Sources of productivity growth in Vietnam: Three essays

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Declaration

I declare that this thesis is my original work and has not been previously submitted to obtain degree, diploma, or its equivalent at any institute of tertiary education. To the best of my knowledge, the thesis contains no material previously published or written by another person, except when due references are acknowledged in the text. All remaining errors are mine.

Phan Le

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List of publications

Chapter 4 has been presented at the Australian Conference for Economists 2021 and a revised version has been published as follows:

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Chapter 3 has been presented at the 16th Annual Conference on Economic Growth and Development.

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Abstract

This thesis examines the sources of productivity growth in Vietnam, a developing country that has been transitioning from a centrally-planned economy to a more market-oriented one since 1986. Following the introduction, which sets the motivation and scope of the study, the thesis is organised into three core chapters, composed of self-contained articles. The first two core chapters focus on the within-firm determinants of productivity, namely the persistence of export activities and the transition into the formal business sector. The third core chapter investigates the between-firm (mis)allocation of capital that impacts aggregate productivity. The final chapter summarises the main findings, discusses contributions and policy implications, and provides suggestions for future research.

Chapter 2 examines the relationship between export and firm learning, with evidence provided on the learning mechanisms of exporters in Vietnam during the period 2010 to 2017. Using a dynamic panel data model, estimated by the generalised method of moments technique, the paper reveals opposite patterns of learning between exporters who pursue their export activities persistently and intermittent exporters whose export is merely a temporary activity. The former experience a U-shaped pattern of ex-post productivity, while the latter exhibit an inverted U-shaped pattern. The paper also finds that compared with intermittent exporters, persistent exporters are more likely to receive technology transfer from foreign buyers and are more likely to invest in technology, infrastructure and staff training in order to meet the requirements of export contracts. Altogether, the evidence suggests a commitment of persistent exporters to expand product variety or improve quality standards which is often a costly and time-consuming process. The short-lived gain in ex-post productivity of intermittent exporters, on the other hand, implies that the quality of their export goods is not far from the quality of what they already sell domestically. These findings help explain why previous studies that treated exporters as a homogeneous group tend to find ambiguous evidence of learning by exporting.

Chapter 3 examines the transition of Vietnam's informal household businesses into formal firms and its impacts upon firm-level productivity and incurred informal costs. Based on a panel dataset of formal and informal firms during 2007-2015, the paper employs the matched difference-in-difference estimation to find that such transition, known as 'formalisation', leads to higher investment, greater capital stock and an increase in labour productivity, which ranges between 23 and 82 percent. There is no statistically

significant surge in total factor productivity, implying that the gain in labour productivity comes from capital deepening rather than true innovation. In addition, the paper finds that household firms have to incur higher informal costs after joining the formal sector. Specifically, managers have to allocate an additional 5 to 8 percent of their time to deal with government regulations and spend an extra VND 9 to 12 million for bribery payments after their household businesses become formal. The presence of such informal costs is in line with anecdotal evidence from the local media and helps explain the low rate of formalisation in the dataset.

Chapter 4 examines capital misallocation of manufacturing firms in Vietnam during the period 2008 to 2017. The paper adopts a general equilibrium model to disentangle the roles of the three sources of capital misallocation: adjustment costs, uncertainty, and policy distortions. The theoretical model is then estimated via the moment matching technique that seeks to minimise the equally weighted distance between simulated values and observed values of the targeted moments. Based on data from the annual Vietnam Enterprise Surveys 2008-2017, the paper finds that overall, distortions create a productivity gap of 147 percent relative to the undistorted first-best level, meaning that productivity can more than double the current level if capital is efficiently allocated. Among the difference sources of misallocation, adjustment costs play a negligible role compared with uncertainty and policy distortions. The latter account for 81 percent of capital misallocation in Vietnam and a productivity gap of 110 percent relative to the first-best level. State ownership policy alone accounts for a 38 percent loss of aggregate manufacturing productivity, indicating the urgency of reforming state-owned enterprises and ensuring a level-playing field regardless of ownership forms.

Overall, the thesis points out important within- and between-firm determinants of productivity in Vietnam. It also highlights issues within the country's business environment that have been hindering productivity growth. Key recommendations include reducing the costs of export, tackling informal costs of formalisation such as bribery or time costs of red tape, and ensuring a level playing field for all firms regardless of their ownership forms.

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List of Acronyms and Abbreviations

ACF	Ackerberg, Caves, and Frazer
ASEAN	Association of South East Asian Nations
BTA	Bilateral Trade Agreement
CIEM	Central Institute for Economic Management
CPI	Consumer Price Index
FDI	Foreign Direct Investment
FE	Fixed Effect Estimation
FIE	Foreign-Invested Enterprise
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
GO	Gross output
GPN	Global Production Network
GSO	General Statistic Office of Vietnam
HHI	Herfindahl-Hirschman index
HS	Harmonised System
ISIC	International Standard Industrial Classification
IV	Istrumental Variable
JV	Joint Venture
MNEs	Multinational Enterprises
MVA	Manufacturing Value Added
LP	Levinsohn and Petrin
OP	Olley and Pakes
OLS	Ordinary Least Squares Estimation
R&D	Research and Development
RE	Random Effect Estimation
SITC	Standard International Trade Classification
SOE	State-Owned Enterprise
TFP	Total Factor Productivity
UN	United Nations
VA	Value-added
VCCI	Vietnam Chamber of Commerce and Industry
VES	Vietnamese Enterprise Surveys
VSIC	Vietnam Standard Industrial Classification
WTO	World Trade Organization

Chapter 1 Introduction

Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.

Paul Krugman, 2008 Nobel Laureate in Economics

1.1. Motivation

The importance of productivity to a nation's living standards has received broad consensus among economists for the past two decades.[1] In simple terms, productivity measures the efficiency of production, that is, how productive inputs such as labour and capital are utilised to produce a given output level. Since the late 1990s, many studies have found that total factor productivity accounted for most variation in per-capita income across countries (Acemoglu, 2001; Hall & Jones, 1999; Klenow & Rodriguez-Clare, 1997; Prescott, 1998). Klenow and Rodriguez-Clare (1997), for example, estimated that productivity differences explained 56 percent of cross-country income variation, compared with 20 percent and 26 percent from physical capital and human capital differences, respectively.

Productivity not only matters across countries. At the industry level, high productivity helps an industry stay competitive internationally and attract productive resources, such as labour, capital and intermediate inputs, from other economic sectors. At the firm level, productivity is a matter of survival. One finding, which has been common to virtually all industries, locations or time periods, is that more productive firms have higher chances of survival than their less productive competitors (Syverson, 2011).

In addition to the importance of productivity for business survival, another finding that has been unvarying across countries and time periods is the persistent and significant productivity gaps even among firms within a disaggregated industry classification. Using

[1] Prior to 2000, papers such as Mankiw, Romer and Weil (1992), Young (1994, 1995) and Barro and Sala-i-Martin (1995) assumed that productivity was basically the same across countries and stressed the more important role of physical and human capital in explaning output differences. Together, these studies constitute the neoclassical revival in growth economics. Later studies such as Klenow and Rodriguez-Clare (1997) have refuted such an assumption.

the United States (US) manufacturing data, Syverson (2004) found that within four-digit industries, a firm at the 90th percentile had more than double the productivity level of its competitor at the 10th percentile. The productivity gaps are even more pronounced for developing countries. Data from the Chinese and Indian manufacturing sectors revealed a gap of more than five times between a firm at the 90th percentile and one at the 10th percentile (Hsieh & Klenow, 2009). Even more puzzling is the fact that such gaps did not seem to go away at all. Studies that regressed current firm-level productivity on its one-year lag found the autoregressive coefficients to range between 0.6 and 0.8 (Syverson, 2011).

The prevalent and persistent productivity gaps across firms, even within a disaggregated industry level, have driven the research agenda on productivity since the early 2000s. Two important and related questions arise: (i) Why did market competition not wipe out inefficient firms and close down the productivity gap? and (ii) What are the different sources of productivity growth? To date, aggregate productivity growth is considered to come from two broad sources: within and between. Within sources are internal to individual firms and allow them to become individually more efficient. Between sources arise when more productive resources are reallocated towards more efficient producers.[2]

Efforts to uncover the various sources of productivity to date still leave open many pressing questions due to the shortage of both data availability and an appropriate methodological framework. Most datasets on production, for instance, are designed for the construction of aggregate macroeconomic variables and thus are limited in their ability to decipher the within sources of productivity (Syverson, 2011). Take learning by exporting, one of the oldest questions in the productivity literature, as an example. Virtually all empirical studies on this topic to date do not have information on the exact number of years producers have engaged in export activities. Rather, most studies assume that the observed years of export in their datasets are the same as the actual export experience of firms. Without information on the starting year of export, a firm with 15 years of export experience may be treated the same as one with only five years of

[2] Another classification is internal and external sources of productivity growth. Internal sources include, for example, management practices and innovation efforts within a business. External sources can include market competition, agglomeration or finance. External factors can influence both within and between sources of productivity growth.

experience in a five-year panel dataset, which consequently can cause misleading empirical outcomes.

In this context, the thesis aims to contribute to the current literature through examining three potential within and between sources of productivity growth in Vietnam, namely the persistence of export activities and the transition of informal firms into the formal sector (within sources); and capital misallocation and the role of state ownership policy (between sources). These potential sources of productivity growth are selected for the following reasons. For the first paper, an export-led development strategy has been the path to rapid and equitable growth for many emerging countries, particularly the so-called Asian Tigers. Evidence on whether exporting actually brings about productivity gains, however, is ambiguous, particularly for developing countries (Silva, Afonso & Africano, 2012). More importantly, the potential channels of firm learning remain as uncharted waters in most previous research on this topic.

Regarding the second paper, the informal sector is a ubiquitous feature in virtually all developing countries. Informal firms are often associated with low productivity, credit constraints, tax evasion and lack of social protection for their employees (Rand & Torm, 2011). For these reasons, most developing countries encourage informal firms to shift into the formal sector – a process known as 'formalisation' – with varying success. In fact, informal firms will not formalise if the expected costs of formalisation outweigh its expected benefits. Longtitudinal data on the informal sector, however, is rarely available in practice, resulting in few, if any, empirical studies that can examine both the benefits on firm-level productivity and incurred costs of formalisation.

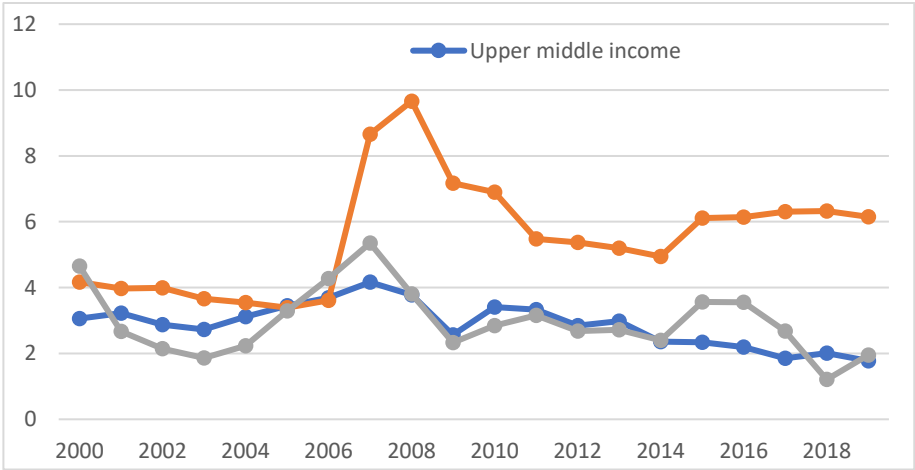
For the last core paper, recent studies have found that a significant fraction of the productivity gaps is due to the misallocation of productive resources across firms, particularly in developing countries (Gopinath et al., 2017; Guner, Ventura & Yi, 2008; Hsieh & Klenow, 2009; Restuccia & Rogerson, 2017). However, relatively few papers have attempted to pin down the severity of different sources of misallocation in a unified framework. Misallocation can be broadly attributed to three distortionary sources: (i) Adjustment costs; (ii) Informational uncertainty; and (iii) Other 'distortions' stemming from economic institutions and policies; for example, picking winners or providing preferential treatments to state-owned enterprises (SOEs) (David & Venkateswaran, 2019). It is hard to implement policies to reduce productivity losses from misallocation without knowing the nature of these losses in the first place.

The empirical examination of the above issues requires an economy with not only the appropriate development context but also detailed data resources. The next two sections will make the case that Vietnam provides the ideal setting to study these three important topics.

1.2. Why Vietnam?

Vietnam is selected for at least four reasons. On the topic of learning by exporting, the country is currently at the early stage of an export-oriented development strategy. Vietnam's total trade has more than doubled its GDP level since 2017, making it one of the most globalised economies in the world. During the period 2000 to 2017, the country exhibited a remarkable annual export growth rate of 16.4 percent, surpassing even that of China (16.1 percent). In addition, Vietnam has been a hot spot for foreign direct investment (FDI), with an FDI-to-GDP ratio of 6.2 percent in 2019, more than three times the world's average of 1.9 percent (see Figure 1.1). The increasing engagement of Vietnamese firms into global production networks makes the country an interesting case to examine learning by exporting.

Figure 1.1: FDI-to-GDP ratio (%)



Source: World Bank (2021).

On the topic of formalisation, the informal sector is prevalent in Vietnam. In 2019, this sector accounted for 32 percent of the country's GDP, three times the contribution of formal domestic private enterprises. The informal sector is composed of mostly small household businesses that have never been considered as a formal business form in Vietnam's national laws on enterprises. Without formal entity status, household businesses are limited in their competitiveness, technology application, formal credit access and management skills, leading to low productivity.

For this reason, since the early 2000s the Vietnam government has tried to incentivise household firms to formalise. Yet according to a recent survey by the General Department of Taxation, most household businesses remained hesitant to join the formal sector due to the perceived high costs of formalisation, such as following formal bookkeeping practices; preparing financial statements; paying informal fees; and spending time on complicated administrative procedures related to insurance, labour, fire safety (Uyen, 2019). Given this, Vietnam provides a fitting context to explore both the potential productivity benefits and the costs of formalisation.

Further, Vietnam's political regime makes it an interesting case to study the influence of capital misallocation and state ownership policy on aggregate productivity. Formerly a centrally planned economy, the country has been gradually transitioning into a more market-oriented one since 1986. This transition entails more economic space for private sector operations while the laws still bestow the 'leading role' in the economy to SOEs. As a result, state-owned firms enjoy preferential treatment in accessing both product and factor markets, compared with private enterprises. In 2017, SOEs made up 0.5 percent of the total number of firms, employed 9 percent of the labour force but held 29 percent of total assets in the economy (Tu, 2019). SOEs have preferential access to credit and foreign currencies from the Vietnam Development Bank and the four state-owned commercial banks which are the largest financial institutions in the country. The State also allocated or leased out prime-location land to these corporations at a much lower prices than the prevailing market price, which SOEs can in turn use as collateral to obtain even more bank loans. Further, the State has often organised the exemption, extension or restructuring of debt repayment obligations for strategic SOEs that are in financial trouble. Such policies present a source of market distortions that can negatively affect aggregate productivity level.

Last but not least, the empirical examination of the above topics requires information that is often rarely available, such as that relating to the mechanisms of learning by exporting, the operations of informal firms or bribery payments to government officials. Fortunately, Vietnam excels in this aspect, with many data sources capable of shedding light on these important topics. The following section will further elaborate on the datasets employed in this thesis.

1.3. Data

To examine the relationship between export and firm learning, the thesis uses the annual Vietnam Technology and Competitiveness Surveys (TCS) for the period 2010-2017. Jointly developed by the University of Copenhagen (UoC), the Central Institute for Economic Management (CIEM) and the General Statistics Office (GSO) of Vietnam, the TCS is a panel dataset designed to explore firm-level innovative and technological capabilities. The surveys include a subset of manufacturing firms in Vietnam, selected through stratified random sampling across two-digit Vietnam Standard Industrial Classification (VSIC) industries, ownership forms, provinces and firm size categories (micro, small, medium and large).

The TCS questionnaire typically contains seven sections: (i) Taking stock of technologies; (ii) Input and supplier relations; (iii) Output and customer relations; (iv) Technology transfer channels; (v) Capacity and the business environment; (vi) Competitors; and (vii) Corporate social responsibility (see Table 1.1). Sections (iii) and (iv) contain valuable information that allows for the construction of four key variables in the first paper: export intensity, export duration, persistence of export and channels of firm learning from exporting. Export intensity is measured as the share of exports in total firm output. Export duration indicates the number of years a firm has engaged in exporting. With information on the starting year of export, I can calculate precisely the years of export duration for firms that begin exporting from 2009 onwards. Export persistence means that firms maintain their export activities continuously once started. Finally, the TCS makes it possible to examine directly two learning channels: technological transfers from foreign clients and self-investment to meet requirements of export contracts. The former comes from the polar question "Do these contracting relationships with international customers [in a particular year] result in technology transfer from the customers to your enterprise?", while the latter comes from the question "Do these contracting relationships with your international customers outside Vietnam require any special investments (for example, production or information technology, infrastructure or staff training) from your enterprise?"

Table 1.1: Structure of a TCS questionnaire

Section	Key content
Taking stock of technologies	Current level of technological investment and capability: age, cost and type of production technologies

Input and supplier relations	Major suppliers' characteristics such as locations, types of inputs supplied, years of doing business and value of inputs obtained
Output and customer relations	Major customers' characteristics such as locations, types of outputs purchased, years of doing business and value of outputs sold
Technology transfer channels	Different transfer channels such as transfer from suppliers/customers or from domestic/international firms
Capacity and the business environment	Organisation of innovative activities in firms; government supports for innovation; business environment obstacles
Competitors	The intensity of market competition; characteristics of main competitors
Corporate social responsibility	The degree of commitment to different corporate social responsibility practices

Source: Adapted from Danida (2013).

For the second paper on formalisation, productivity and informal costs, the thesis employs data from the Vietnam Small and Medium Enterprise (SME) surveys for the period 2007-2015. Jointly developed by UoC, CIEM and the Institute of Labour and Social Science Affairs of Vietnam (ILSSA), the SME surveys provide insights into the characteristics and dynamics of Vietnamese SMEs. The surveys are carried out every two years, starting from 2005. Since the first survey was more of a trial attempt, the thesis only uses biennial data from 2007 to the latest available year of 2015.

For each survey round, there were about 2,500 non-state manufacturing firms being interviewed. Efforts are made to re-interview as many firms as possible each round in order to create a panel dataset; firms that exit the market are replaced by similar ones in terms of provinces, two-digit VSIC industries, ownership forms and firm size categories. The surveys cover ten cities/provinces, namely Ha Noi, Ha Tay, Hai Phong, Phu Tho (Northern region); Nghe An, Khanh Hoa, Quang Nam (Central region); Lam Dong (Central highlands region); Long An and Ho Chi Minh city (Southern region). The selection of provinces aims to ensure that the surveys cover different geographical regions in Vietnam, and that firms from major urban cities as well as from rural areas are included.

More importantly, the SME surveys contains valuable information for the second paper that is often rare to find in practice. For example, the surveys present a panel dataset of formal and informal firms, thus allowing for the study of formalisation impact. The questionnaire also contains a full section on fees, taxes and informal costs which makes it possible to investigate the cost side of formalisation; for example, time spent dealing with government red tape or bribery payments.

The third paper on capital misallocation and state ownership policy uses data from

the annual Vietnam Enterprise Surveys (VES) conducted by the GSO. The VES provides the most comprehensive and authoritative firm-level survey in Vietnam, covering all SOEs and foreign-invested enterprises (FIEs) as well as domestic private firms exceeding certain employment thresholds. For domestic private firms below the employment thresholds, a subsample is selected based on stratified random sampling across sectors and provinces. All registered firms, if selected, are obligated to participate in the VES according to the Statistics Law 2015.

