)	(0.026)
NPC_{t-1}	0.042***	0.039***	0.048***	0.041***	0.045***	0.043***	0.044***	0.041***	0.042***
	(0.015)	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)
ROA	0.049***	0.035***	0.044***	0.039***	0.035***	0.054***	0.046***	0.030**	0.030**
	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)	(0.013)	(0.013)	(0.014)	(0.013)
FIRMSIZE	0.025***	0.022***	0.023***	0.023***	0.022***	0.033***	0.023***	0.021***	0.021***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
FIRMAGE	-0.000	-0.001	-0.000	-0.001	-0.001	-0.000	-0.000	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GENDER	0.017*	0.008	0.017**	0.008	0.010	0.022**	0.013	0.006	0.006
	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)
AGE	-0.000	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HUMANCAP	0.017*	0.028***	0.024***	0.024***	0.026***	0.002	0.022***	0.028***	0.027***
	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.011)	(0.008)	(0.008)	(0.008)
LSKILL	0.279***	0.216**	0.281***	0.250**	0.210**	0.286***	0.257***	0.212**	0.219**
	(0.100)	(0.099)	(0.095)	(0.098)	(0.099)	(0.095)	(0.097)	(0.100)	(0.099)
EXPORT	0.068***	0.064***	0.065***	0.063***	0.064***	0.070***	0.057***	0.067***	0.068***
	(0.022)	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)	(0.021)	(0.021)	(0.021)
ZONE	0.044	0.055**	0.040	0.047*	0.055**	0.011	0.056**	0.054**	0.053**
	(0.027)	(0.025)	(0.024)	(0.025)	(0.026)	(0.028)	(0.025)	(0.025)	(0.025)
HERFINDAHL	0.044	0.009	-0.033	-0.003	0.009	0.014	-0.003	0.012	-0.000
	(0.052)	(0.046)	(0.050)	(0.044)	(0.047)	(0.048)	(0.044)	(0.048)	(0.046)
TECHGAP	-0.000	0.010**	0.001	0.008*	0.010**	-0.003	0.005	0.010**	0.008*
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weak instrument test									
- F statistic	7.318	10.582	6.442	10.427	9.262	14.250	6.958	7.731	6.932
- Critical value at 10%	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61
Underidentification test	33.314***	49.293***	27.852***	50.934***	6.725***	69.833***	35.340***	43.183***	35.450***
Overidentification test	1.493	2.691	3.453	4.561	0.030	3.860	3.267	3.749	0.411
Endogeneity test	9.464**	9.357*	9.692**	6.812*	8.338**	6.725*	8.747**	8.692**	8.508**
Observations	6,089	6,089	6,089	6,089	6,089	6,089	6,089	6,089	6,089

Table A15. Developing country FDI, institutional sub-indices and process innovation of domestic SMEs