In addition to being the largest firm survey in Vietnam, the VES also provides rich information on the production inputs and outputs of firms. This allows for the construction of key variables in the third paper such as capital stock, value-added, marginal revenue product of capital, net investment growth or productivity growth. Data from 2008 to 2017 are selected, which corresponds to Period 3 of the SOE equitisation process in Vietnam. In this period, the remaining SOEs are mostly large in size and operate in what the State deems as strategic sectors. As a consequence, these firms receive preferential access to both the product and factor markets, compared with domestic private firms. This provides an ideal setting to examine the issue of capital misallocation and state ownership policy.

1.4. The three research papers

*1.4.1. **Paper 1:** Learning by persistent exporting: Evidence from Vietnam*

The first paper examines the relationship between export and firm learning, with evidence on the learning mechanisms of manufacturing firms in Vietnam during the period 2010-2017. It aims to address four research questions: (i) Do exporters have higher productivity in the period prior to export entry than non-exporters? (Self-selection effect) (ii) Does export participation lead to sustained productivity gains (learning) for exporters? (Learning by exporting effect) (iii) How do learning patterns differ between persistent exporters and intermittent exporters and what are the implications? and (iv) If there is indeed a learning difference in (iii), what underlying channels give rise to such a difference?

In order to examine the self-selection hypothesis, the paper uses a dynamic random-effect probit estimator with unobserved heterogeneity, as proposed in Rabe-Hesketh and Skrondal (2013) (RS). The RS estimator allows for serial correlation in the unobserved error terms, which a pooled probit model does not. It also relaxes the strict

random-effect assumption of no correlation between unobserved time-invariant factors and the observed control variables.

Regarding learning by exporting, the paper adopts the difference generalised method of moments (GMM) estimator, developed by Arellano and Bond (1991). This approach employs within-firm differencing to control for unobserved and time-invariant firm heterogeneity, together with internal instruments[3] (lag levels) for all endogenous explanatory variables. The flexible GMM framework is capable of addressing the endogeneity of multiple regressors while avoiding dynamic panel bias. Further, it is well-suited for an unbalanced, 'small T, large N' panel dataset such as the data used in this paper.

The key results are as follows. First, the paper confirms the self-selection hypothesis that higher-productivity firms are more likely to enter export markets than lower-productivity ones, all else being equal. Second, the paper finds opposite learning patterns for persistent exporters and intermittent exporters. While the former display a U-shaped pattern of ex-post productivity, the latter group experience an inverted U-shaped learning pattern. Finally, compared with intermittent exporters, persistent exporters are found to be more likely to receive technology transfer from foreign buyers and more likely to invest in technology, infrastructure and staff training in order to meet export contracts' requirements.

1.4.2. Paper 2: *Formalisation, productivity and informal costs: Evidence from Vietnam*

This paper sheds light on the micro-level benefits and costs of formalisation in Vietnam during the period 2007-2015. Specifically, the paper examines two research questions: (i) Does formalisation bring about higher productivity for formalised firms? and (ii) Does formalisation lead to higher informal costs, including the time costs of dealing with red tape and the costs of bribery, incurred by formalised firms?

To address the issue of self-selection, the paper employs two empirical approaches: (i) matched difference-in-difference (DiD); and (ii) instrumental variable (IV). The main approach, matched DiD, resolves the issue of permanent average differences in outcomes between formal and informal firms that exist prior to formalisation. It also helps address the the problem of selection on observables, that is, *observed* factors that may influence both the decision to formalise and outcome variables.

[3] External instruments are also allowed in GMM.

The IV approach, on the other hand, helps resolve the issue of selection on unobservables; that is, *unobserved* factors that influence both formalisation decision and firm outcomes. The key explanatory variable, formality status, is instrumented by the share of formal firms within the same year, province and industry, excluding the firm of interest.

The findings are as follows. First, formalisation leads to higher investment, higher capital stock and a 39 percent increase in labour productivity. There is, however, no statistically significant impact on total factor productivity, meaning that the gain in labour productivity comes from capital deepening rather than true innovation sources. Second, the paper finds that household firms have to spend more time dealing with government regulations and officials, and have to pay higher bribes after joining the formal sector. These findings reveal that formalisation in Vietnam brings about both higher benefits and higher costs for firms.

1.4.3. Paper 3: *Capital misallocation and state ownership policy in Vietnam*

This paper examines capital misallocation of manufacturing firms in Vietnam during the period 2008 to 2017, with a focus on the following research questions: (i) To what extent is capital misallocated in the Vietnamese manufacturing sector? (ii) What are the contributions of adjustment costs, uncertainty and policy distortions to total capital misallocation and total factor productivity (TFP) losses? and (iii) Among different policy distortions, how does state ownership policy contribute to overall capital misallocation and aggregate TFP losses, relative to the first-best level?

The paper adopts a general equilibrium model to disentangle the roles of the three sources of capital misallocation: adjustment costs, uncertainty and policy distortions – which in turn can be decomposed into correlated, transitory and permanent policy distortions. The model matches the unobserved distortionary sources with five observed moments: (i) investment variance; (ii) investment autocorrelation; (iii) the correlation of investment with past productivity; (iv) the covariance of marginal revenue product of capital (mrpk) with productivity; and (v) the variance of mrpk. The model is then estimated via the moment matching technique which seeks to minimise the equally weighted distance between simulated values and observed values of the five targeted moments.

The findings are as follows. First, the paper finds modest contributions of adjustment costs to total misallocation (1.1 percent) and aggregate TFP losses (1.5 percent). Uncertainty is found to cause a 35.4 percent loss in aggregate TFP, which should

not be surprising given that the period 2008-2017 included the Global Financial Crisis, the 2008 oil price shock and their aftermaths. The most severe source of capital misallocation comes from policy distortions, accounting for 81 percent of capital misallocation in Vietnam and causing an aggregate TFP loss of 110 percent relative to the undistorted first-best level. Among different policy distortions, state ownership policy alone accounts for a significant 38-percent loss in aggregate manufacturing TFP compared with the first-best scenario.

1.5. Thesis outline

This thesis is composed of five chapters. Chapters 2-4 present the core materials which can be divided into two parts. The first two core chapters shed light on the within sources of productivity growth in Vietnam. Chapter two examines the relationship between export and firm learning, with evidence on the learning channels of Vietnam's manufacturing firms from 2010 to 2017. Chapter three explores the micro-level benefits and costs of formalisation during the period 2007-2015. The last core chapter investigates the between sources of productivity growth in Vietnam. Specifically, chapter four examines capital misallocation and state ownership policy from 2008 to 2017. Finally, chapter five summarises the main findings, discusses contributions and policy implications, and provides suggestions for future research.

Chapter 2 Learning by persistent exporting: Evidence from Vietnam

ABSTRACT This paper examines the relationship between export and firm learning with evidence on the learning mechanisms of exporters in Vietnam during 2010-2017. The paper finds opposite patterns of learning between persistent exporters and intermittent exporters after netting out self-selection effects. Persistent exporters experience a U-shaped pattern of revenue-based productivity after exporting, while intermittentt

exporters show an inverted U-shaped pattern of learning. Compared with intermittent exporters, persistent exporters are more likely to receive technology transfer from foreign buyers and more likely to invest in technology, infrastructure and staff training in order to meet requirements of export contracts.

Learning is not attained by chance. It must be sought for with ardour and attended to with diligence.

Abigail Adams

2.1. Introduction

It is widely recognised that many emerging economies, particularly the so-called Asian Tigers[4], achieved rapid and equitable growth through export-led development strategies. Empirical evidence to date often reveals a positive relationship between export orientation and productivity of exporting firms (Bernard & Jensen, 1999; Clerides, Lach & Tybout, 1998). What remains debatable is the mechanisms underlying this positive relationship: (i) Do more productive firms self-select into exporting? or (ii) Does exporting raise firm productivity through a learning-by-exporting process, and, if so, *how* did exporters actually learn through exporting?

The self-selection (SS) hypothesis states that only the most productive firms are able to enter export markets because of fierce global competition and barriers to entry (Melitz, 2003; Melitz & Ottaviano, 2008). Entry barriers include a multitude of trade costs such as international transportation, distribution, marketing or management of overseas networks. Conversely, learning-by-exporting (LBE) occurs when exporters experience a *sustained* increase in productivity after entering foreign markets thanks to learning.[5] There are several channels of learning, such as the acquisition of new knowledge from foreign partners or self-upgrading efforts in order to cope with increasing pressures. While the SS and LBE hypotheses are not mutually exclusive, the distinction

[4] The initial Asian Tigers consisted of South Korea, Singapore, Taiwan and Hong Kong. The current Asian Tigers often refer to Indonesia, Thailand, the Philippines and Vietnam.

[5] The *sustainability* of productivity increase is an important sign to distinguish actual learning, which should be long-lasting, from a one-off increase due to capacity utilisation (Silva, Afonso & Africano, 2011).

of each effect is important for policy purposes. If firms are found to learn by exporting, for example, government supports for the internationalisation of domestic firms can be justified.

Despite their importance, empirical evidence on the above questions remains ambiguous, particularly for developing countries (Silva, Afonso & Africano, 2012). Clerides, Lach and Tybout (1998) for instance found strong evidence of SS but none of LBE for manufacturing firms in Columbia, Mexico and Morocco. Blalock and Gertler (2004) and Van Biesebroeck (2005) detected the presence of both SS and LBE for Indonesia and nine African economies, respectively. Rankin, Söderbom and Teal (2006) found very weak evidence of SS for five sub-Saharan countries. More importantly, evidence is obscure on how firms learn, or why they did not learn, from exporting in those cases.

This paper aims to make four contributions to the export-productivity debate. First, it shows that the extent of exporters' learning varies depending on the persistence, intensity and duration of their export activities. Ignoring these factors can muddle the presence of LBE effects. These findings contribute to the recent empirical literature that explores how heterogeneity in firms' characteristics and behaviours affects their export decisions and learning outcomes (Aghion et al., 2018; Aw, Roberts & Yi, 2011; Lileeva & Trefler, 2010).

Second, the paper sheds light on the role of export contracts in facilitating exporters' learning. Two specific channels are examined: (i) Technological transfers from foreign buyers; and (ii) Self-investment in technology, infrastructure and staff training (hereafter 'upgrading investment') in order to meet requirements of export contracts. Although there have been studies that look at learning channels from foreign-invested enterprises (FIEs) to domestic firms such as Newman et al (2015), the examination of learning channels through export contracts has been rarely explored in the literature due to the scarcity of relevant data.

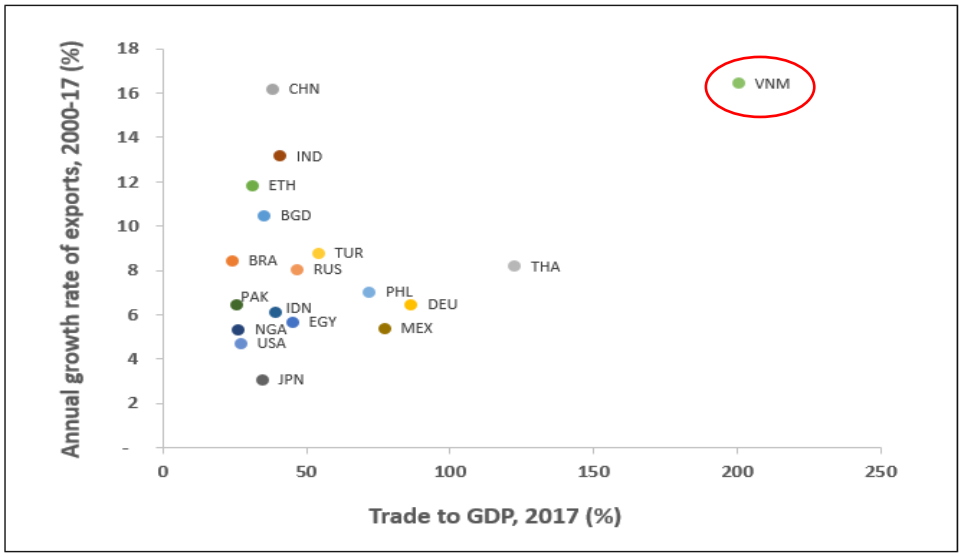
Among the few studies that were able to examine technical learning from buyers is Atkin, Khandelwal and Osman (2017) in which the authors designed a randomised experiment to investigate LBE and documented knowledge transfers from foreign buyers to local exporters in Egypt. Their study however covered only a small number of firms from the rug-manufacturing industry. Crespi, Criscuolo and Haskel (2008) studied technological learning from clients among manufacturing firms in the United Kingdom. Unfortunately, the study was unable to distinguish between domestic clients and foreign

clients. For developing countries, the latter are more relevant for LBE, as foreign sources of technological knowledge have been crucial in accounting for productivity growth in most emerging economies (Coe, Helpman, & Hoffmaister, 1997).

Third, the empirical analysis in this paper distinguishes between foreign-invested enterprises (FIEs) and local firms. The former tend to be 'born-global' businesses that are export-oriented by birth and whose export-entry decisions may differ markedly from those of local exporters. This difference, however, was left unexplored in most previous studies.

Finally, the paper contributes new evidence for Vietnam, an emerging economy currently at the early stage of export-oriented development strategy. On the export side, Vietnam has a highly globalised economy with total trade exceeding 200 percent GDP in 2017, the highest among the world's 20 most populous nations (Chamorro & Nguyen, 2018). The country also exhibits a remarkable annual growth rate of exports during the period 2000 to 17, averaging 16.4 percent per annum, which surpasses even the export growth rate of China (16.1 percent) (See Figure 2.1).

Figure 2.1: Export performance of the world's most populous nations



Source: Author's calculations based on the World Development Indicators.

On the productivity side, domestic firms are mostly at the early stage of labour-intensive production and assembly. Labour productivity of Vietnam in 2018, based on 2011 PPP, was only 7 percent of that of Singapore, 19 percent of Malaysia, 37 percent of Thailand, 45 percent of Indonesia and 56 percent of the Philippines (See Table 2.1). This is not too surprising given that the country had been under US embargo up until 1995, therefore lagging in development decades behind other countries in the region. Yet, since

1995 when Vietnam started to open up its economy, the annual growth rate of labour productivity has far exceeded those of its neighbours, averaging 4.5 percent during 1995-2018. To what extent exporting contributes to this productivity growth is thus an important question for researchers, firm managers and policy makers alike.

Table 2.1: Productivity performance of Vietnam and some ASEAN countries

	Labour productivity, 2018 (constant 2011 PPP $/ps)	Annual growth rate of productivity, 1995-2018
Indonesia	24,849	2.4%
Malaysia	58,687	1.9%
Philippines	19,918	2.7%
Singapore	152,418	2.2%
Thailand	30,115	2.4%
Vietnam	11,142	4.5%

Source: Author's calculations based on the World Development Indicators.

Newman et al. (2017) is the only study on Vietnam that is close to this paper, in which the authors found strong evidence of both SS and LBE for manufacturing firms in Vietnam during 2005-2012. Using the TCS data, the paper also found suggestive evidence that initial productivity gains are associated with innovations in product variety. Their empirical strategy, however, suffers from several issues that contribute to the difference in point estimates compared with those of this Chapter. First, they used value-added and capital stock in *nominal* values, due to the lack of industry-specific deflators before 2010. Their key explanatory variable, export status, was also not reliable because the binary variable of trade orientation taken from the Vietnam Enterprise Surveys covered not only exports but also imports of goods and services. To unravel import-only firms from exporters in their dataset is a formidable challenge. Besides, export status does not distinguish between different levels of export intensity – a potentially important determinant of LBE. Another key variable of interest, export duration, was also not measured precisely in their paper due to insufficient data.

This paper seeks to address the above methodological issues in the examination of four specific research questions: (i) Do exporters have higher productivity in the period prior to export entry than non-exporters? (ii) Does export participation lead to sustained productivity gains for exporters? (iii) How do learning patterns differ between persistent exporters and intermittent exporters? and (iv) If there is indeed a learning difference in (iii), what underlying channels give rise to such difference? Question (iv) is further broken down into two specific sub-questions: (iv-a) Are persistent exporters more likely

to receive technology transfer from foreign buyers? and (iv-b) Are persistent exporters more likely to make upgrading investment in order to meet requirements of export contracts?

The findings confirm the SS hypothesis that exporters are more productive than non-exporters prior to export entry. Further, this paper finds opposite patterns of learning between persistent exporters and intermittent exporters after separating out SS effects. Persistent exporters experience a U-shaped pattern of revenue-based total factor productivity (TFPR). This is in line with findings from Atkin, Khandelwal and Osman (2017) and suggests the presence of learning to meet higher quality standards, which often takes much trial and error to accomplish. In contrast, intermittent exporters exhibit a weak evidence of an inverted U-shaped learning pattern, implying that their export products possess a similar quality to what they already produce for the domestic market – hence learning can take place immediately. This is further strengthened by the evidence that compared with intermittent exporters, persistent exporters are more likely to receive new technologies from foreign buyers and also more likely to make upgrading investment in order to meet contractual requirements of foreign buyers. To the best of my knowledge, the findings on learning mechanisms and different learning trajectories of manufacturing exporters in this paper are novel contributions to the literature.

The remainder of the paper is structured as follows. Section 2 briefly reviews the theoretical and empirical development of the export-productivity debate. Section 3 specifies the models used to verify the relationship between export and firm learning. Section 4 describes the dataset and variable selection. Section 5 discusses empirical results and robustness checks. The last section concludes.

2.2. Analytical context

The relationship between exporting and productivity gains for exporters started to catch attention from the early 1980s with important works by Rhee, Ross-Larson and Pursell (1984) or Westphal, Rhee and Pursell (1984). These studies were in turn influenced by earlier works on the link between export orientation and economic development of the Asian Tigers in the 1970s (Balassa, 1971; Westphal & Kim, 1974). This section highlights some theoretical and empirical development of the export-productivity literature, with a distinction between SS and LBE.

2.2.1. Theory

Clerides, Lach and Tybout (1998) developed a partial equilibrium model of export entry decision with LBE effects. The model is based on the dynamic problem of forward-looking firms deciding whether or not to export in each period. Consumers are assumed to have constant elasticity of substitution (CES) utility. LBE is linked to marginal cost, which is a decreasing function of previous participation in foreign markets. Due to transport costs and trade barriers, only firms with marginal costs below a certain threshold *self-select* into exporting.

Melitz (2003) incorporated firm heterogeneity into a general equilibrium model of trade with monopolistic competition to study the intra-industry effects of trade. Consumers have CES preferences. In the model, trade affects the distribution of local firms only through the domestic labour market. SS occurs due to high barriers of entry into export markets, thus only the more productive firms can afford the entry cost. Export entry increases domestic labour demand and drives up real wage, which in turn forces the least productive firms to exit.

Melitz and Ottaviano (2008) extended the model of Melitz (2003) by incorporating endogenous mark-ups and endogenous differences in the 'toughness' of competition across markets. Consumer preferences are assumed to be quadratic instead of CES as in most previous models. Larger and more integrated markets are assumed to have tougher competition and lower mark-ups, which in turn affect the SS of heterogeneous producers and exporters into these markets.

Mrázová and Neary (2019) relaxed modelling restrictions on consumer preferences to confirm the robustness of SS effects. The authors find the sufficient condition for SS to hold is for ex post profit to be a monotonically-decreasing function of marginal cost. Their model allows for easy generalisation of existing results on SS into exporting as well as into spending on marketing or worker screening.

Grossman and Helpman (1991) presented the first theoretical model of LBE in which endogenous technological progress increases with the extent of contacts between local entrepreneurs and their counterparts in sinternational business communities. The numbers of such contacts are assumed to vary positively with commercial exchange levels. In other words, export intensity raises productivity of the local exporting firms.

Pack and Saggi (1999) developed a model whereby LBE occurs when an importer from a developed country transfers technologies to an exporter from a developing nation. This 'vertical' diffusion of knowledge benefits the importer through increasing demand

for its services. Even if the transferred technologies were leaked to other firms, both the importer and its original developing-country supplier may still benefit because knowledge diffusion makes the upstream as well as downstream market become more competitive.

Kostevc (2009) presented a general equilibrium model of trade in which higher competition in foreign markets increases demand elasticity for exported goods of developing-country exporters and consequently affects their profit margin. Facing tougher competition, developing-country exporters must either learn to improve productivity or exit the export market.

Eaton et al. (2010) developed a continuous time model in which LBE occurs during the costly search to identify foreign buyers for exported goods from developing-country firms. Successful exporters form finite-lived business relationships with foreign buyers and gradually learn about the appeal of their products, which affect the intensity of their search for additional buyers.

Aghion et al. (2018) combined modeling insights from the literature on firm heterogeneity and trade into a new growth theory to study the impact of export shocks on innovation. On the one hand, a positive shock increases market size and boosts innovation incentives for all exporting firms. On the other hand, new export entry raises competition, lowers profit opportunities and hence innovation incentives. The authors postulate that export shocks should raise innovation investment for initially high-productivity firms while inducing less innovation for initially low-productivity firms.

Overall, while the theoretical literature on the export-productivity relationship seems voluminous, open areas remain for further research. Firm productivity remains largely a black box, with relatively little understanding of the separate roles played by production technology, firm organisation, management practice, business environment and product attributes toward efficiency differences across firms. Another fruitful area for theoretical development is on the *underlying mechanisms* of LBE in order to explain the variation in learning among exporters. For instance, why do some exporters learn while others do not, even within the same industry and country setting? When does learning happen and how will it change over time?

2.2.2. Empirical evidence

Empirical evidence to date tends to confirm the SS hypothesis. Most of these studies, however, have focused on either firms in developed countries or those in developing countries that have pursued import-substitution strategies for a long time, such as Brazil,

Colombia, Indonesia, or are at an advanced stage of export-oriented industrialisation such as Taiwan. This paper contributes new evidence of SS for an emerging country currently at the early stage of an export-oriented development strategy.

On the other hand, the evidence for LBE remains inconclusive. Specifically, the presence of LBE has been investigated using two different but complementary approaches: (i) The *qualitative* approach, such as case studies, where firms are interviewed about the sources of efficiency improvements; and (ii) The *quantitative* studies of potential productivity gains for exporters using micro-level panel datasets.

In the qualitative approach, managers of exporting firms are often asked directly whether their companies have received some form of assistance or technological knowledge from foreign businesses. LBE evidence is compelling. Rhee, Ross-Larsen and Pursell (1984) for instance surveyed 112 South Korean exporting firms, 40 percent of which claimed that foreign customers brought product models and patterns for South Korean engineers to follow and that the customers even went out to production lines to train domestic workers. In a recent study, Athukorala and Ekanayake (2018) found evidence that multinational apparel retailers and brand marketers, such as Marks & Spencer, The Limited, GAP, Victoria's Secret, Nike or Abercrombie, passed on the managerial, technical and marketing know-how to Sri Lankan exporters and set the stage for a composition change in the export mix from mass-market products to niche products.

While the qualitative approach has the potential to clarify the mechanisms by which technological knowledge is transferred internationally, it is prone to selection bias as studies tend to select the most successful exporters for examination. In addition, this approach by nature fails to quantify the effect of exporting on firm productivity.

Bernard and Jensen (1995) and Aw and Hwang (1995) presented the first quantitative studies on the export-productivity relationship using micro-level panel datasets. Although the authors recognised the significant productivity differences between exporters and non-exporters, they did not distinguish LBE from SS effects. The following years saw more quantitative studies with contradictory results. Clerides, Lach and Tybout (1998) found evidence of SS but none of LBE for manufacturing firms in Columbia, Mexico and Morocco. Sun and Hong (2011) obtained similar findings for state-owned enterprises in China. On the contrary, Van Biesebroeck (2005) detected the presence of both SS and LBE for nine African economies while Rankin, Söderbom and Teal (2006) only found weak evidence of SS for five sub-Saharan countries.

These contradictory results are not too surprising given that the identification of LBE effects can be confounded due to a number of factors. First is the choice of *productivity* measure. The use of a simple labour productivity variable has been chosen by several papers (Aldan & Gunay, 2008; Newman et al., 2017). However, despite its convenience, labour productivity captures not only labour efficiency but also capital deepening in the production process. For this reason, TFP is a preferred measure of productive efficiency as it accounts for both capital intensity and capital productivity.

However, the measurement of TFP is not without methodological challenges. One issue is the adjustment for changes in the quality of factors of production, for example, the differences between trained workers and non-trained workers or those between old equipment and imported equipment with better embedded technology. Another issue is the choice of weights used in combining the productivity of labor and capital to arrive at TFP. To mitigate these issues, the paper will also use labour productivity to check the robustness of the key results.

Further, the choice between revenue-based TFP (TFPR) and quantity-based TFP (TFPQ) can also affect the identification of LBE. On the one hand, the former measures firm output by revenue or value-added, often deflated to a common year's real values using annual industry-specific price indexes. The limitation of this approach is that TFPR changes capture not only deviation in productivity but also changes in markups, product mix and product quality (de Loecker & Goldberg, 2014; Garcia-Marin & Voigtlander, 2019). On the other hand, TFPQ measures output in terms of production quantity and hence solves issues related to changing markups. This measure, however, still cannot account for changes in product quality. In addition, TFPQ is problematic when firms produce multiple products and the specific amount of inputs used by each good is not observed (de Loecker et al., 2016). Atkin, Khandelwal and Osman (2017) is the first study that uses a randomised experiment to measure TFPQ precisely. The external validity of their study is neverthelesss questionable as the authors only examined single-product rug manufacturers in Egypt. Given the limitations of both methods and based on the availability of data, this paper measures TFP by the *revenue*-based approach (TFPR) and uses evidence on firm learning to strengthen the robustness of key findings.

The extent of exporters' learning may vary owing to multiple factors. For one, learning channels such as process innovation often take *time* to be observed (Aw, Chung & Roberts, 2000; Damijian, Kostecv & Polanec, 2008). When using a quality-unadjusted TFP measure, Atkin, Khandelwal and Osman (2017) found a U-shaped pattern of ex-post

productivity, suggesting that it takes time for local exporting firms to adapt to the higher quality standards of foreign clients. The persistence, intensity and experience of export activities also affect firm learning. Andersson and Löof (2009) pointed out a serious weakness among LBE studies that fail to take these factors into account: "Strong learning effects from exporting that influence a firm's productivity are unlikely to take place when exporting is a *temporary* activity and of *minor* importance for the firm's sales" (776). In addition, the presence of learning-by-importing may confound the relationship between exporting and productivity gain, as import status can correlate with the likelihood of export entry.[6]

Last but not least, most LBE tests use non-exporters as the control group, which can be problematic for two reasons. First, the productivity gains by new exporting firms make them tougher competitors in the domestic markets and accelerate exit rates for low-productivity non-exporters. Second, newly-gained technical knowledge can also spill over to local non-exporting firms. These factors may close down any gap that opens up initially between exporters and non-exporters (Aw, Chung & Roberts, 2000).

This paper aims to address the above-mentioned issues, which may confound the true effects of LBE. The following section presents our empirical approach.

2.3. Empirical framework

2.3.1. Self-selection hypothesis

The baseline model is a dynamic panel data model. For testing the SS hypothesis, I employ a dynamic random-effect probit (DREP) estimator for the baseline specification. Compared with a simple pooled probit or fixed-effect estimation used in many previous SS studies, a DREP estimator has two main advantages. First, it allows for serial correlation in the unobserved error terms which a pooled probit model does not. Second, the demeaning process in a fixed effect (FE) estimation is not appropriate for a dynamic model specification as the lag dependent variable will correlate with the demeaned error term, thus violating the exogeneity assumption of ordinary least square (OLS) regression.

Our baseline model has the following specification:

$$Export_{it} = \gamma Export_{it-1} + \alpha Prod_{it-l} + \boldsymbol{\beta X_{it-1}} + s_j + \rho_t + (c_i + \varepsilon_{it}) \qquad (1)$$

[6] Other factors that influence LBE effects may include export destinations, relationship with lead firms, change in organisational structure, or intra-industry competition (Silva et al., 2012; Syversson, 2011).

where the dependent variable ($Export_{it}$) represents the decision of firm *i* to enter export markets in year *t*. This is a binary variable equal to one if firm *i* exports in year *t*, and zero otherwise. $\mathbf{X_{it-1}}$ is the vector of covariates including lag firm characteristics such as firm size, ownership type, age, industrial zone location and R&D engagement; s_j, ρ_t are industry- and year dummies, respectively; $(c_i + \varepsilon_{it})$ is the unobserved error term, which is assumed to include a firm fixed-effect component c_i and an i.i.d component ε_{it}.

The vector of firm characteristics is based on the previous literature. Firm size is measured by the number of employees, classified into four dummy variables: micro (1-9 employees); small (10-49); medium (50-199); and large (200 and more). To avoid perfect multicollinearity issue, the 'small' dummy is selected as a baseline and excluded from (1). The expected sign for the coefficients of 'medium' and 'large' is positive, meaning that larger firms are more likely to enter export markets than smaller firms.

The ownership variable is also divided into four categories: state-owned enterprise (SOE); cooperative; private domestic; and foreign. In Vietnam, cooperatives operate under their own Cooperative Law and thus are separated out from other types of firms. To avoid perfect multicollinearity, the 'private domestic' dummy is selected as the baseline and excluded from (1). As foreign firms in Vietnam are mostly export-oriented, the expected sign for the 'foreign' variable is positive.

Firm age is expected to have a positive sign, as older firms tend to have more experience and better networks to enter export markets than younger firms.

'Industrial zone location' is a dummy variable equal to one if a firm is located in an industrial zone and zero otherwise. Firms located in industrial zones often receive preferential treatments, such as tax exemption or reduction, and tend to be connected to global production networks. The expected sign for 'industrial zone location' is thus positive.

R&D engagement is measured by a dummy variable equal to one if a firm engages in R&D and zero otherwise. The rationale here is that innovation may help firms increase product quality or reduce marginal costs of production, thus raising the likelihood of entering export markets. The expected sign is therefore positive.

The lag dependent variable ($Export_{it-1}$) represents the sunk costs associated with entering export markets, including the costs of learning about foreign demand, establishing marketing channels, or adjusting product characteristics and packaging to meet foreign tastes (Clerides, Lach & Tybout, 1998). Ever since the hysteresis literature developed by Baldwin (1989), Dixit (1989) and Krugman (1989), sunk costs have been

considered an important barrier to export. The rationale here is that if a firm already incurred the cost of learning about foreign demand in the past, it can utilise such knowledge to facilitate export entry in the current period. The coefficient γ is expected to be positive and statistically significant.

The key explanatory variable of interest ($Prod_{it-1}$) is the lag value of firm productivity. If the SS hypothesis holds, the coefficient α is expected to be positive and statistically significant. To ensure the robustness of our findings, we measure productivity with labour productivity as well as TFP. The former is computed as real value-added divided by the number of employees. Several papers use wage bill instead of employment size in order to capture labour quality variation. The rationale is that ideally, market wages should reflect the differences in employees' contributions to production. This approach, however, is not without problems: wage difference may reflect local labour market conditions rather than labour quality; or causation can run from productive firms to higher wage bills instead of the other way around (Syversson, 2011; Van Reenen, 1996).

TFP is estimated from the well-known Cobb-Douglas production function:

$$Y_{it} = A_{it} K_{it}^{\beta_k} L_{it}^{\beta_l} \tag{2}$$

Here Y is output and A represents TFP. K and L are capital and labour inputs, respectively. β_k and β_l stand for the output elasticities of capital and labour. All nominal values are deflated using 2-digit industry-specific price indexes. The logarithmic transformation of equation (2) gives:

$$y_{it} = a_{it} + \beta_k k_{it} + \beta_l l_{it} + v_{it} \tag{3}$$

where lower cases mean logs of the same variables, and v_{it} is the unobserved random error term.

The OLS estimation of (3) is subject to the problem of simultaneity between unobservable productivity shocks and the observable input levels: a positive shock often leads firms to expand their output levels and input demand; a negative shock does the opposite. Olley and Pakes (1996) (OP) first proposed a two-step procedure to tackle this simultaneity issue, using investment level to proxy for productivity. Later, Levinsohn and Petrin (2003) (LP) argued for the use of intermediate inputs instead of investment level. Wooldrige (2009) pointed out the problem of collinearity between labour demand and the control function in both the OP and LP approaches, and proposed a single-step generalised method of moments (GMM) framework to tackle this issue. This paper adopts the Wooldrige (2009) method for the calculation of TFP.

Despite its advantages over pooled probit and fixed effect estimators , the baseline specification rests on the random-effect assumption of no correlation between unobserved factors c_i and the observed covariates. It follows that by including the lag dependent variable ($Export_{it-1}$), this assumption is violated. To tackle this issue, we also test the SS hypothesis using the DREP model with unobserved heterogeneity, as proposed in Rabe-Hesketh and Skrondal (2013) (RS). This approach augments the baseline specification in equation (1) with the initial values of the dependent variable *and* of all time-varying explanatory variables, along with the within-firm averages of all time-varying explanatory variables. This solution is based upon ideas proposed in Wooldrige (2005) but has the advantage of being more flexible while still producing unbiased estimates (Grotti & Cutuli, 2018). Specifically, we extend model (1) by writing the firm-specific unobserved effect c_i as follows:

$$c_i = \omega_0 + \omega_1 Export_{i0} + \boldsymbol{\delta}\overline{\boldsymbol{Z}}_{\boldsymbol{i}} + \boldsymbol{\phi}\boldsymbol{Z}_{\boldsymbol{i0}} + a_i \qquad (4)$$

Here $Export_{i0}$ is the initial value of the dependent variable. $\overline{\boldsymbol{Z}}_{\boldsymbol{i}} = \frac{1}{T-1}\sum_{t=0}^{T-1}\boldsymbol{Z}_{\boldsymbol{it}}$ and $\boldsymbol{Z}_{\boldsymbol{i0}}$ represent the within-firm averages and initial values of all covariates in the vector $\mathbf{X_{it-1}}$ and of the key explanatory variable ($Prod_{it-1}$), respectively. a_i is a firm-specific time-constant error term, normally distributed with mean 0 and variance σ_a^2.

The extended model has the following specification:

$$Export_{it} = \omega_0 + \gamma Export_{it-1} + \omega_1 Export_{i0} + \alpha Prod_{it-l} + \boldsymbol{\beta}\boldsymbol{X}_{\boldsymbol{it-1}} + \boldsymbol{\delta}\overline{\boldsymbol{Z}}_{\boldsymbol{i}} + \boldsymbol{\phi}\boldsymbol{Z}_{\boldsymbol{i0}} + s_j + \rho_t + a_i + \varepsilon_{it} \qquad (5)$$

The inclusion of $\overline{\boldsymbol{Z}}_{\boldsymbol{i}}$ picks up any correlation between the observed covariates and the unobserved firm fixed effect c_i. The coefficient vector $\boldsymbol{\delta}$ captures the *between-firm* effect, while α and β produce the *within-firm* effect. More precisely, the between-firm coefficient of $Prod_{it-1}$ assesses whether firms with higher productivity are on average more likely to enter export markets than lower-productivity firms. On the other hand, the within-firm coefficient of $Prod_{it-1}$ reveals whether firms are more likely to export in the years that they have higher productivity relative to those years in which they have lower productivity, all else equal. For the purpose of testing SS hypothesis, the between-firm effect of productivity is the key coefficient of interest.

2.3.2. Learning-by-exporting hypothesis

LBE refers to exporters' productivity gains thanks to entry into foreign markets. The gains in productivity may come from the acquisition of new knowledge or expertise; self-

upgrading efforts to cope with increasing competitive pressures; or exploitation of economies of scale. Since learning should leave a long-lasting effect on TFP, the productivity gains should exhibit some degree of persistency if LBE is to indeed occur.

There are a number of endogeneity issues that need to be addressed in the causal investigation of LBE effects. First, since export status can correlate with input variables, a separate estimation of TFP that excludes export status may produce inconsistent input coefficients and productivity estimates. To address this issue, this paper employs Van Biesebroeck's (2005) *one-step* approach where production function parameters and the impact of exporting on productivity are jointly estimated.

To address *omitted variable bias*, the empirical model includes important time-varying covariates to capture observed heterogeneity in productivity. Time and sector dummies are added to control for unobserved time- and sector-invariant heterogeneity. The model also controls for SS effects that may confound the direction of causality. The most challenging sources of heterogeneity thus come from the unobserved and time-variant omitted variables. For instance, a change of managers and management practice may affect both the productivity of a firm and its export orientation. A standard fixed-effect estimation would not be able to capture such unobserved and time-variant heterogeneity. Moreover, the inclusion of a lag output regressor to account for dynamic adjustment to input changes violates the exogeneity assumption in the fixed-effect estimator – a problem known as 'dynamic panel bias' (Nickell, 1981).

For these reasons, the paper adopts the difference-GMM estimator developed by Arellano and Bond (1991). This approach employs within-firm differencing to control for unobserved and time-invariant firm heterogeneity, together with *internal* instruments[7] (lag levels) for *all* endogenous explanatory variables. The flexible GMM framework is capable of addressing the endogeneity of multiple regressors while avoiding dynamic panel bias. Further, it is well-suited for an unbalanced, 'small T, large N' panel dataset such as the data used in this paper (Roodman, 2009).

As with all instrument-based approaches, the validity of GMM instruments rests on their relevance and exogeneity. For difference GMM, the relevance condition is likely to fail when the outcome variable is close to a random walk, since in this case, past levels convey little information about future changes and therefore internal instruments based on untransformed lags are weak instruments for transformed regressors (Blundell and

[7] External instruments are also allowed in GMM.

Bond, 1998). To address this issue, I report unit-root test for the outcome variable to ensure that it is nowhere close to a random walk. In addition, the paper applies the useful insight suggested in Bond, Hoeffler and Temple (2001) that the coefficient of the lag output regressor in a difference GMM should lie within the OLS coefficient (upper bound) and the FE coefficient (lower bound) if the instruments are indeed relevant.

The exogeneity condition requires the instruments to be uncorrelated with the unobserved error term. To ensure the exogeneity of instruments, the paper reports both the Arellano-Bond tests for autocorrelation in first differences (AR) and the Hansen test for overidentifying restrictions. For the exogeneity condition to hold, the AR(2) test should fail to reject the null hypothesis of no autocorrelation of order two, and the Hansen test should also fail to reject the null hypothesis that the instruments are valid. The Hansen test in turn is weakened in the presence of instrument proliferation, that is, too many instruments relative to the number of firm clusters. To address this issue, the paper makes sure that the instrument count is well below the number of firm clusters through collapsing GMM-style instruments and limiting the lags used.

The core empirical model is given by equation (6):

$$q_{it} = \beta_0 q_{it-1} + \beta_1 Expyrs_{it-1} + \beta_2 (Expyrs_{it-1})^2 + \beta_3 Expint_{it-1} + \boldsymbol{\phi W_{1it}} + \boldsymbol{\omega W_{2it-1}} + \boldsymbol{\gamma W_{3it-2}} + HHI_{jt} + \eta_i + s_j + \rho_t + e_{it} \quad (6)$$

where q_{it} and q_{it-1} are output levels of firm *i* in periods *t* and *(t – 1)*, respectively. $\mathbf{W_{1it}}$ is a vector of inputs assuming a Cobb-Douglas functional form, which includes labour and capital for firm *i* at time *t*. $\mathbf{W_{2it-1}}$ contains lag of import intensity to control for learning-by-importing. $\mathbf{W_{3it-2}}$ includes control variables for SS which comprises firm characteristics from equation (1) but at *two lags*, such as firm size, ownership type, age, export status and/or productivity; η_i, s_j, τ_t are firm, sector and year fixed effects, respectively. e_{it} is the random error term.