Variables	Entry cost	Land access	Transparency	Control of Corruption	Time cost	Proactivity	Rule of Law	Labour Training	Business support
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FDI	-4.448***	-1.812***	1.295	-1.121**	-3.917***	-2.401**	-3.375***	2.422***	2.729**
	(1.439)	(0.611)	(1.523)	(0.509)	(1.470)	(0.975)	(1.226)	(0.722)	(1.109)
FDI×INST	**0.559*** **	**0.322*** **	**-0.188**	**0.243** **	**0.636*** **	**0.474** **	**0.632*** **	**-0.396*** **	**-0.473** **
	(0.177)	**(0.104)**	**(0.270)**	**(0.099)**	**(0.236)**	**(0.193)**	**(0.226)**	**(0.119)**	**(0.200)**
INST	-0.057	-0.060	-0.004	-0.025	-0.044	-0.036	-0.089**	-0.072	0.024
	(0.046)	(0.049)	(0.049)	(0.047)	(0.077)	(0.046)	(0.041)	(0.117)	(0.023)
NPC_{t-1}	0.043***	0.041***	0.041***	0.043***	0.043***	0.042***	0.045***	0.044***	
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
ROA	0.036***	0.042***	0.039***	0.038***	0.042***	0.043***	0.038***	0.031**	0.034***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.011)	(0.013)	(0.012)
FIRMSIZE	0.025***	0.024***	0.025***	0.025***	0.023***	0.024***	0.024***	0.024***	0.026***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)
FIRMAGE	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000	-0.000	-0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GENDER	0.010	0.012	0.015*	0.012	0.007	0.010	0.008	0.009	0.008
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
AGE	-0.001*	-0.001*	-0.001**	-0.001*	-0.001*	-0.001**	-0.001*	-0.001	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HUMANCAP	0.019**	0.024***	0.022***	0.023***	0.024***	0.028***	0.024***	0.023***	0.021***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.010)	(0.008)	(0.008)	(0.008)
LSKILL	0.262***	0.275***	0.270***	0.268***	0.280***	0.271***	0.290***	0.244***	0.244***
	(0.087)	(0.090)	(0.089)	(0.091)	(0.092)	(0.089)	(0.089)	(0.088)	(0.087)
EXPORT	0.059***	0.064***	0.066***	0.065***	0.058***	0.059***	0.054***	0.064***	0.062***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
ZONE	0.041*	0.044*	0.042*	0.041	0.047*	0.044*	0.038	0.042*	0.037
	(0.024)	(0.024)	(0.024)	(0.025)	(0.025)	(0.024)	(0.024)	(0.024)	(0.024)
HERFINDAHL	0.035	0.026	0.077	0.105**	0.025	0.003	0.059	0.069	0.066
	(0.047)	(0.047)	(0.050)	(0.053)	(0.047)	(0.047)	(0.048)	(0.048)	(0.051)
TECHGAP	0.005	0.004	0.001	0.000	0.005	0.007*	0.004	0.003	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Region dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weak instrument test									
- F statistic	20.231	24.081	14.488	26.183	13.433	13.347	21.823	9.655	9.167
- Critical value at 10%	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61
Underidentification test	127.749***	120.071***	64.139***	116.951***	101.905***	64.906***	120.476***	48.814***	44.586***
Overidentification test	2.283	2.366	1.866	2.654	2.310	2.249	0.556	0.699	0.383
Endogeneity test	9.534**	10.951**	6.654*	10.612**	7.781*	8.103**	8.341**	10.392**	13.899***
Observations	6,089	6,089	6,089	6,089	6,089	6,089	6,089	6,089	6,089

Appendix B

Table B1. FDI, institutions and product innovation of domestic SMEs – lagged effects

Variables	IV-Probit (1)	IV-2SLS (2)	GMM-Poisson (3)
FDI_lag	-5.163***	0.354	-6.864***
	(1.266)	(0.548)	(1.182)
FDI_lag×INST_lag	**0.114**	**-0.147**	**1.200*** **
	(0.260)	**(0.097)**	**(0.146)**
INST_lag	0.022	0.028	-0.420***
	(0.093)	(0.029)	(0.059)
NPD_{t-1}	0.083	-0.013	-0.514***
	(0.138)	(0.023)	(0.134)
ROA	0.056	0.004	0.114
	(0.053)	(0.014)	(0.169)
FIRMSIZE	0.006	0.003	0.070
	(0.017)	(0.004)	(0.077)
FIRMAGE	-0.001	-0.000	-0.002
	(0.002)	(0.000)	(0.005)
GENDER	-0.046	-0.006	-0.018
	(0.038)	(0.009)	(0.093)
AGE	-0.001	-0.000	0.001
	(0.002)	(0.000)	(0.001)
HUMANCAP	0.149***	0.016	0.022
	(0.040)	(0.010)	(0.070)
LSKILL	0.519	0.019	0.815*
	(0.366)	(0.101)	(0.458)
EXPORT	-0.039	0.027	0.561***
	(0.086)	(0.020)	(0.178)
ZONE	0.143	0.031	0.020
	(0.088)	(0.022)	(0.186)
HERFINDAHL	-1.019***	0.052	0.112
	(0.327)	(0.102)	(0.553)
TECHGAP	0.137***	0.011	0.064**
	(0.021)	(0.007)	(0.026)
Year dummies	Y	Y	Y
Industry dummies	Y	Y	Y
Region dummies	Y	Y	Y
Weak instrument test			
- Cragg-Donald Wald F statistic	7.827	7.827	84.511
- Stock-Yogo critical value at 10%	6.61	6.61	13.43
Underidentification test	57.543***	39.291***	188.639***
Overidentification test[a]	1.878	1.878	2.086
Endogeneity test	18.196***	18.196***	4.089**
Observations	6,085	6089	4072

Note. This table reports the estimation results of the lagged impacts of FDI presence on product innovation of domestic SMEs. *FDI* is instrumented by the output shares of foreign firms in two service industries. *INST* is instrumented by *TENURE*, which is the months in position of the provincial leader. Constants are excluded for brevity. Robust standard errors are in parentheses in Columns 1-2. Bootstrap standard errors are in parentheses in Column 3. *, ** and *** denote significant levels at 10%, 5% and 1%, respectively.