In addition, the model includes a Hirschman-Herfindahl Index (HHI) variable to account for the possibility that the impacts of exporting on TFP may differ between competitive sectors and concentrated ones. Since the level of competition in a market affects firms' mark-up choices, the inclusion of HHI_{jt} reduces the likelihood that observed productivity effects are due to changes in mark-ups instead of technical efficiency gains (Amiti & Konings, 2007). The HHI at the 2-digit level is measured as follows:

$$HHI_{jt} = \sum_{i=1}^{n} s_{ijt}^2 \quad (7)$$

where s_{ijt} is the revenue share of firm *i* in sector *j* at time *t*. The index ranges from zero to one, with one being perfect market concentration and zero being perfect competition.

Export intensity ($Expint_{it-1}$) is measured as the share of export in revenue for firm *i* at time *t-1*. The lag of export intensity is used since the impact on TFP often does not materialise immediately. The expected sign for β_3 is positive, that is, higher export intenstity leads to higher TFP, all else equal. The positivity and significance of β_3 may be due to learning and/or capacity utilisation. The latter concept refers to a one-time productivity increase thanks to access to larger product markets, where exporters simply utilise their spare capacity without learning. This positive shock to productivity is often short-lived as firms proceed to increase their inputs to accommodate the increased sales (Damijan and Kostevc, 2005).

The key variable of interest ($Expyrs_{it-1}$) is measured as firms' years of experience on export markets. The model includes the square term of $Expyrs_{it-1}$ to account for the possibility that the impact on productivity may vary as firms get more mature in exporting actitvities. The two coefficients β_1 and β_2 show the accumulated effects of export duration on TFP and constitute evidence for true LBE since learning should have a lasting effect on productivity.

In addition, the pattern of learning may differ for different types of exporters. Firms' learning curves may have an inverted U-shaped pattern (β_1 positive and β_2 negative), meaning that learning takes place immediately after firms begin exporting. This can be the case if the quality of firms' exports is not much higher than the quality of their domestic products. On the contrary, learning may take time to be detected if firms face much higher product standards in the export markets. Upgrading efforts such as managerial improvements, process innovations or technological adoptions cannot cause immediate lasting effects on productivity (Pisu, 2008). In this case, because the TFPR measure is quality-unadjusted, learning curves can take a U-shaped pattern (β_1 negative and β_2 positive) similar to the findings in Atkin, Khandelwal and Osman (2017).

Based on Clerides, Lach and Tybout (1998), the paper classifies firms into five categories according to the *persistence* of their export activities. Always exporters are firms that export in all the observed years from 2009 to 2017. Entry exporters are firms that start exporting during the sampling years and maintain their export activities continuously. Intermittent exporters include firms that change their export status more than once during 2009-17. Stop exporters are firms that quit exporting during 2009-17. Finally, non-exporters are firms that never export during 2009-17. The first two

categories, always- and entry-exporters, are together referred to as *persistent* exporters, in the sense that their export activities are maintained continuously once started.

Table 2.2: Five types of exporters

Always exporters	Firms that export in *all* years during 2009-17
Entry exporters	Firms that begin exporting during 2009-17 and maintain their export activities continuously
Intermittent exporters	Firms that change their export status more than once during 2009-17
Stop exporters	Firms that stop exporting during 2009-17
Non-exporters	Firms that never export during 2009-17

Source: Author's classification based on Clerides, Lach and Tybout (1998).

The classification of firms into five exporting types is subject to measurement error. For example, a firm that began exporting in 2007, then stopped exporting in 2009 before resuming in 2013 would be classified as an entry exporter while in fact it is an intermittent exporter. To deal with this issue, only the firms that begin exporting from 2009 onwards are examined in the subsequent LBE tests. To the best of my knowledge, this is the first paper that measures export duration precisely for the manufacturing sector.

In order to address research question three, model (6) is estimated separately for persistent exporters and intermittent exporters. Further, the paper estimates the following model to examine any difference in learning patterns between persistent exporters and intermittent ones:

$$q_{it} = \beta_0 q_{it-1} + \beta_1 Expyrs_{it-1} + \beta_2 (Expyrs_{it-1})^2 + \beta_3 Expyrs_{it-1} * Persistent_i + \beta_4 (Expyrs_{it-1})^2 * Persistent_i + \beta_5 Expint_{it-1} + \beta_6 Expint_{it-1} * Persistent_i + \beta_7 Persistent_i + \boldsymbol{\phi W_{1it}} + \boldsymbol{\omega W_{2it-1}} + \boldsymbol{\gamma W_{3it-2}} + HHI_{jt} + \eta_i + s_j + \rho_t + e_{it} \quad (8)$$

The only difference between model (6) and (8) is the inclusion of the interaction terms between export duration ($Expyrs_{it-1}$), its square term, export intensity ($Expint_{it-1}$) and the dummy variable $Persistent_{it}$ which is equal to one if a firm is a persistent exporter and zero otherwise. The significance of β_3 and β_4 indicates the difference in learning patterns between persistent exporters and intermittent ones.

2.3.3. Learning mechanisms

While the previous section seeks to examine the learning patterns of persistent and

intermittent exporters, it is still unclear *how* firms actually learn through exporting. Do they receive assistance from foreign clients? Or do they make investment to upgrade existing capabilities?

This section aims to uncover the productivity 'black box' through investigating two specific channels of learning: technological transfers from foreign clients and self-investment to meet contractual obligations of international customers.[8] The former can include not only new machinery and equipment, but also engineering support; advice on production processes; or transfer of know-how to improve quality standards. This is an important learning channel since for most emerging countries, foreign sources of technological knowledge play a crucial role in accounting for productivity growth (Coe, Helpman, & Hoffmaister, 1997).

The second channel covers a range of upgrading investment undertaken by firms, such as technical training, technological innovation, or infrastructure upgrade. More importantly, the purpose of these investments is to meet the contractual requirements of foreign importers. Such investments thus provide direct evidence for learning by exporting.

The main empirical model is,

$$LEARN_{it} = \beta_1 LEARN_{it-1} + \beta_2 Expyrs_{it-1} + \beta_3 Expyrs_{it-1} * Persistent_i + \beta_3 Persistent_i + \boldsymbol{\phi L_{1it-1}} + s_j + \rho_t + (c_i + e_{it}) \quad (9)$$

where the unobserved heterogeneity c_i is expressed as follows:

$$c_i = \omega_0 + \omega_1 LEARN_{i0} + \boldsymbol{\delta \overline{M}_i} + \boldsymbol{\phi M_{i0}} + a_i \quad (10)$$

The dependent variable ($LEARN_{it}$) indicates a direct learning channel – either technological transfers from foreign clients or self-investment to meet contractual requirements of international customers. The lag outcome variable ($LEARN_{it-1}$) represents past learning which should facilitate future learning by firms. $Expyrs_{it-1}$ indicates lag export duration of firm *i* and is included to examine how learning changes with experience in the export markets. In line with the literature, it is expected that the learning rate decreases as exporters become more mature. $Persistent_i$ is a dummy variable equal to one if firm *i* is a persistent exporter and zero otherwise. s_j, ρ_t are industry-

[8] These channels are not comprehensive. Firms may decide to purchase new machinery or implement quality/variety/process innovation as part of their proactive export strategy, not just in response to contractual obligations.

and year dummies, respectively; ($c_i + e_{it}$) is the unobserved error term, which is assumed to include a firm fixed-effect component c_i and an i.i.d component e_{it}.

$\boldsymbol{L_{1it-1}}$ is a vector of covariates including firm size, ownership type, age, export intensity and import intensity. Similar to the SS test, $\boldsymbol{\overline{M}_i}$ and $\boldsymbol{M_{i0}}$ represent the within-firm averages and initial values of all time-varying endogenous variables, respectively. Since equation (7) is estimated using the RS model, the inclusion of $\boldsymbol{\overline{M}_i}$ and $\boldsymbol{M_{i0}}$ help pick up any correlation between the firm fixed effect c_i and the observed covariates. Besides, the model only includes intermittent and persistent exporters since it is obvious that non-exporters receive no export contract.

The key coefficient of interest (β_3) measures the difference in the likelihood of learning between persistent exporters and intermittent ones. If the former are more likely to receive technological transfers from foreign clients or to make upgrading investments, β_3 should be positive and statistically significant.

2.4. Data and descriptive statistics

This paper uses data from the annual survey of Technology and Competitiveness Surveys (TCS) (2010-17) conducted by the General Statistics Office (GSO) of Vietnam. The survey was jointly designed by the University of Copenhagen (Denmark), the Central Institute for Economic Management (Vietnam) and the GSO in an effort to gather policy-relevant information on firm-level technology, investment and innovation. From 2009 to 2013, the TCS was funded by the Danish International Development Agency (Danida) under the Business Sector Programme Support (BSPS) Project. Since 2014, after the end of BSPS, the GSO has been conducting the TCS as an official module in the annual Vietnam Enterprise Surveys (VES) – the most comprehensive and authoritative firm surveys in the country.[9]

There are three reasons why the TCS is preferred to the larger VES for this study. First, the TCS contains additional data on firm-specific export intensity, starting year of exporting and channels of technological learning.. The latter also combines export status and import status together, making it difficult to precisely identify exporting firms. Second, the TCS is designed to be a panel dataset for the same cross-section of firms, including small-and-micro-size ones, except in the case of firm exit. In contrast, the GSO

[9] All registered firms above certain employment threshold are required to participate in the VES according to the 2015 Law on Statistics.

changes the VES' sample selection criteria almost every year, making it hard to detect small firms that exit from those no longer sampled.[10] Third, while the VES is the *de facto* choice for all empirical LBE studies of Vietnam, the TCS has remained largely unexplored. Newman et al. (2017) conducted a rare study that employs this survey to examine LBE, but only as a supplement to their main dataset, the VES. With this study, I hope that such a valuable dataset as the TCS will garner more attention from researchers in the coming time.

In order to examine SS and LBE, data from the TCS is combined with the VES which contains general firm characteristics and information from income statements and balance sheets. The GSO provided both datasets in raw format and I undertook a number of measures to ensure consistency at the firm level within and across years. The following subsections detail the construction of important variables and the data cleaning process.

2.4.1. Export status and export intensity

One of the key variables of interest, *export intensity*, is measured as the share of exports in total firm output. In the TCS, export intensity for non-exporters is recorded as either zero or blank. The paper converts blank entries for export intensity into zeros to ensure consistency.

The export-intensity variable is then used to create an export-status dummy and classify firms into five exporting types. *Export status* is a dichotomous variable equal to one if export intensity is positive and zero otherwise. This is further used to generate dummy variables for five exporting types: always-; entry-; stop-; intermittent-; and non-exporter. Always-exporters are firms with export status equal to one for all the years in the panel. Entry-exporters have export status of zero for initial year(s) and one for the remaining years in the panel. Stop-exporters have export status of one for initial year(s) and zero for the remaining year(s). Intermittent-exporters include firms that change export status more than once during the sampling years. Non-exporters have export status of zero for all the years in the panel. The first two categories constitute the *persistent-exporter*

[10] For instance, in 2012 all private domestic firms with more than 20 employees (30 for Dong Nai, Binh Duong, Hai Phong and 50 for Hanoi and Hochiminh city) are sampled. In 2013 the threshold became 50 for Hai Phong, Da Nang, Dong Nai, Binh Duong and 100 for Hanoi and Hochiminh city.

group, in the sense that export activities are maintained persistently once started. For each firm, the exporting type is constant for all the sampling years.

Table 2.3 describes some characteristics of each type of exporters in the data panel during the period 2010 to 2017. Over half of the sampling firms are non-exporters, forming an ideal baseline for comparison. The other half comprises persistent exporters (33 percent); stop exporters (5 percent); and intermittent exporters (10 percent). Persistent exporters, which include entry- and always-exporters, have the highest average revenue, real value-added, export intensity, import intensity, average employment and average capital. Due to under-developed upstream industries, firms in Vietnam that require high-quality input materials often rely on imports. Thus the higher share of real value-added in revenue, along with higher import intensity, of persistent exporters suggests that these firms produce higher-quality products than intermittent exporters.

On the other hand, non-exporters rank the lowest in all of these indicators. This is understandable given that learning about foreign demand is a costly and time-consuming process, thus export starters tend to maintain a sizable portion of their sales in the domestic market to reduce the risks associated with exporting.

Table 2.3: Types of exporters and their characteristics, 2010-17

Exporter type	Obs.	Average revenue (VND mil.)	Average value-added (VND mil.)	Average export intensity[1] (%)	Average import intensity[2] (%)	Average employment (ppl.)	Average capital (VND mil.)
Non	22,782	73,213	8,402	-	6	69	23,519
Stop	2,305	133,217	16,816	38	19	185	54,172
Intermittent	4,282	232,928	29,650	35	23	243	98,575
Persistent	14,838	394,994	64,254	63	35	572	151,388

Source: Author's calculations from the 2010-17 TCS.
[1]: Only for exporting years; [2]: Only for importing years.

The classification of firms into five exporting types begets certain caveats. For instance, a firm that enters export markets in 2011 and continues until 2016 (not exporting in 2017) is classified as an *intermittent* exporter, while another that begins and maintains export from 2011 to 2017 belongs to the *persistent* exporter group, despite the marginal difference in export duration between the two. For this reason, the paper will also run

model (6) for a sub-sample of intermittent exporters with less than 5 years of export duration for robustness checks.

Table 2.4: Proportions of intermittent- and entry-exporters by years of exporting*

Years of exporting	Intermittent	Entry
1	21%	18%
2	15%	10%
3	14%	10%
4	12%	15%
5	15%	13%
6	10%	17%
7	14%	18%

Source: Author's calculations from the TCS.
*: Proportions are calculated only for firms with more than 4 years in the panel.

Further, the classification of exporters based only on observed years is subject to measurement error. An entry exporter during the period 2010 to 2017 could have turned out to be an intermittent exporter had more years been observed. The following subsection will detail how the paper deals with this issue.

2.4.2. Export duration

Export duration is measured as the number of years a firm engages in exporting. While this is the key variable of interest in the examination of firm learning, most previous studies measure experience as the number of *observed* exporting years in their datasets. For instance, suppose that the data cover a 6-year period from 2005 to 2010, then an exporter with 6 years of export duration is no difference from one that has been exporting since 1990.

This paper on the other hand benefits from the availability of information on firms' starting year of export. With this information, I can calculate the precise years of export duration for firms that begin exporting from 2009 onwards. This subsample of firms will be used in the subsequent empirical investigations.

Table 2.5: Firms that start exporting from 2009 onwards

Export duration	Always	Entry	Intermittent
1	63	382	579
2	69	210	358
3	65	204	273
4	55	212	204

5	63	172	140
6	49	174	59
7	110	72	47
8	204	-	32
9	184	-	-
Total obs.	**862**	**1,426**	**1,692**

Source: Author's calculations based on the 2010-17 TCS.

2.4.3. Productivity

Productivity describes how much output can be produced given a set of inputs. There are two measures of productivity used in this paper: labour productivity and total factor productivity (TFP). Labour productivity for a firm is calculated as its gross value-added divided by the employment size. Gross value-added (GVA) is approximated by the sum of gross wages and pre-tax profits.[11] Nominal values are deflated by 2-digit industry-specific cost deflators provided by the GSO to obtain real values. Employment size is measured as the number of employees at the end of the year. The data are obtained by merging each firm in the TCS with the same firm in the VES using a unique firm identification, which is a combination of firm location and its tax code. Firms with missing data on gross wage, pre-tax profit and employment size are excluded from the sample.

The other and arguably more precise measurement of productivity is TFP. This is calculated using Wooldridge's (2009) system-GMM approach that does not suffer from the collinearity issue between labour demand and the control function identified in the previous OP and LP methodologies. The dependent variable used in the estimation of TFP is the log of real GVA. Inputs include capital, measured as the log of real fixed assets, and labour, measured as the log of the number of employees. The proxy variable is the log of real materials, with materials measured by substracting (nominal) gross value-added from gross revenues of firms. TFP is measured using the larger manufacturing sample in the VES before merging back into corresponding firms in the TCS. Firms with missing or negative data on GVA, input materials or fixed assets are excluded from the sample.

[11] Another component of GVA is indirect taxes less subsidies. Unfortunately, data on taxes and subsidies in the VES are not reliable with many missing or conflicting values.

2.4.4. Learning channels

Learning channels help shed light on how firms actually learn through exporting. This paper investigates two specific learning channels: technological transfers from foreign clients and self-investment to meet contractual requirements of international customers. The former is measured as a time-varying dummy equal to one if a firm receives technology transfers from foreign clients in a particular year and zero otherwise. Data are derived from the TCS question "Do these contracting relationships with international customers [in a particular year] result in technology transfer from the customers to your enterprise?" Similarly, the latter channel is measured as a binary variable equal to one if a firm makes an upgrading investment to meet contractual requirements of international customers. Data are derived from the TCS question "Do these contracting relationships with your international customers outside Vietnam require any special investments (for example, production or information technology, infrastructure or staff training) from your enterprise?"

A simple two-sample t-test with unequal variances reveals a statistically significant mean-difference between intermittent exporters and persistent exporters in terms of technolgical learning from foreign clients and self-investment to meet contractual requirements of foreign customers (see Table 2.6 below). The null hypothesis is that the two groups have the same proportion of firms receiving technological transfers or making upgrading investments. This is soundly rejected at the one-percent significance level against the alternative hypothesis that persistent exporters are more likely to receive technological transfers and to make upgrading investment compared with the intermittent group.

Table 2.6: Technological learning and upgrading investment by exporter type

Group	Obs	Technological learning (mean)	Upgrading investment (mean)
Intermittent	4,282	0.05	0.05
Persistent	14,838	0.10	0.09
Mean-difference		**-0.05*** **	**-0.04*** **

Source: Author's calculations based on the 2010-17 TCS.

*, **, ***: significant at the ten-, five- and one-percent level, respectively.

2.4.5. Other control variables

Firm size is measured as four dummy variables: micro (1-9 employees); small (10-49); medium (50-199); and large (200 or more). Data on the number of employees are taken from the VES. Firms with missing or non-positive employment are excluded from the sample.

Similarly, ownership is measured as four dummies: SOE; cooperative; private domestic firm; and foreign-invested enterprise (FIE). Prior to 2012, SOEs include central and local SOEs; central state-owned limited liability companies (LLCs); local state-owned LLCs; and joint stock companies with more than 50 percent state capital. From 2012 onwards, SOEs include one-member LLCs with 100 percent central state capital; one-member LLCs with 100 percent local state capital; and joint stock companies with more than 50 percent state capital. Private domestic firms include private enterprises; partnerships; LLCs with less than 50 percent state capital; and joint stock companies with less than 50 percent state capital. FIEs include 100 percent foreign-owned firms; joint ventures between SOEs and foreign investors; and joint ventures between private domestic firms and foreign investors. Ownership data are from the VES. Firms with missing ownership information are excluded from the sample.

Firm age is measured by subtracting year of establishment from the current year in the data. If a firm reports different years of establishment (often due to change in ownership forms), the earliest year is selected. Information on year of establishment is again taken from the VES. Firms with missing year of establishment are excluded from the sample.

Industrial zone location is measured as a dummy variable equal to one if a firm is located inside an industrial zone and zero otherwise. Industrial zones in Vietnam include industrial parks; export processing zones; economic zones; and high-technology parks. Data are taken from the VES.

R&D engagement is measured as a dummy variable equal to one if a firm engages in R&D and zero otherwise. Information on R&D engagement comes from the TCS question “Does your enterprise undertake research and development (R&D) activities in order to develop new technologies?”

Finally, import intensity is measured as the share of imported inputs in total input value. This is taken from the TCS question “Where does enterprise procure raw materials (including unprocessed materials and intermediate inputs) from (in percentage)?” The answers include five options: (i) Same province; (ii) Other provinces in the same region;

(iii) Other regions in the same country; (iv) ASEAN countries; and (v) Non-ASEAN countries. The share of imported inputs is the sum of the import shares from (iv) and (v).

Table 2.7: Descriptive statistics of key control variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Employment	44,207	261.16	819.00	1	29,132
SOE	44,207	0.00	0.06	0	1
COOPERATIVE	44,207	0.02	0.12	0	1
PRIVATE	44,207	0.74	0.44	0	1
FDI	44,207	0.24	0.43	0	1
Age	44,207	12.36	7.39	1	73
Industrial zone location	44,207	0.27	0.45	0	1
R&D engagement	44,207	0.06	0.24	0	1
Import intensity	44,207	17.06	31.94	0	100

Source: Author's calculations from the 2010-17 TCS and VES.

2.4.6. Descriptive analysis

Table 2.8 shows the distribution of firms in the final sample by the 2-digit Vietnam Standard Industrial Classification (VSIC) 2007, after the data cleaning. The paper drops two sectors – *Manufacture of coke and refined petroleum products* (VSIC code 19) and *Repair and maintenance of industrial machinery and equipment* (VSIC code 33) – due to the lack of industry-specific cost deflators. Duplicate entries are also removed.

A notable feature in the final sample is the sharp drop in the number of firms in 2014, from nearly 7000 in 2013 to 4561 just one year later. This is because after the BSPS project ended in 2013, the GSO decided to reduce the panel sample size. To make sure that key empirical results are not due to this abrupt change, the paper uses a subsample of firms with at least 5 years in the panel for robustness checks.

The sectoral distribution of firms remains fairly stable over the period 2010-17, even after the abrupt change in the number of firms in 2014. Further, the sample does not appear to have a strongly dominant industrial sector, suggesting that any evidence on learning is not biased by oversampling within a specific industry.

Table 2.8: Distribution of firms by industrial sector, 2010-17

VSIC 2007	2010	2011	2012	2013	2014	2015	2016	2017
Food	14%	14%	14%	14%	15%	15%	15%	14%
Beverage	2%	2%	2%	2%	2%	2%	2%	2%
Tobacco	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Textile	4%	5%	4%	4%	6%	5%	6%	6%
Apparel	8%	8%	8%	8%	6%	5%	6%	6%
Leather	3%	3%	3%	3%	3%	3%	3%	3%
Wood	8%	7%	7%	7%	6%	6%	6%	5%
Paper	5%	5%	5%	6%	5%	5%	5%	5%
Printing	2%	2%	2%	2%	2%	3%	2%	2%
Chemical	4%	4%	4%	4%	5%	5%	6%	6%
Pharmaceutical	1%	1%	1%	1%	1%	1%	1%	1%
Rubber/Plastic	8%	8%	8%	8%	8%	9%	8%	9%
Non-metallic mineral	10%	11%	11%	11%	10%	10%	10%	10%
Basic metal	3%	3%	3%	3%	3%	3%	3%	3%
Fabricated metal	11%	11%	11%	11%	10%	10%	10%	10%
Electronics	1%	1%	1%	1%	2%	2%	2%	2%
Electrical	2%	2%	2%	2%	3%	3%	3%	3%
Other machinery	2%	2%	2%	2%	3%	3%	3%	3%
Motor vehicles	1%	1%	1%	1%	1%	2%	1%	2%
Other transport	2%	2%	2%	2%	2%	2%	2%	2%
Furniture	7%	7%	7%	7%	6%	6%	6%	6%
No. firms	**7,582**	**7,922**	**7,373**	**6,898**	**4,561**	**4,708**	**4,330**	**4,170**

Source: Author's calculations from the 2010-17 TCS. Detailed names of each VSIC 2007 classification are included in the Appendix 2.1.

Table 2.9 disaggregates the sample by ownership types and sizes to investigate, for example, whether there are systematic differences between firms with some degree of foreign ownership (100 percent foreign-owned or joint ventures) and SOEs or private domestic firms. It is not surprising that FIEs and SOEs have the highest shares of medium and large firms compared to cooperatives and private domestic firms. The largest firms in Vietnam (those with 300 or more employees) are dominated by FIEs, while the majority of micro firms (less than 10 employees) are private domestic businesses.

Table 2.9: Sampling distribution by ownership type and employment size

	Micro (1-9)	**Small (10-49)**	**Medium (50-299)**	**Large (300+)**	**Total obs.**
SOE	1	3	108	51	163
Cooperative	128	390	171	12	701
Private firm	2,381	14,329	12,333	3,555	32,598
FIE	88	1,655	4,833	4,169	10,745

Source: Author's calculations from the 2010-17 TCS.

Regarding the sampling distribution by ownership and exporter type, it can be seen that the majority of FIEs are persistent exporters (75 percent), while the majority of domestic firms (SOEs, cooperatives or private domestic businesses) are non-exporters. Given that 98 percent of SOEs in the sample are medium- and large-firms and that these firms often receive generous preferential treatments in terms of tax, bank loan and land rent, it is a worrying sign that 67 percent of SOEs are non-exporters. Besides, each type of exporter contains observations for all four types of ownership, thus aiding the investigation of whether SS or LBE results are driven by a specific ownership form.

Table 2.10: Sampling distribution by ownership and exporter type

	SOE	**Cooperative**	**Private domestic**	**FIE**	**Total obs.**
Non	109	600	21,001	1,072	22,782
Stop	9	24	1,805	467	2,305
Intermittent	6	19	3,129	1,128	4,282
Persistent	39	58	6,663	8,078	14,838

Source: Author's calculations from the 2010-17 TCS.

The proportion of exporting firms in total firms gradually increases from 34 percent in 2010 to 45 percent in 2017, suggesting the presence of entry exporters. Unsurprisingly, FIEs are more likely to export and also export more than private domestic

firms. In 2017, for instance, 82 percent of FIEs in the sample are exporters compared to 28 percent of private domestic firms. The average export intensity, measured as the share of export in total sales, for FIEs in the same year is 67 percent, exceeding the corresponding figure of 57 percent for private domestic firms.

Table 2.11: Proportion of firms that export and average export intensity

	All ownership types		**Private domestic**		**Foreign-invested**	
	Share of exporters	Average export intensity	Share of exporters	Average export intensity	Share of exporters	Average export intensity
2010	34%	68%	23%	64%	78%	72%
2011	34%	67%	23%	64%	78%	70%
2012	35%	65%	23%	61%	80%	68%
2013	36%	64%	23%	61%	80%	68%
2014	44%	64%	28%	58%	82%	68%
2015	44%	63%	27%	58%	81%	67%
2016	44%	63%	27%	58%	80%	67%
2017	45%	63%	28%	57%	82%	67%

Source: Author's calculations from the 2010-17 TCS.

2.5. Results

2.5.1. Self-selection hypothesis

The results relating to the SS hypothesis that entry into export markets is associated with higher levels of productivity in the period prior to entry relative to firms that never export are presented in Table 2.12. The first two columns display outcomes for the DREP model (equation (1)), with column (1) using the lag of log labour productivity as the key explanatory variable of interest and column (2) using the lag of log TFP instead. The coefficient for the productivity variable is positive and statistically significant at the one percent level regardless of whether labour productivity or TFP is selected. This confirms the SS hypothesis that all else being equal, high-productivity firms are more likely to enter export markets than lower-productivity ones.

The SS hypothesis is further validated through the RS estimation which relaxes the strict random-effect assumption that observed covariates are uncorrelated with the unobserved within-firm effects. Column (3) measures productivity as the lag of log labour productivity, while column (4) uses the lag of log TFP. Regardless of which productivity

measure is selected, the coefficient for the productivity variable is positive and significant at the one-percent level.

Table 2.12: Selection into export markets

(Dependent variable: Export market entry)

Explanatory variables (in lag one)	DREP estimate		RS estimate	
	(1)	(2)	(3)	(4)
Export entry	0.216***	0.217***	0.173***	0.174***
	(0.01)	(0.01)	(0.01)	(0.01)
Productivity	0.0069***		0.015***	
	(0.00)		(0.00)	
TFP		0.0061**		0.015***
		(0.00)		(0.01)
Age	0.0017*	0.0017*	0.0001	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)
Age sq.	-0.00003*	-0.00003*	-0.0002	-0.00002
	(0.00)	(0.00)	(0.00)	(0.00)
SOE	-0.029	-0.029	-0.008	-0.008
	(0.03)	(0.03)	(0.02)	(0.02)
Coop	-0.057**	-0.059**	-0.017	-0.019
	(0.023)	(0.02)	(0.2)	(0.02)
FDI	0.071***	0.073***	0.038***	0.039***
	(0.01)	(0.01)	(0.01)	(0.01)
Micro	-0.037***	-0.035***	-0.0002	-0.0008
	(0.01)	(0.01)	(0.02)	(0.02)
Medium	0.070***	0.070***	0.061***	0.059***
	(0.00)	(0.00)	(0.01)	(0.01)
Large	0.111***	0.110***	0.093***	0.092***
	(0.01)	(0.01)	(0.02)	(0.02)
R&D	0.014*	0.014**	0.037*	0.035*
	(0.01)	(0.01)	(0.02)	(0.02)
Ind. zone	0.016***	0.016***	0.011**	0.011**
	(0.00)	(0.01)	(0.00)	(0.00)
Constant	-2.251***	-2.276***	-2.686***	-2.689***
	(0.09)	(0.09)	(0.20)	(0.20)
No. obs.	23,791	23,374	23,791	23,374

Source: Author's calculations from the 2010-17 TCS.

Note: Firms that export in all years are excluded. Each model includes year dummies. Model (1) and (2) include 4-digit industry dummies, while model (3) and (4) include two-digit sector dummies. Model (3) and (4) also include the averages and initial values of all time-varying regressors. Robust standard errors clustered at the firm level are included in parentheses. ****p<0.01, **p<0.05, *p<0.10.*

Other firm characteristics, such as R&D engagement or industrial zone location, have the expected positive and significant effect on the probability of exporting. Innovation activities often allow firms to differentiate their products from those of their

competitors, thus facilitating the entry into export markets. In terms of location, firms located inside industrial zones tend to be better connected to global production networks that, all else being equal, can increase the likelihood of export entry.

In addition, firm size is an important determinant of export decision. The positive and significant coefficients of medium- and large firms mean that they are more likely to enter export markets than small firms who have less than 50 employees. Micro firms seem to be even less likely to become exporters than small firms; however, the results from column (3) and (4), while negative, are not statistically significant.

Further, in terms of ownership forms, only FIEs have the positive and significant coefficients. The insignificance of the SOE variable indicates that all else equal, state-owned groups are no more likely than private domestic firms to become exporters. In every National Party Congress of Vietnam, SOEs are considered to play a leading role in the country's economic development. Given that Vietnam is a highly export-oriented economy, it is doubtful that these state-owned firms deserve such merit and a host of other incentives including tax breaks, easy access to credits and primely-located land (Davies, 2015).

The positive and significant coefficients of FIEs naturally make one wonder whether the SS effects are driven by foreign firms only. Table 2.13 displays results of SS effects focusing on domestic firms. Columns (1) and (2) in Table 2.13 are respectively columns (2) and (4) in Table 2.12 without FIE observations. Column (3) in Table 2.13, on the other hand, adds an interaction term between the log of TFP and the FDI dummy to investigate the heterogeneity in SS effects between FIEs and domestic firms. All explanatory variables are in lag one.

In all specifications, the coefficients of productivity are positive and significant, thus confirming that the SS effects hold for domestic firms. The positive and significant coefficient of the interaction term in column (3) suggests that all else equal, the SS effects are much more pronounced for FIEs than domestic firms. Indeed, the SS effect for FIEs are more than 20 times larger than that for domestic ones. This is not surprising given that most FIEs are born-exporters that choose Vietnam as one location of their global production networks.

Table 2.13: Self-selection effects among domestic firms

Dep. variable:	**DREP model**	**RS model**	
Export entry	(1)	(2)	(3)
Lag export entry	0.194***	0.141***	0.209***

	(0.01)	(0.01)	(0.01)
TFP	0.008***	0.014***	0.014***
	(0.00)	(0.00)	(0.00)
TFP*FDI			0.282***
			(0.02)
FDI			-0.019**
			(0.01)
SOE	-0.026	-0.002	
	(0.03)	(0.02)	
Coop	-0.052*	-0.015	
	(0.02)	(0.02)	
Age	0.0018**	0.0006	-0.0005
	(0.00)	(0.00)	(0.00)
Age sq.	-0.000031*	-0.0000142	0.0002
	(0.00)	(0.00)	(0.00)
Micro	-0.026*	-0.0022	-0.0038
	(0.01)	(0.02)	(0.02)
Medium	0.063***	0.0493***	0.053***
	(0.00)	(0.01)	(0.01)
Large	0.103***	0.0765***	0.081***
	(0.01)	(0.02)	(0.02)
R&D	0.011	0.038**	0.041**
	(0.01)	(0.02)	(0.02)
Ind. zone	0.012**	0.006	0.008*
	(0.00)	(0.00)	(0.00)
Constant	-2.234***	-2.608***	-2.270***
	(0.10)	(0.23)	(0.18)
No. obs	20,758	20,758	23,374

Source: Author's calculations from the 2010-17 TCS.

Note: All explanatory variables are in lag one. TFP is measured in log. Firms that export in all years are excluded. Each model includes year dummies. Column (1) includes four-digit industry dummies, while columns (2) and (3) include two-digit sector dummies. Columns (2) and (3) include the within-firm averages and initial values of all time-varying regressors. Column (1) and (2) exlude foreign-invested enterprises. Robust standard errors clustered at the firm level are included in parentheses. ****p<0.01, **p<0.05, *p<0.10.*

2.5.2. Learning by exporting

To explore whether firms learn by exporting, the paper estimates equations (6) and (8) using the Arellano and Bond (1991) difference-GMM estimator. As pointed out in Blundell and Bond (1998), internal instruments based on unstranformed lags in a difference-GMM likely fail the relevance condition when the outcome variable is close

to a random walk. Upon examination, the paper finds that the outcome variable, log of real GVA, does not exhibit any random-walk pattern. Table 2.14 summarises results from the Harris-Tzavalis (HT) and Im-Pesaran-Shin (IPS) panel unit-root tests for log of real GVA. Both the HT and IPS tests are suitable for a 'small T, large N' panel dataset, with the former assuming a common autoregressive (AR) parameter while the latter assumes the AR parameters to be panel-specific. Cross-sectional means are removed to alleviate the problem of cross-sectional dependence. Regardless of which test is selected, the null hypothesis that the outcome variable contains unit roots is soundly rejected at the one percent significance level.

Table 2.14: Summary of panel unit-root tests

	Harris-Tzavalis statistic	Im-Pesaran-Shin statistic
Log of real GVA	0.2037***	-29.1673***
	(-67.98)	

Note: z-statistics and $W_{t\text{-}bar}$-statistic are reported for the Harris-Tzavalis and Im-Pesaran-Shin unit-root tests, respectively. The tests are conducted for a balanced panel of firms in the TCS. The cross-sectional means of log real GVA are substracted. The null hypothesis H_0 for both tests is that log of real GVA contains unit roots. ***, **, *: H_0 is rejected at the one-, five- and ten-percent, respectively.

LBE results for persistent exporters are presented in Table 2.15. Non-exporting firms are included in all models as the baseline comparison. Column (1) includes all persistent exporters that began exporting from 2009 onwards. Column (2) is for a subset of column (1) whose firms appear for at least 5 years in the panel. This is meant to ensure that any LBE outcome is not driven by the abrupt change in the TCS sample size in 2014. Column (3) includes only always-exporters that began exporting from 2009 onwards. Each model includes firm-, 2-digit sector- and year fixed effects so that LBE results come from within-firm variation in export duration and productivity. All models include SS controls comprised of log labour, log real capital, ownership dummies, log age, log TFP and log export status at *two* lags. Besides, since the TCS is an unbalanced panel, orthogonal deviations are used instead of first-difference to avoid the excessive loss of observations after the differencing process.

In all three specifications, the coefficients of export duration and its square term are significant and hold opposite signs. The negative coefficient for the former variable and positive one for the latter mean a U-shaped learning pattern for persistent exporters. Using values from specification (1), the turning point is approximately at $-\frac{-0.182}{2*0.0142} \approx$ 6 years. Since an increase in TFPR captures not only physical productivity improvement

but also changes in product mix and quality, the U-shaped learning pattern suggests a strong commitment of persistent exporters to expand product variety and/or improve quality standards, which is often a costly and time-consuming process.

Table 2.15: Learning-by-exporting effects for persistent exporters

Dep. Variable: Real value-added	**(1)**	**(2)**	**(3)**
Lag real value-added	0.127***	0.123***	0.181***
	(0.04)	(0.04)	(0.07)
Export years	-0.182**	-0.153**	-0.226**
	(0.07)	(0.07)	(0.11)
Export years sq.	0.0142**	0.0115*	0.0172*
	(0.01)	(0.01)	(0.01)
Export intensity	0.00618	0.00819	0.00372
	(0.01)	(0.01)	(0.01)
Import intensity	0.000216	0.000138	-0.00141
	(0.00)	(0.00)	(0.00)
Import years	0.0597**	0.0573**	0.0460*
	(0.02)	(0.02)	(0.03)
Inputs			
(Log) employee	0.662***	0.676***	0.739***
	(0.10)	(0.10)	(0.11)
(Log) capital	0.0773*	0.0820*	0.0864*
	(0.04)	(0.05)	(0.05)
Sector concentration			
HHI2	-1.264**	-1.280**	-1.228*
	(0.53)	(0.54)	(0.55)
F-test	10.92	11.16	10.35
AR(1)	0.000	0.000	0.000
AR(2)	0.371	0.371	0.238
Hansen	0.136	0.165	0.154
OLS-FE range: real V-A	[0.39;-0.04]	[0.39;-0.04]	[0.38;-0.05]
No. instruments	94	94	101
No. groups	3,148	3,111	2,966
Observations	9,119	9,082	8,465

Source: Author's calculations from the 2010-17 TCS.

Note: Each model includes firm fixed effects, 2-digit sector dummies, year dummies and a set of control variables for SS, which includes log labour, ownership dummies, log age, log TFP and log export status at two lags. In all columns, selection controls at two lags, time-, sector-dummies and the HHI index are treated as exogenous. The set of internal instruments include the third and higher lags for lnrva, export intensity, export duration, export duration squared, import experience, age; the second and higher lags for import intensity, log TFP, export status, the labour- and capital inputs. All instruments are collapse to reduce the problem of instrument proliferation. AR(1) refers to the p-value from the Arellano-Bond test for AR(1) in first differences and AR(2) to the test in second

differences. Hansen refers to the p-value for the Hansen test of over-identifying restrictions. Orthogonal deviations are applied to avoid losing observations in an unbalanced panel. All columns use two-step estimator to increase asymptotic effciency. Windmeijer-corrected robust standard errors clustered at the firm level are included in parentheses. ****p<0.01, **p<0.05, *p<0.10.*

Besides LBE, the positive and significant coefficient of import experience suggests the presence of learning-by-importing among persistent exporters. As many exporters in Vietnam are suppliers in global production networks, import experience may allow them to take up Original Equipment Manufacturer (OEM) roles, which often requires firms to be able to source their own inputs domestically and internationally.

Further, the negative and significant coefficient of the 2-digit sectoral HHI means that competition facilitates learning. This makes intuitive sense as more competition reduces firms' power to set mark-ups and force them to be more innovative in order to survive in the dynamic markets.

The results in Table 2.15 are robust to a range of endogeneity problems. First, the coefficients for the lag dependent variable lie well within the OLS upper bounds and FE lower bounds in all three models. This suggests the higher suitability of difference-GMM compared to system-GMM (Bond, Hoeffler & Temple, 2001). Second, both the AR(2) test and the Hansen test fail to reject the null hypotheses of no autocorrelation at order two and that all instruments are valid, therefore strengthening the validity (relevance and exogeneity) of the instrument set. Third, the instrument count is much smaller than the number of groups, meaning that instrument proliferation is not an issue in all three models. Last but not least, the F-statistic is larger than 10 for each column, hence confirming the joint significance of the selected variables.