[a] Hansen J statistics

Table B2. FDI, institutions and process innovation of domestic SMEs – lagged effects

Variables	IV-Probit (1)	IV-2SLS (2)	GMM- Poisson (3)
FDI_lag	-5.991***	-1.161***	-4.942
	(1.691)	(0.438)	(10.187)
FDI_lag×INST_lag	**1.183*** **	**0.233*** **	**2.247*** **
	(0.325)	**(0.088)**	**(0.588)**
INST_lag	-0.290**	-0.059**	-1.420***
	(0.117)	(0.027)	(0.378)
NPC_{t-1}	0.132**	0.038***	-1.543***
	(0.065)	(0.015)	(0.055)
ROA	0.243***	0.051***	0.380
	(0.062)	(0.013)	(0.263)
FIRMSIZE	0.136***	0.024***	0.521***
	(0.026)	(0.004)	(0.053)
FIRMAGE	-0.002	0.000	-0.015***
	(0.003)	(0.000)	(0.004)
GENDER	0.077	0.012	0.338
	(0.048)	(0.008)	(0.341)
AGE	-0.005**	-0.001**	-0.023***
	(0.002)	(0.000)	(0.001)
HUMANCAP	0.166***	0.025***	1.023***
	(0.057)	(0.008)	(0.293)
LSKILL	1.513***	0.390***	0.762***
	(0.375)	(0.109)	(0.195)
EXPORT	0.180**	0.055***	0.896*
	(0.090)	(0.021)	(0.537)
ZONE	0.144	0.046*	0.090
	(0.092)	(0.025)	(0.231)
HERFINDAHL	-0.283	-0.068	-0.356
	(0.342)	(0.060)	(3.385)
TECHGAP	0.034	0.007	-0.122
	(0.026)	(0.005)	(0.456)
Year dummies	Y	Y	Y
Industry dummies	Y	Y	Y
Region dummies	Y	Y	Y
Weak instrument test			
- Cragg-Donald Wald F statistic	10.542	10.542	6.171
- Stock-Yogo critical value at 10%	6.61	6.61	6.61
Underidentification test	48.106***	48.106***	31.111***
Overidentification test[a]	1.805	1.805	4.072
Endogeneity test	15.63**	8.858**	9.268**
Observations	6,061	6,089	4,052

Note. This table reports the estimation results of the lagged impacts of FDI and institutions on process innovations of domestic SMEs *FDI* is instrumented by the output shares of foreign firms in two service industries. *INST* is instrumented by *TENURE*, which is the month in position of the provincial leader. Constants are excluded for brevity. Robust standard errors are in parentheses in Columns 1-2. Bootstrap standard errors are in parentheses in Column 3. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.

[a] Hansen J statistics

Table B3. FDI, institutions and product/process innovation of domestic SMEs - Negative binomial regression.

Variables	New product (1)	New process (2)
FDI	-21.573***	-6.846***
	(0.040)	(0.019)
FDI×INST	**6.521***	**1.889***
	(0.011)	**(0.004)**
INST	-1.432***	-0.475***
	(0.002)	(0.001)
$INNOD_{t-1}$	0.346***	0.234
	(0.005)	(0.015)
ROA	0.076***	0.351***
	(0.0003)	(0.002)
FIRMSIZE	0.076***	0.295***
	(0.0001)	(0.002)
FIRMAGE	0.001***	-0.007***
	(0.000)	(0.0001)
GENDER	-0.154***	0.133
	(0.003)	(0.0004)
AGE	-0.004***	-0.015***
	(0.000)	(0.000)
HUMANCAP	0.222***	0.475***
	(0.0004)	(0.002)
LSKILL	-0.071***	1.751***
	(0.0008)	(0.002)
EXPORT	0.469***	0.420***
	(0.001)	(0.004)
ZONE	0.318***	0.065***
	(0.0004)	(0.002)
HERFINDAHL	0.508***	0.280***
	(0.0007)	(0.002)
TECHGAP	0.051***	-0.004***
	(0.0001)	(0.0003)
Observations	6,092	6,085

Note. This table presents the estimation results of Equation (4) using negative binomial regression. *FDI* is instrumented by the output shares of foreign firms in two service industries. *INST* is instrumented by *TENURE*, which is the month in position of the provincial leader. Constants are excluded for brevity. Bootstrap standard errors are in parentheses. ***, **, * denote significant levels at 1%, 5% and 10%, respectively.