LBE effects for intermittent exporters are presented in Table 2.16. Non-exporting firms are included in all models as the baseline comparison. Column (1) includes all intermittent exporters that began exporting from 2009 onwards. Column (2) contains a subsample of intermittent exporters that appear for at least five years in the panel. This is meant to ensure that any LBE outcome is not driven by the abrupt change in the TCS sample size in 2014. Column (3) comprises only intermittent exporters with less than 4 years of export duration. Finally, column (4) includes the interaction terms between export duration, its square term, export intensity and a dummy variable for persistent exporters, as described in equation (8). Firm-, 2-digit sector-, year fixed effects and selection controls are included in all models, similar to the previous LBE tests for

persistent exporters. Orthogonal deviations are used instead of first-difference to maximise sample size in a panel with gaps.

Except for column (3), the coefficients of export duration, L.exp_yrs, and its square term are significant and hold opposite signs. The positive coefficient of the former variable and negative sign for the latter mean an inverted U-shaped learning pattern for intermittent exporters. Using values from specification (1), the turning point is approximately at $-\frac{0.279}{2*(-0.0421)} \approx 3$ years.

Regarding firms for which export is merely a temporary activity, the immediate gain in productivity after exporting suggests that the quality of their exported goods is not far from the quality of what they already sell domestically. This reasoning is further strengthened when one looks at the positive and significant coefficients of export intensity in all models, which signals firms' ability to utilise spare capacity thanks to a positive export demand shock. In column (3) where export duration is restricted to 3 years and below, learning effects dissipate and only capacity utilisation effect is present. Learning is thus a time-consuming process, even for intermittent exporters.

Table 2.16: Learning-by-exporting effects for intermittent exporters

Dep. Variable: (Log) RVA	**(1)**	**(2)**	**(3)**	**(4)**
(Lag) log RVA	0.148***	0.155***	0.147***	0.157***
	(0.04)	(0.03)	(0.04)	(0.03)
Export years	0.279*	0.286*	0.679	0.338**
	(0.16)	(0.16)	(0.42)	(0.17)
Export years sq.	-0.0421*	-0.0473**	-0.131	-0.0502**
	(0.02)	(0.02)	(0.09)	(0.02)
Export years*pers.				-0.415**
				(0.18)
Export year sq.*pers.				0.0563**
				(0.02)
Export intensity	0.00419**	0.00380**	0.00333*	0.00433**
	(0.00)	(0.00)	(0.00)	(0.00)
Export intensity*pers				0.00243
				(0.01)
Import intensity	-0.00166	-0.000572	-0.00164	-0.000171
	(0.00)	(0.00)	(0.00)	(0.00)
Inputs				
(Log) employee	0.763***	0.778***	0.729***	0.776***
	(0.09)	(0.09)	(0.09)	(0.08)
(Log) capital	0.107**	0.111**	0.0830*	0.110**
	(0.04)	(0.04)	(0.05)	(0.04)
Sector concentration				
HHI2	-1.038*	-0.879	-1.391**	-0.843*
	(0.58)	(0.55)	(0.59)	(0.51)

F-test	14.82	13.39	10.98	13.20
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.135	0.154	0.222	0.307
Hansen	0.111	0.153	0.126	0.204
OLS-FE range: lnrva	[0.38;-0.03]	[0.39;-0.04]	[0.38;-0.04]	[0.39;-0.03]
No. instruments	93	95	103	109
No. groups	3,100	3,083	3,036	3,318
Observations	8,978	8,961	8,716	9,887

Source: Author's calculations from the 2010-17 TCS.

Note: Each model includes firm fixed effects, two-digit sector dummies, year dummies and a set of control variables for self-selection, which includes log labour, ownership dummies, log age, log TFP and log export status at two lags. Column (4) includes a dummy for persistent exporters. In all columns, selection controls at two lags, time-, sector-dummies and the HHI index are treated as exogenous. The set of internal instruments include the third and higher lags for lnrva, export intensity, export duration, export duration squared, import experience, age; the second and higher lags for import intensity, log TFP, export status, the labour- and capital inputs. All instruments are collapse to reduce the problem of instrument proliferation. AR(1) refers to the p-value from the Arellano-Bond test for AR(1) in first differences and AR(2) to the test in second differences. Hansen refers to the p-value for the Hansen test of over-identifying restrictions. Orthogonal deviations are applied to avoid losing observations in an unbalanced panel. All columns use two-step estimator to increase asymptotic effciency. Windmeijer-corrected robust standard errors clustered at the firm level are included in parentheses. ****p<0.01, **p<0.05, *p<0.10.*

2.5.3. Learning mechanisms

This section investigates *how* firms actually learn through exporting. Specifically, the paper examines the rarely-explored role of export contracts in facilitating learning. Two questions are of interest: (i) Are persistent exporters more likely to receive technology transfers from foreign clients than intermittent exporters? and (ii) Are persistent exporters more likely to invest in new technologies, infrastructure or staff training in order to meet contractual requirements of their international customers? If persistent exporters are more committed to expand product variety and/or improve quality standards, and if intermittent exporters tend to export similar-quality products to their domestic goods, the answers to both of the above questions should be yes.

Table 2.17 presents results for equation (7). The dependent variable for column (1) is a dummy equal to one if a firm receives technology transfer from foreign clients in a particular year and zero otherwise. The dependent variable for column (2) is a dummy

equal to one if a firm makes an upgrading investment in a particular year and zero otherwise. All explanatory variables are in lag one. Since this section investigates technology transfer and upgrading investment related to *export contracts*, only intermittent and persistent exporters are included in the models.

In both columns, the interaction terms between export duration and the persistent-exporter dummy, *pers*, have positive and significant coefficients, meaning that all else being equal, persistent exporters are more likely to receive technology transfer from foreign clients and to make upgrading investment to meet contractual requirements of international customers than the intermittent group. Specifically, for each year increase in export duration, persistent exporters are 2.2 percent more likely than their intermittent counterparts to make upgrading investment, all other things being equal.

As expected, the coefficients of export duration is negative and significant in both columns, meaning that as firms get more mature in the export markets, they tend to receive less technology transfers from clients and also do not need to exert as much effort to meet contractual requirements of international customers.

Table 2.17: Learning mechanisms

	(1) **Dep. var: Tech transfer**	**(2)** **Dep. var: Self investment**
(W) Tech transfer	0.134***	
	(0.01)	
(W) Self investment		0.138***
		(0.01)
(W) Export yrs	-0.035***	-0.052***
	(0.01)	(0.01)
(W) Export yrs*pers	0.013***	0.022***
	(0.00)	(0.00)
(R) Persistence	0.0080	0.022
	(0.01)	(0.01)
(W) Export intensity	-0.00015	-0.0002
	(0.00)	(0.00)
(W) Import intensity	0.00004	0.0000384
	(0.00)	(0.00)
(W) Age	0.014***	0.025***
	(0.00)	(0.00)
(B) Age	-0.024***	-0.040***
	(0.01)	(0.01)
(B) SOE	-0.034	0.056
	(0.06)	(0.04)
(B) Coop	0.011	-0.021
	(0.03)	(0.04)
(B) FDI	-0.017***	-0.008
	(0.00)	(0.01)
(B) Micro	0.002	0.036

	(0.05)	(0.05)
(B) Medium	0.007	-0.0069
	(0.02)	(0.02)
(B) Large	0.030	0.018
	(0.023)	(0.02)
Constant	-1.957***	-2.509***
	(0.25)	(0.27)
No. obs.	15,034	15,034

Source: Author's calculations from the 2010-17 TCS.

Notes: All explanatory variables are in lag one. Only intermittent and persistent exporters are included. Each model includes year and two-digit sector dummies, along with initial values of all time-varying regressors. W indicates within-cluster effects, B between-cluster effects and R means a time-invariant variable. Clustered standard errors (at the firm level) are included in parentheses. ****p<0.01, **p<0.05, *p<0.10.*

2.6. Conclusions

In this paper, I have studied the relationship between exporting and firm learning using data for the period 2010-17 on the learning mechanisms of manufacturing firms in Vietnam. The analysis specifically focused on four questions: (i) Do exporters have higher productivity in the period prior to export entry than non-exporters? (ii) Does export participation lead to sustained productivity gains (learning) for exporters? (iii) How do learning patterns differ between persistent exporters and intermittent exporters and what are the implications? and (iv) If there is indeed a learning difference in (iii), which underlying channels give rise to such a difference?

The findings confirm the SS hypothesis that higher-productivity firms are more likely to enter export markets than lower-productivity ones, all other things being equal. The results are robust to a range of model specifications, including different measures of productivity (labour productivity and TFP); modeling choices (DREP and RS); and the inclusion and exclusion of FIEs. I find that the SS hypothesis holds for both domestic and foreign firms, but the effects are much more pronounced for the latter group. While the confirmation of SS effects are in line with previous literature findings, the use of RS estimation, which relaxes the random-effect assumption in DREP estimation, is novel in the empirical literature on the export-productivity relationship.

The main novel contributions of the paper come from the causal investigation of export and firm learning;a that is, answers to research questions (ii) and (iii). First, this paper is, to the best of the author's knowledge, the first study able to precisely measure firms' export duration *manufacturing-wide*. Despite the crucial role of this variable in the investigation of firm learning, previous studies relied on observed years of export as a

proxy for *actual* export duration – a practice that is seriously vulnerable to measurement error.

Second, using difference-GMM estimation, I find opposite learning patterns for persistent exporters and intermittent exporters. While the former display a U-shaped pattern of ex-post productivity, the latter group experience an inverted U-shaped pattern of learning. This novel finding helps shed light on why previous studies which aggregated all exporters into a homogeneous group tend to find contrasting evidence of LBE.[12]

Specifically, the U-shaped learning pattern suggests a strong commitment of persistent exporters to expand product variety and/or improve quality standards, which is often a costly and time-consuming process. In contrast, for firms whose export is merely a temporary activity, the immediate (sustained) gain in productivity after exporting suggests that the quality of their exported goods is not far from the quality of what they already sell domestically. Learning here can be thought of as a cost discovery process, where a firm has an idea that it is going to be a successful exporter, then trying it out and discovering its position in the productivity distribution. The firm then takes a decision whether or not to exit the export market.

These stories are supported by a host of other evidence. Persistent exporters on average have a higher share of imported inputs, which tend to be more expensive and of higher quality than domestic inputs. They also have higher average share of value-added in gross revenue, which all else being equal provides a suggestive evidence of higher-quality products. In addition, only intermittent exporters display immediate productivity gains after exporting, implying the ability to utilise spare capacity to export similar-quality products.

Further, this paper is among the very few studies able to examine two important contract-related learning channels: technology transfer from foreign clients and upgrading investment to meet contractual requirements of international customers. The paper finds that persistent exporters are more likely to experience both of these learning channels compared with intermittent exporters. This evidence again helps confirm the stories telling that the former have a stronger commitment to quality/variety upgrade than the latter group.

[12] It should be noted that empirical results for learning by exporting in this Chapter is only for firms that have selected into exporting, and do not include stop- and non-exporters.

The policy implications are three-fold. First, exporting *does* benefit learning, but only if it is maintained for a number of years. This is true for both persistent- and intermittent exporters. It is thus important for export promotion policies to focus on this *persistence* aspect instead of merely getting more firms to export.

Second, despite the numerous preferential treatments in terms of credit access or land grant, SOEs do not show any superior performance in terms of export orientation or learning compared with private domestic firms. Vietnamese policy-makers need to ensure a level-playing field for private domestic firms in the coming time.

Third, data on firm learning should be incorporated into the larger VES instead of being confined in a module with a much smaller sample size. A sustained productivity increase is the only feasible way for Vietnam to catch up with its better-developed neighbours, and only by understanding how firms actually learn, or why they do not experience any learning, can we devise sound policies to boost productivity.

Appendix 2.1

List of 2-digit Vietnam International Standard Industrial Classification (VSIC) 2007

VSIC	Sector name
10	Manufacture of food products
11	Manufacture of beverages
12	Manufacture of tobacco products
13	Manufacture of textiles
14	Manufacture of wearing apparel
15	Manufacture of leather, fur and related products
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
17	Manufacture of paper and paper products
18	Publishing, printing and reproduction of recorded media
20	Manufacture of chemicals and chemical products
21	Manufacture of pharmaceutical products
22	Manufacture of rubber and plastics products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of electronic products
27	Manufacture of electrical machinery and apparatus
28	Manufacture of machinery and equipment

29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
31	Manufacture of furniture

Source: Author's compilation.

Chapter 3 Formalisation, productivity and informal costs: Evidence from Vietnam

ABSTRACT This paper examines the transition of Vietnam's informal household businesses into formal firms during the period 2007 to 2015 and its impacts upon firm-level productivity and incurred informal costs. The paper finds that such transition, or 'formalisation', leads to higher investment, greater capital stock and an increase in labour productivity, which ranges between 23 to 82 percent. There is no statistically significant surge in total factor productivity, implying that the gain in labour productivity comes from capital deepening rather than true innovation. Regarding informal costs, the paper finds that household firms have to pay higher bribes and spend more time dealing with government red tape after formalisation.

Just because corruption is petty does not mean its harmful effects are trivial; a massive dyke can collapse from tiny termite nests.

Vuong Dinh Hue, current Chair of Vietnam's National Assembly

3.1. Introduction

Informality is a prevalent feature in most, if not all, developing countries. While definitions vary, the informal sector essentially comprises micro firms, often household-based, whose business activities are unregulated by the national laws on enterprises (Boyd, 2017). Most firms in emerging economies operate in the informal sector. In Vietnam, for instance, the number of informal firms in 2019 was eight times that of formal firms, and the former's contribution to GDP was more than three times that of the latter (GSO, 2019).

At the macro level, countries with larger informal sectors tend to have smaller income per capita, more primitive financial systems, lower investment and higher inequality (World Bank, 2021). At the micro level, informal firms are commonly associated with low productivity, credit constraints, tax evasion and lack of social protection for their employees (Rand & Torm, 2011). For these reasons, most developing

countries encourage informal firms to shift into the formal sector, a process known as 'formalisation'. Recent literature considers formalisation to be a conscious investment decision; that is, informal firms will not formalise if the expected costs of formalisation outweigh its expected benefits (de Mel, Mckenzie & Woddruff, 2011; Levy, 2008; Maloney, 2004). The cost of formalisation includes formal and informal costs. The former includes initial registration and ongoing costs such as tax payments, while the latter often entails the time spent on dealing with government red tape as well as bribery payments. The potential benefits of formalisation include better access to formal credit, official contracts and government support programs, which help raise profitability or productivity. Whether formalisation brings about net benefits varies across countries and remains an important empirical question for academics and policy makers alike.

However, most of the literature on informality to date focuses on its determinants and macro-level effects rather than on micro-level impacts. The often-cited determinants of informality include: excessive regulations; burdensome tax and social security obligations; weak legal assistance; and financial constraints (Dabla-Norris et al., 2008; Ulyssea, 2010). Regarding macro-level effects, Omar and Al-Towati (2020) found that a growing informal sector reduces monetary policy effectiveness and trust in the formal banking sector. Loayza (1996) showed that formalisation is associated with higher tax revenues and higher investments in public goods. Nevertheless, due to the scarcity of longitudinal data covering both formal and informal firms, there are few studies that discuss the micro-level impacts of formalisation on productivity and/or the amount of informal costs incurred by firms.

Using the biennial surveys of small and medium enterprises (SMEs) in Vietnam from 2007 to 2015, this paper aims to shed light on the micro-level benefits and costs of formalisation. Specifically, the paper examines two research questions: (i) Does formalisation bring about higher productivity for formalised firms? and (ii) Does formalisation lead to higher informal costs incurred by formalised firms? Regarding (i), the paper finds that formalisation leads to higher investment, higher capital stock and an increase in labour productivity, which ranges between 23 to 82 percent. There is, however, no statistically significant impact on total factor productivity, meaning that the gain in labour productivity comes from capital deepening rather than true innovation sources. Regarding (ii), the paper finds that formal firms have to spend more time dealing with government red tape and have to pay higher bribes to officials than informal firms.

These findings reveal that formalisation in Vietnam brings about both higher benefits for productivity and higher costs for firms.

To the best of my knowledge, this is the first empirical study to shed light on both the micro-level benefit and cost sides of formalisation. Previous micro-level studies were able to examine only the benefits side. Farrel (2004) found that informality had a negative effect on firm-level productivity for a number of selected countries. Fajnzylber, Maloney and Montes-Rojas (2009) concluded that formalisation brought about a 20 percent increase in profitability of Mexican firms. Demenet, Razafindrakoto and Roubaud (2016) found that formalisation in Vietnam increases value added by 20 percent. Boly (2018) showed that becoming formal led to an additional increase in formalised firms' profit and value-added. Formalisation in this study, however, includes both registered households and formal firms as. This may muddle the effect of formalisation on firm performance. McCaig and Nanowski (2019), for example, showed that the impact of formalisation was not significant for registered household businesses.

Rand and Torm (2011) conducted the closest study to this paper, in which the authors showed that formalisation led to higher profitability and investments, along with a decrease in the use of casual labour in Vietnam. However, besides exploring only the benefits side of formalisation, their study only used two years of panel data, from 2007 to 2009. This made it difficult to study the micro-level impacts on productivity, since such impacts often take time to occur. This paper instead uses five rounds of the SME surveys from 2007 to 2015 and is thus more suitable to examine the impact of formalisation on firm productivity.

The rest of the paper is structured as follows. Section 2 reviews the background of policies on the informal sector in Vietnam. Section 3 discusses the models used to verify the relationship between formalisation and productivity and informal payments. Section 4 describes the SME survey dataset and the selection of variables, including productivity, formality and informal costs. Section 5 discusses empirical results and robustness checks. The last section summarises key findings and contributions of the paper, proposes policy recommendations to facilitate the formalisation process in Vietnam and discusses future research areas.

3.2. Background of policies on the informal sector in Vietnam

The concept of 'informality' was first launched by the International Labour Organisation (ILO) in 1972 (ILO, 1993). Prior to that, the dominant development discourse in the

1950s and 60s was to focus on capital formation, infrastructure investment and export promotion while leaving the labour market to self-regulate (Bangasser, 2000). The rationale was that as capital investment accelerated economic growth, people working in 'informal' activities would be absorbed into the 'formal, modern' sectors of the economy. Informal employment was thus viewed as a residual and temporary problem that would go away once the economy took off.

Yet, not only did this 'residual' and 'temporary' problem not go away, it grew larger and more visible throughout the 1960s in most developing countries, despite significant efforts in capital investment and export promotion programs. Demographic trends, together with massive urban migration, brought about an ever-increasing number of people entering the urban labour market and outpacing the generation of formal and modern-sector jobs available in developing countries. It was not until 1972 that the ILO finally brought the topic of informality into the spotlight of development discourse. The informal sector, according to ILO, consists of household businesses that are not considered separate legal entities from their owners, do not follow formal bookkeeping practices and are insufficiently covered by formal arrangements, for example, national laws on enterprises.

Given this definition, all household businesses in Vietnam belong to the informal sector. While recognised as an autonomous economic unit and important part of the economy, the household business has never been included as a formal enterprise form in the country's national laws on enterprises. Specifically, the first Law on Private Enterprise and Company Law in 1990 allowed three formal forms of private businesses: limited liability company; shareholding company; and private company. Household businesses at the time existed in the form of individual households and small industrial households as stipulated by Decree No. 27 of the Council of Ministers (now the government).

Later, the Enterprise Law 1999 stipulated four formal forms of private businesses: limited liability company; shareholding company; partnership; and private company. Household businesses were regulated under the separate Decree No. 66 of the Council of Ministers and existed in the form of individual households or small business groups whose legal capital stayed below certain thresholds.

In 2005, the Enterprise Law was again revised prior to Vietnam's accession to the World Trade Organisation (WTO) two years later, and six forms of private enterprises were stipulated in the law: one-member limited liability company; limited liability with

more than one member; shareholding company; partnership; private company; and business group. Household businesses at this time existed in the form of individual businesses owned by individuals or households as stipulated in Decree No. 20 of the government. Further, according to this Decree, household businesses were not allowed to hire regular workers; that is, employees with stable contracts. In order to facilitate the operations of household businesses, in 2004 the government issued Decree No. 109 on business registration, which removed the provision that household businesses were not allowed to hire regular workers.

The latest Enterprise Law 2014 retained the six forms of formal private enterprises as in the Enterprise Law 2005. Household businesses are regulated under the Decree No. 88 of the government in 2006 and include firms that: are established by an individual who is a Vietnamese citizen or a group or a household; can only register business at one location; may use not more than ten employees; do not have legal entity status; and are fully liable with all of their assets to their business activities. Household businesses that want to hire more than ten employees must convert into formal enterprises.

As the Vietnamese economy developed and restrictions on household business activities gradually relaxed, the number of household businesses rose dramatically, from 0.33 million in 1989 to 1.5 million in 1999, and to 4.75 million in 2015. In 2019, they accounted for 32 percent of the country's GDP, three times that of formal domestic private enterprises. Household business is one of the driving forces that promote entrepreneurship and develop Vietnam's market economy. However, with the characteristics of small and fragmented businesses without legal entity status, household businesses have many limitations in competitiveness, technology application, formal credit access and management skills leading to low productivity and production efficiency. Their contributions to the country's industrialisation and modernisation have also remained modest.

For this reason, since the early 2000s the Vietnamese government has tried to incentivise household businesses to convert into formal enterprises. The list of incentives include: (i) Free consultation and guidance on documents and procedures for enterprise establishment; (ii) Exemption of fees for enterprise registration and initial enterprise information provision; free evaluation, fees and charges for the first business license for conditional business lines; license fees are exempted for a period of three years from the date of issuance of the first enterprise registration certificate; (iii) Free consultancy and guidance on tax administrative procedures and accounting regimes within three years

from the date of being granted the first enterprise registration certificate; (iv) Exemption or reduction of corporate income tax for a definite period in accordance with the law on corporate income tax; and (v) Exemption or reduction of land use fees for a definite period in accordance with the Law on Land. To receive these supports, household businesses must be registered and have been engaged in continuous production and business activities for at least one year.

Yet, according to a recent survey by the General Department of Taxation, most household businesses remained hesitant to convert into formal enterprises due to the perceived high costs of conversion, for example: following formal bookkeeping practice; preparing financial statements; keeping invoices and books; and spending time on complicated administrative procedures related to insurance, labour, fire safety (Uyen, 2019). Many household businesses also prefer paying lump sum taxes rather than having to deal with tax procedures as formal enterprises. In this context, the paper sets out to explore whether the benefits of formalisation actually outweigh its perceived costs.

3.3. Empirical frameworks

To address the research questions of whether formalisation leads to higher productivity and/or higher informal costs for formalised firms, the paper uses the following baseline model:

$$Outcome_{it} = \alpha + \beta Formal_{it-1} + \boldsymbol{\omega X_{it}} + \delta_i + \boldsymbol{\rho} + \epsilon_{it} \quad (1)$$

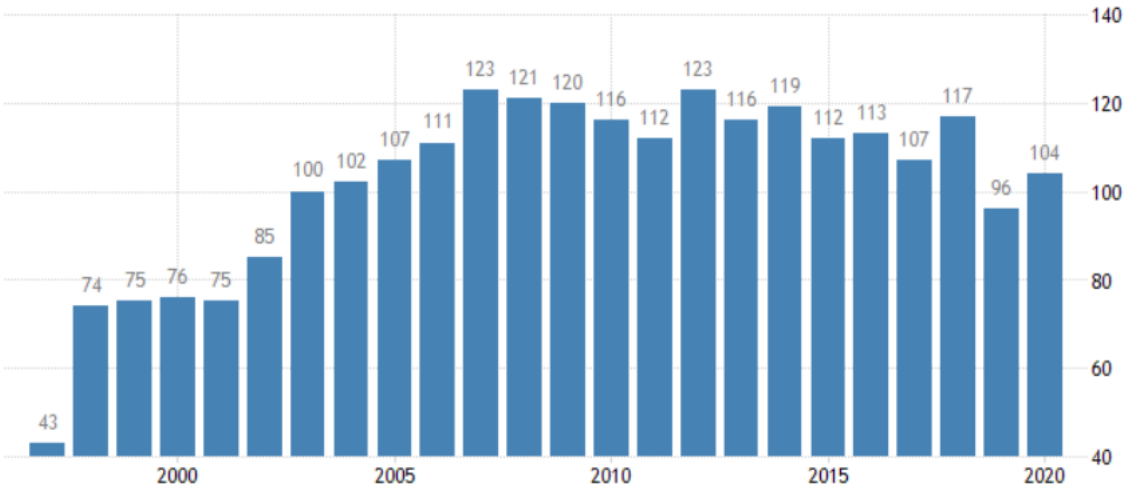
where $Outcome_{it}$ can indicate labour productivity, total factor productivity, time spent on dealing with government red tape or bribery payments of firm *i* at time *t*. The first two dependent variables represent different measures of productivity and help answer the first research question. While easier to measure, labour productivity changes capture both innovation in firm efficiency and variation in capital deepening. For this reason, TFP, having taken into account changes in both labour and capital, is a better indicator of efficiency improvement. By analysing both measures, the paper seeks to investigate the channels through which formalisation in Vietnam affects firm-level productivity; that is, innovation or capital deepening.

The latter two dependent variables measure different types of informal costs. One variable is the amount of time firms have to spend dealing with government red tape – a reason often cited in the Vietnamese media for the low rate of formalisation (Doan & Pham, 2019). Based on qualitative evidence, formality status is associated with frequent government inspections and complex accounting/bureaucratic procedures (Nguyen,

2020). The additional time that formal firms have to spend dealing with government officials and regulations represents an informal cost that may deter household businesses from formalising.

The second measure of informal costs is bribery payments to government officials. Corruption remains a serious issue in Vietnam, as can be seen from the country's consistently low ranking in the Corruption Perception Index throughout the period 2007-2015 (see Figure 3.1). If it were true that formalisation induces higher frequency of government inspections, it would be possible that formal firms have to pay higher amounts of bribes than informal ones. On the other hand, some household businesses may decide to bribe government officials to evade paying taxes, as the accounting procedures for household businesses tend to be opaque (Nguyen, 2017). Whether formalisation induces higher bribery payments remains an open question for empirical investigation.

Figure 3.1: Vietnam's ranking in the Corruption Perception Index



Source: Trading Economics (2020). *Higher ranking means more corruption.

The explanatory variable of interest is a binary variable indicating the formality status of firms. This indicator takes the value of 1 if the firm is formal and 0 otherwise. There are some firms that are always informal in the sample, while others formalise at different time periods (see Table 3.2). The formality status variable is included in the baseline models in lag one since productivity changes often take time to occur and also to alleviate the potential issue of reverse causality.

Regarding the vector of covariates $\boldsymbol{X_{it}}$, an important control variable is firm size. Since larger firms tend to be more productive than smaller ones, the coefficient of firm size is expected to be positive when productivity is the outcome variable. Similarly, larger firms are more likely to attract attention from government inspectors than smaller ones

and thus may have to spend more time dealing with government red tape and to pay higher amount of bribes. This means that the expected sign for firm size is also positive when informal costs are the outcome variables.

Other important firm-specific variables are about owners' characteristics, such as gender, education and business networks, which may affect both firm-level productivity and the decision to formalise. Rand and Tarp (2011), for example, showed that female owners tend to provide more generous non-wage benefits which can affect the productivity of their workers. Babbitt et al. (2015) found that female entrepreneurs in rural Indonesia are 20 percent more likely to join the formal sector than their male counterparts. Regarding owners' education, La Porta and Shleifer (2008) affirmed that formal firms are, on average, run by much better-educated owners than those of informal ones. Jaramillo (2009) found a positive association between an owner's level of education and the likelihood of formalisation. As for business networks, Sheng, Zhou and Li (2011) carried out a survey of Chinese firms and found that business ties have a positive impact on firm performance. More recently, Chien, Welsh and Breunig (2019) revealed a positive association between firm performance and participation in research and development, commercial or shared-director business networks.

Aside from owners' characteristics, other firm-specific covariates include workforce skill level, access to infrastructure, possession of property rights and/or the intensity of inspections. The importance of a skilled workforce to firm performance has been emphasised in multiple previous studies (Atkinson & Mayo, 2010; Peri, Shih & Sparber, 2015; Siepel, Camerani & Masucci, 2021). Similarly, infrastructure access can serve as a determinant of productivity due to its impacts on production techniques and supply chain management (Tybout, 2000). Possession of property rights facilitates credit access which can affect investment and labour productivity. Malesky and Taussig (2009) also found that property rights have a stronger influence on formalisation in Vietnam compared to other types of institutions. Last but not least, the intensity of inspection, which indicates the frequency of government investigation into firm activities, has been shown to be negatively associated with the decision to formalise (Jaramillo, Arias & Arboleda, 2011). Household firms may also decide to pay higher bribes in order to reduce the likelihood of being inspected.

Further, the baseline models control for year, province and 2-digit sector fixed effects, represented by the vector $\boldsymbol{\rho}$, to alleviate the issue of omitted variable bias. Nguyen et al. (2007) and Malesky and Taussig (2009) found that economic governance in

Vietnam varied significantly across provinces and served as a determinant of formalisation. The sector fixed effect, on the other hand, captures inherent sectoral differences, such as technology intensity, which is likely to affect firm-level productivity.

The baseline models, however, do not adequately address the issue of self-selection and omitted variable bias. If there exists permanent differences in outcomes between formal and informal firms, the estimated effect of formalisation will be confounded. Second, the baseline models fail to account for unobserved time-variant factors that may simultaneously affect the decision to formalise as well as productivity or the amount of informal costs firms have to incur. For example, Siepel, Camerani and Masucci (2019) showed that it is the combination of various skills, such as STEM, creativity or management, that determines firm performance; a variable that measures the share of trained workers would fail to capture such nuances. In addition, the business aptitude or experiences of firm owners/managers, which influence their decision to formalise as well as firm performance, are not fully reflected in the observed variables such as educational attainment.

To address the above endogeneity issues, the paper employs two different empirical approaches: (i) matched difference-in-difference (DiD); and (ii) instrumental variable (IV). The main approach, matched DiD, resolves the issue of permanent average differences in outcomes between formal and informal firms that exist prior to formalisation. Following the strategy outlined in Dettman, Giebler and Weyh (2020) (DGW), treated and control groups are matched one period prior to the (different) years of formalisation based on combined statistical distance functions. These statistical distance functions incorporate the mean absolute differences for selected continuous variables and the matching coefficients for selected categorical variables, and have been shown to be superior to other distance measures such as propensity score matching or Mahalanobis distance (Dettman, Becker & Schmeiβer, 2011). From the statistical distances, each treated unit is matched with its corresponding control(s) based on either nearest neighbour matching or radius matching. The former matches each treated unit with its closest control in terms of statistical distances, while the latter matches treated units with controls that fall within the predefined neighbourhood of the treated units'

statistical distances.[13] After the matching process is complete, the mean differences in outcomes (productivity, informal costs) between formalised firms and their corresponding controls are used to estimate the average treatment effect of the treated (ATT):

$$ATT = \frac{1}{N}\sum_{i=1}^{N}[(Y_{i,t_{0i+\delta_i}} - Y_{i,t_{0i}}) - (Y_{j,t_{0i+\delta_i}} - Y_{j,t_{0i}})] \qquad (1)$$

In equation (1), the date of formalisation is denoted t_{0i}, allowing for varying treatment time, while $t_{0i+\delta_i}$ indicates the individual duration from the time of formalisation to outcome observation. Outcome differences for the treated firms *i*, $Y_{i,t_{0i+\delta_i}} - Y_{i,t_{0i}}$, are benchmarked against those for the respective controls *j*, $Y_{j,t_{0i+\delta_i}} - Y_{j,t_{0i}}$. The ATT is then calculated as the average of individual comparisons.

The DGW estimator has been shown to be asymptotically unbiased under four conditions (Baker, Larcker & Wang, 2021). First, the common support condition must hold as with all matching procedures. Second, there must be no spillover effect from the treated group to the control group at the matching time. Third, treatment cannot be reversed; that is, a treated unit must remain treated for all the remaining time periods. Fourth, the conditional parallel trend assumption must hold; that is, unobserved individual factors must be time-invariant for units with the same observed characteristics.

To meet condition one, the paper carries out multiple tests for the matching procedures such as the covariate imbalance test proposed by Leuven and Sianesi (2003), the nonparametric Kolmogorov-Smirnov tests which compare the cumulative distributions between treated and control group for *continuous* variables and the chi-square tests for *categorical* variables. To meet condition three, firms that switch their formality status more than one are removed from the final sample. In addition, the paper follows the best practices as suggested by Baker, Larcker and Wang (2021), such as reporting the treatment timing of the formality status indicator and excluding post-treatment control variables when running matched DiD estimation.

For robustness checks, the paper uses another empirical approach, IV, to address the endogeneity issue of selection on unobservables. Specifically, the formality status of a firm is instrumented by the share of formal firms within the same year, province and 2-

[13] Each approach has its pros and cons. Nearest neighbour matching is vulnerable to imprecise matches in cases the nearest neighbours are far away from the treated units. For radius matching, the setting of predefined radius can be quite arbitrary.

digit sector, excluding the firm of interest. The rationale for this instrument is as follows. First, the decision to formalise by other competitors in the same province is likely to influence the decision to formalise of the firm of interest. The Staiger-Stock F-test, which examines partial correlations in first-stage regressions, can be used to validate the relevance of the selected instrument (Staiger & Stock, 1997). Second, since the selected instrument excludes the firm of interest and the owner's business networks have been controlled for, unobserved time-variant factors such as skill composition or business experience are unlikely to correlate with the instrument. In addition, to take into account the economy-of-localisation-and-urbanisation effects, the paper also instruments formality status with the proportion of formal firms in the same sector but outside the province where the firm of interest is located. Results for the second IV are reported in Appendix 3.2.

3.4. Data and variable selection

The main dataset used in this paper is the biennial small-and-medium enterprise (SME) surveys for the period 2007-2015. This unique panel dataset contains information on informality status, firm performance, time spent dealing with government red tape and bribery payments which are rare to find in the literature.

The paper uses five rounds of SME surveys in 2007, 2009, 2011, 2013 and 2015. Each round covers about 2500 firms in ten cities/provinces, namely: Hanoi, Ha Tay, Haiphong, Phu Tho (Northern region); Nghe An, Khanh Hoa, Quang Nam (Central region); Lam Dong (Central highlands region); Long An and Hochiminh city (Southern region). The selection of provinces aims to ensure that (i) the surveys cover different geographical regions in Vietnam; and (ii) firms from major urban cities as well as from rural areas are included.

Regarding firm selection, the SME surveys cover micro-, small- and medium-sized firms: micro firms have between 1 and 10 employees; small firms between 11 and 50 employees; and medium firms between 51 and 300 employees. This categorisation broadly follows the World Bank's SME definition and differs from the formal definition of SMEs stipulated in the Vietnamese government's Decree No. 90/2001 on supporting

the development of small and medium enterprises.[14] Further, the surveys sample non-state manufacturing firms based on ownership form, which includes household firms, private firms, collectives, partnerships, limited liability firms and joint stock firms. Joint ventures between MNEs and domestic firms are excluded due to the opaque involvement of the state or foreign investors in these firms' ownership structures. This exclusion is of little concern to the paper as the focus of this study is on household firms.

One caveat here is that for each city/province, the SME surveys were confined to only districts covered in the Annual Enterprise Surveys (AES). Both surveys are implemented by the Vietnamese General Statistics Office (GSO), with the latter covering only formal firms that have fixed professional premises. This sampling strategy means that household firms in the SME surveys operate in areas with many formal firms and are likely more competitive than other (non-surveyed) household firms which cluster in areas with little or no presence of formal businesses.

To examine the effect of formalisation, the paper uses a subset of firms that were household businesses in the base year of 2007, because all informal firms in the SME surveys belong to the household sector. Firms that formalised during the period 2009 to 2015 form the treatment group while remaining informal firms constitute the control group. In addition, different from Rand and Torm (2012), which treats *registered*[15] household firms as formal firms, this paper considers *all* household firms to be informal for two reasons. First, Vietnam's national laws on enterprises have never recognised household businesses as a *formal* enterprise form. Thus, regulations of the Enterprise Law, which formal firms are subject to, for example accounting procedures, do not apply to household firms, regardless of their registration status. Second, households can use their certificates of land use rights as collateral to obtain loans without the need to register; thus the advantages of registration for household businesses are unclear.[16]

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[14] According to Decree No. 90/2001, micro firms have between 1 and 10 employees; small firms between 11 and 100 employees; and medium firms between 101 and 200 employees.

[15] Registration means having a business registration certificate and a tax code.

[16] An alternative definition of informality is to count registered households as formal firms. However, upon checking, the business registration certificate variable in the dataset contains many inconsistencies and missing values that makes it unreliable to be used.

The data are then cleaned to remove duplicate firm-year observations and conflicting values of the selected variables; for example, negative value-added, revenues, employees or productivity. A small number of firms who switch their formality status more than once are also removed from the dataset. As shown in Table 3.1, the final dataset contains 5909 firm-year observations, with 220 observations for formal firms (the treatment group) and 5689 observations for informal firms (the control group).

Table 3.1: Number of firms by formality status, 2007-2015

	2007	2009	2011	2013	2015
Informal	1669	1323	1050	899	748
Formal	0	41	55	59	65
Total obs.	1669	1364	1105	958	813

Source: Author's compilation.

The outcome variables of interest are productivity and informal costs (time spent dealing with red tape and bribery payments). Productivity measures include both labour productivity and TFP. The former is calculated as real value-added divided by the number of employees. Gross value-added (GVA) is proxied by the sum of gross wages, pre-tax profits and indirect taxes. To obtain real values of GVA, its nominal values are deflated using 2-digit industry-specific producer price indexes with the base year of 2010. The number of employees is measured as the year-end number of full-time production workers.

Since changes in labour productivity reflect not only innovations in production methods but also variations in capital deepening, a more precise measure of productivity is TFP. In this paper, TFP is calculated using the method proposed by Ackerberg, Caves and Frazer (2015) (ACF). The ACF method yields nonlinear, robust generalised method-of-moment estimates that do not suffer from the functional dependence problems identified in the Olley and Pakes (1996) and Levinsohn and Petrin (2003) approaches (Ackerberg, Caves, & Frazer, 2015).

From Table 3.2, one can see that there are statistically-significant differences in value-added, firm size and labour productivity between formal firms and informal ones during the period 2009 to 2015. On average, household firms that formalise have higher value-added and larger sizes than those that stay informal. The former's labour productivty is also significantly higher than the latter's for nearly all sampled years. However, there seems to be no significant difference in TFP between formal firms and informal ones, except for the final year of 2015. This suggests that the differences in

labour productivity comes from capital deepening of formal firms rather than technological improvement. Since formalised household firms in the sample are still mostly small firms, that we do not see significant technological upgrading after formalisation should come as no surprise.

Table 3.2: Summary statistics

Initially informal (household in 2007)	Formal – 2009		Formal – 2011		Formal – 2013		Formal – 2015	
	Yes	No	Yes	No	Yes	No	Yes	No
Value-added (log real mil. VND)	12.4	11.1***	12.5	11.1***	13.2	11.9***	13.3	11.8***
Labour productivity (log mil. VND/person)	10.1	9.7*	10.1	9.8	11.0	10.7***	11.2	10.6***
Log TFP	7.8	7.9	7.7	7.7	8.6	8.6	8.8	8.5***
Capital stock (log real mil. VND)	11.8	9.6***	12.9	11.3***	13	11.4***	12.9	11.4***
Investment (log mil. VND)	12.8	10.5***	12.1	10.5***	12.7	10.7***	12.5	10.6***
Firm size (no. full-time employees)	13	5***	15	4***	11	4***	11	4***
Sex of owner (male=1, female=0)	0.6	0.7	0.7	0.7	0.6	0.7	0.5	0.6
Education of owner (unskilled=0, vocational level=1; college or above=2)	1.1	0.7***	1.3	0.9***	1.3	1.0***	1.3	1.0***
Owner's business networks (no. business/govt contacts)	40	36	65	26**	45	30*	43	32**
Workforce skill level (share of unskilled production workers)	37%	31%	35%	34%	33%	38%	50%	51%
Property rights (land use cert.=1; 0=otherwise)	0.5	0.7	0.5	0.8	0.7	0.8	0.8	0.9
Road/Port/Rail access (none=0; all=3)	2.1	1.6***	1.8	1.4***	2.1	1.7***	2.1	1.7***
High-tech sectors (yes=1; no=0)	0.17	0.12	0.25	0.1***	0.25	0.1***	0.25	0.1***
Time costs of red tape (pct. mgmt time)	1.7	0.8***	3.5	2.2***	3.4	2.1***	2.2	1.3***
Bribery payments (thousand VND)	7,682	2,921**	7,787	2,397**	6,583	2,298***	2,571	2,838

Notes: Mean estimates, by year and formality status. *T*-tests by formality status and with unequal-variance assumption are implemented for each year. *, **, *** indicates that the differences between formal firms and informal firms are significant at the 10-, 5-, and 1-percent respectively.

To examine the hypothesis that differences in labour productivity between formal and informal firms in Vietnam come from capital deepening rather than efficiency improvement, this paper includes two outcome variables related to capital deepening, namely firm-level capital stock and the amount of investment. Capital stock is measured in this study as fixed reproducible tangible assets (buildings, equipment and machinery), thus excluding such assets as land, inventories or financial assets. Investment in the SME surveys is reported as total invesment and investment by sub-categories; for example, land, buildings, equipment, R&D, human capital upgrading, or patents. For the purpose of this study, the total amount of investment is used. For both variables, it is clear from Table 3.2 that the average figures for formal firms are significantly higher than those for informal ones in all years from 2009 to 2015. This suggests that easier access to capital can be an important driver of formalisation in Vietnam.

The two measures of informal costs are the amount of time spent dealing with red tape and bribery payments. The former is based on the question: "What percentage of management's working time is spent each month dealing with government regulations and officials (including taxes, permits, licenses, business and trade regulations)?"; while the latter is derived from the question: "Approximately how much did you pay [informal fees] in total in a year?" For both types of informal costs, the burden upon formal firms is on average significantly higher than that of informal ones (see Table 3.2). For example, formal firms have to pay nearly three times the amount of bribery as informal firms do. This can act as a barrier that discourages informal firms from formalisation.

Since the decision to formalise is made by household business owners, it is important to control for owners' characteristics. An owner's sex is a dummy variable equal to 1 if the owner is male and 0 otherwise. The education level of owner is a categorical variable equal to 0 if the owner is an unskilled worker (having no vocational training or higher educational degree); 1 if the owner receives vocational training; and 2 if the owner has a university-level education and above. Owner's business networks is derived from the question: "Approximately with how many people do you presently have regular contact with? (Business people, bank officials, politicians and civil servants)." Regular contacts are defined as at least once every three months and that the owners find useful for their business operations.

The two-sample mean-comparision tests for formal and informal firm groups show that an owner's sex plays an insignificant role in the decision to formalise (see Table 3.2). In contrast, the education level of owners is significantly higher in formal firms

compared with informal ones. This is in line with La Porta and Shleifer (2008) and Jaramillo (2009), who demonstrated the positive correlation between owners' educational attainment and the decision to formalise. Further, compared with those of informal firms, owners of formal firms tend to have higher number of regular contacts that they find useful for their business, which can facilitate their formalisation process.

Since the skill composition of firms' workforce is likely to affect firm-level productivity, the paper controls for the shares of unskilled production workers of the firms. Somewhat surprisingly, there seems to be no significant difference in terms of workforce skill level between formal and informal firms, suggesting that the decision to formalise in Vietnam is not to obtain access to better skilled workers. This is in line with La Porta and Shleifer (2008) and Rand and Torm (2012) who also found no difference in workers' educational levels between formal and informal firms.

Another important control variable is property rights of the firms, measured as a dummy equal to 1 if the firm has a certificate of land use rights and 0 otherwise. Firms with certificates of land use rights hold advantage in obtaining loans compared with those that do not have a well-established property rights. This in turn facilitates the former's capital deepening process and can affect firm-level productivity, especially labour productivity. In the case of Vietnam, there seems to be no significant difference regarding property rights between formal and informal firms; in each group, on average more than half of the firms possess certificates of land use rights.

The infrastructure variable is constructed based on whether the firm has easy access to: (i) A main road (Yes=1, No=0); (ii) Rail (Yes=1, No=0); and (iii) Port (Yes=1, No=0). The ease of access is based on the subjective perception of the firm's owner. The three answers are then added up into a variable measuring the firm's infrastructure access, whose values range between 0 and 3. From Table 3.1, one can see that formal firms on average have significantly better access to main roads, railways and ports than informal ones – a factor that is likely to impact productivity levels and highlights the importance of controlling for this variable.

Further, as different sectors have different levels of technological intensity and government supports, the paper includes a dummy variable equal to 1 if the firm belongs to a medium and high-tech (MHT) sector and 0 otherwise. The reason a full set of two-digit sector dummies is not used is due to the inconsistent reporting of operating sector. For example, a firm that manufactures wooden furnitures may report its sector to be 16 (wood and products of wood) in one year and 31 (furnitures) in another. Since both sectors

belong to the low-technology group, using a high-tech dummy variable helps alleviate this issue of inconsistency.

The classification of MHT sector is adapted from UNIDO (2010) and based on the 2-digit International Standard Industrial Classification (ISIC) Revision 4 (see Table 3.3 below). The share of formal firms in the MHT sector is about 25 percent while the figure for informal firms is significantly lower at about 10 percent. This low share is understandable given that the focus of this study is on household firms.

Table 3.3: Classification of manufacturing industries by technological intensities

ISIC Rev. 4 codes	Sector	Technology classification
10	Food products	Low technology
11	Beverages	
12	Tobacco products	
13	Textiles	
14	Wearing apparel	
15	Leather and related products	
16	Wood and products of wood	
17	Paper and paper products	
18	Printing and reproduction of recorded media	
19	Coke and refined petroleum products	
25	Fabricated metal products except weapons and ammunition	
31	Furniture	
22	Rubber and plastics products	Medium technology
23	Other non-metallic mineral products	
24	Basic metals	
32	Other manufacturing except medical and dental instruments	
20	Chemicals and chemical products	High technology
21	Pharmaceuticals	
26	Computer, electronic and optical products	
27	Electrical equipment	
28	Machinery and equipment n.e.c	
29	Motor vehicles, trailers and semi-trailers	
30	Other transport equipment	

Source: UNIDO (2010).

Last but not least, the key explanatory variable of interest in this paper is an indicator equal to 1 if a firm belongs to the formal sector and 0 otherwise. Firms that are not household establishments are considered to be in the formal sector, which can include

the following ownership forms: (i) Sole proprietorship; (ii) Partnership; (iii) Collective/Cooperative; (iv) Limited liability company; (v) Joint stock company with state capital; (vi) Joint stock company without state capital; (vii) Joint venture with foreign capital; (viii) State enterprise (central); and (ix) State enterprise (local). In the dataset though, there are no household firms that transform into categories (vii)-(ix) during the period 2007 to 2015.

3.5. Results

3.5.1 Productivity

Table 3.4 shows the baseline estimates for the relationship between formalisation and labour productivity. Following Aw, Chung and Roberts (2000) and Damijian, Kostecv and Polanec (2008), the key explanatory variable of interest, *formal*, is included with one lag because potential impact on productivity often takes time to be observed. Columns (1)-(3) presents the pooled OLS specification with labour productivity (in logs) as the outcome variable.

Column (1) shows the simplest specification with only Firm size (in logs), a set of dummies for year, location and sector as covariates, in addition to the key variable representing the formality status of firms. Under this specification, becoming formal is associated with a 25.8 percent increase in labour productivity, all else being equal. Besides, in line with existing literature, larger firms are found to be more productive than smaller ones. It is estimated that a 10 percent increase in the number of full-time employees corresponds to a 0.6 percent increase in labour productivity.

Columns (2) and (3) expand the specification of column (1) to include more control variables. In column (2), owner's characteristics (sex, education, business networks), workforce skill level, possesion of property rights, infrastructure access and year dummies are added to control for potentially important factors affecting labour productivity besides formalisation. Similar to (1), formalisation is significantly and positively correlated with labour productivity, which increases by 23.1 percent when a household business converts into a formal firm. Among the other control variables, firm size, owner's educational level and infrastructure access are also significantly and positively associated with labour productivity. A 10 percent increase in the number of full-time workers is associated with a 0.7 percent gain in labour productivity. In addition, a one-point rise in infrastructure access (values range between 0 and 3), and owner's

education corresponds to a 5.6 percent and 10.4 percent increase in labour productivity, respectively.

Column (3) contains the control variables as in column (2), plus the full set of dummies for year, location and sector. Under this full specification, labour productivity is estimated to increase by 23.8 percent after household firms enter the formal sector. The coefficients of firm size and infrastructure access remain positive and significant as in column (2) specification. A 10 percent increase in employment size is associated with a 0.5 percent gain in labour productivity, while a one-point increase in infrastructure access leads to a 3.8 percent rise in the same outcome variable.

Different from columns (1)-(3), columns (4)-(6) display the fixed effects (FE) estimates of formalisation impacts on labour productivity. The lag outcome variable is excluded in all FE estimates due to its correlation with the demeaned error term, which is a violation of the exogeneity assumption of OLS regression. In column (4), only the lag firm size and the set of dummies for year, location and sector are included in addition to the formality variable. Similar to pooled OLS estimates, the coefficient of formality status is positive and significant at the 1 percent level, further confirming the (positive) association between formalisation and labour productivity. Specifically, becoming formal corresponds to a 39.3 percent increase in labour productivity.

Columns (5)-(6) extend the set of covariates in column (4) specification. In column (5), the lag firm size, owner's characteristics, workforce skill level, possessions of property rights, infrastructure access and year dummies are included, besides the formality variable. Labour productivity is found to increase by 39 percent when household firms join the formal sector. In a similar fashion, formalisation corresponds to a 38.9 percent gain in labour productivity according to column (6), which includes the set of covariates in column (5), plus additional FEs for location and sector.

Somewhat surprisingly, none of the covariates besides formality status is significant at the 10 percent level under FE specification. There can be two reasons for this phenomenon. First, household establishments, even after formalisation, are still mostly micro and small firms. Thus it may take a longer time before the effects of the other covariates on productivity can be realised. Second, and more importantly, the FE specification is not ideal to address the impact of formalisation on productivity. While productivity tends to be highly persistent, the FE specification does not allow for the inclusion of the lag dependent variable. It is also vulnerable to omitted variable bias since fixed effects cannot take into account the influence of unobserved time-varying factors.

For this reason, it is important to complement the baseline estimates here with other approaches that can minimise the possible endogeneity biases.

Table 3.4: Formality and labour productivity – Baseline estimates

Dep. var: **Labour productivity**	(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE
(Lag) Formal (Yes=1, No=0)	0.258**	0.231**	0.238**	0.393***	0.390***	0.389***
	(2.46)	(2.22)	(2.29)	(3.01)	(3.02)	(2.98)
Firm size	0.0585**	0.0660***	0.0501*	0.0294	0.0261	0.0260
	(2.23)	(2.61)	(1.82)	(0.61)	(0.54)	(0.54)
Sex of owner (male=1; female=0)		-0.0626 (-1.52)	-0.0466 (-1.11)		-0.0544 (-0.77)	-0.0544 (-0.76)
Education of owner (unskilled=0; vocational level=1; college or above=2)		0.104** (2.36)	0.0624 (1.40)		0.00978 (0.17)	0.00984 (0.17)
Owner's business networks (No. business/govt contacts)		0.000226 (1.51)	0.000194 (1.47)		-0.000102 (-0.85)	-0.000102 (-0.85)
Workforce skill level (Share of unskilled prod. workers)		-0.0282 (-0.58)	-0.0239 (-0.49)		-0.0473 (-0.85)	-0.0473 (-0.85)
Property rights (Land use certificate=1; =0 otherwise)		0.0446 (0.82)	0.0692 (1.26)		0.0504 (0.63)	0.0504 (0.63)
Road/Port/Rail access (None=0; All=3)		0.0564*** (3.34)	0.0388** (2.17)		0.0190 (0.73)	0.0190 (0.73)
Constant	8.822***	8.209***	8.705***	9.762***	9.738***	9.747***
	(40.49)	(37.56)	(37.12)	(72.92)	(81.51)	(62.81)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	No	Yes	Yes	No	Yes
MHT sector dummy	Yes	No	Yes	Yes	No	Yes
Observations	4,164	4,164	4,164	4,173	4,173	4,173
R^2	0.150	0.142	0.152	0.162	0.163	0.163

Notes: OLS and FE estimates. *t* statistics (reported in parentheses) are heteroskedascity robust. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Since labour productivity captures not only efficiency improvement but also capital deepening, the paper also examines the relationship between formalisation and TFP – a more precise measure of productivity (see Table 3.5 below). Columns (1)-(3) show the pooled OLS estimates while columns (4)-(6) present the different FE specifications. The outcome variable is TFP (in logs). The key explanatory variable of interest is the formality status of firms (in lag one).

For the baseline OLS estimates, column (1) includes the lag dependent variable, lag firm size and a full set of dummies for year, location and sector as control variables in addition to the formality status variable. Column (2) expands the list of control variables in (1) to incorporate the lag TFP, lag firm size, owner's characteristics (sex, education, business networks), workforce skill level, possession of property rights, infrastructure access and year dummies. Column (3) contains all the variables in column (2) plus additional dummies for location and sector. Further, in line with the mean-comparison tests which show no significant difference in terms of TFP between formal and informal firms, the coefficients of the formality status variable in columns (1)-(3) are not significant at the 10 percent level, suggesting that the benefits of formalisation comes from capital deepening rather than true productivity improvement.

Regarding the baseline FE specifications, column (4) presents the most simple set-up with only lag firm size and the set of fixed effects for year, location and sector as covariates besides the formality status variable. Column (5) includes the full set of control variables but with only year fixed effects. Column (6) extends column (5) specifications by adding fixed effects for location and sector. Different from OLS specifications, the lag dependent variable is excluded from FE models due to its correlation with the demeaned error terms.

Under the FE specifications, formalisation is found to have a positive and significant correlation with TFP. In column (4), TFP rises by 23.8 percent when a household firm becomes formal, all else being equal. The figures for columns (5) and (6) are 24.3 percent and 27.6 percent, respectively. These results however should be taken with a grain of salt since the FE estimates do not take into account the dynamic factor as in the OLS models; thus it is likely that the significance of formality status merely reflects the self-selection of highly-productive households into the formal sector. Further, the coefficients of formality status variable in columns (4)-(5) are marginally significant at the 10 percent level. When introducing the lag dependent variable into (6), the coefficient of the formality status variable loses its significance.

Table 3.5: Formality and TFP – baseline estimates

Dep. var: **TFP**	(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE
(Lag) Formal (Yes=1, No=0)	0.0832	0.0795	0.0444	0.238*	0.243*	0.276**
	(0.82)	(0.80)	(0.43)	(1.74)	(1.76)	(2.00)
Firm size	0.0160	-0.00587	0.0110	-0.00871	-0.00955	-0.01
	(0.51)	(-0.19)	(0.33)	(-0.17)	(-0.19)	(-0.19)
Gender of owner (male=1; female=0)		0.00326	0.00306		-0.0536	-0.0536
		(0.07)	(0.06)		(-0.74)	(-0.73)
Education of owner (unskilled=0; vocational level=1; college or above=2)		0.118*	0.0733		0.111	0.1092
		(1.78)	(1.08)		(1.58)	(1.56)
Owner's business networks (No. business/govt contacts)		-0.00794	-0.00665		0.000117	0.0001
		(-0.14)	(-0.12)		(0.13)	(0.12)
Workforce skill level (Share of unskilled prod. workers)		0.000818	0.00104		-0.0254	-0.0293
		(1.27)	(1.52)		(-0.41)	(-0.47)
Property rights (Land use certificate=1; =0 otherwise)		-0.0258	0.00675		0.0231	0.0205
		(-0.42)	(0.11)		(0.26)	(0.23)
Road/Port/Rail access (None=0; All=3)		0.0309	0.0183		0.00481	0.0052
		(1.54)	(0.84)		(0.19)	(0.20)
Constant	7.019***	6.715***	6.889***	7.929***	7.812***	7.88***
	(28.48)	(27.20)	(26.48)	(41.88)	(53.98)	(52.73)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	No	Yes	Yes	No	Yes
MHT sector dummy	Yes	No	Yes	Yes	No	Yes
Observations	2,339	2,339	2,339	3,299	3,299	2,339
R^2	0.111	0.105	0.112	0.154	0.156	0.157

Notes: OLS and FE estimates. *t* statistics (reported in parentheses) are heteroskedascity robust. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To alleviate the potential issues of reverse causality and omitted variable bias, the paper applies a matched DiD approach to control for observable determining factors that may influence both the decision to formalise and the resulting productivity performance (see Table 3.6 below). Matching between treated and control groups is carried out one period[17] prior to the (varying) time of formalisation, with formality status indicator as the outcome variable while the list of covariates includes both continuous variables (productivity, firm size, owner's business networks, workforce skill level) and categorical variables (owner's sex or education level, posessions of property rights, infrastructure access and dummies for province and MHT sector). Labour productivity is used as a control variable for matching when the outcome variable of interest is labour productivity, and TFP is used when the outcome variable is TFP. For robustness checks, observations are matched using bias-corrected nearest neighbor matching (Row A in Table 3.6), allowing for multiple matches with the same statistical distances per observation, as well as bias-corrected radius matching (Row B in Table 3.6). Further, following Dettman, Becker and Schmeiβer (2011), the paper employs aggregated statistical distance functions for the matching procedure, which has been shown to better summarise similarities in differently-scaled variables in small samples compared with the often-used measures such as propensity score, index score or Mahalanobis distance.

The comparability of the matched groups can be seen through multiple tests shown in Appendix 3.1. These include the covariate imbalance test proposed by Leuven and Sianesi (2003), the nonparametric Kolmogorov-Smirnov (K-S) tests that compare the cumulative distributions between treated and control groups for *continuous* variables and the chi-square tests for *categorical* variables. The covariate imbalance test measures the standardised percentage difference, or bias, between the means of the treated group and the control group for each of the matching variables, in order to examine whether both groups have equal means. In addition, the test sheds light on the similarity of the variances in the treated and control group for each matching variable. Results from Appendix 3.1 show that both the means and variances of the matching variables are balanced, regardless of whether nearest neighbour matching or radius matching is employed.

The balance of the matching variables is further confirmed through the K-S tests and chi-square tests. The (corrected) p-values of most matching variables are higher than 0.1, indicating that the cumulative distributions between treated and control groups for most variables are not significantly different.

[17] One period is equivalent to two years.

In Table 3.6, the dependent variable in column (1) is labour productivity (in logs) and in column (2) is TFP (in logs). Row A displays results for neareast neighbor matching while Row B for radius matching. The full set of control variables is employed in both rows. For column (1), the ATT result from nearest neighbor matching shows a 69 percent increase in labour productivity one period after household firms become formal and 82 percent rise in the case of radius matching. Together with the baseline estimates, this outcome further confirms the significantly positive impact of formalisation on labour productivity.

In column (2), to the contrary, the ATT of formalisation is not significant at the 10 percent level when the dependent variable is log of TFP. This holds true for both nearest neighbour matching and radius matching, showing that the formalisation of household firms does not actually lead to efficiency improvement even after two years of formalisation.

Table 3.6: Formality and productivity – matched DiD estimates

	Formalisation treatment effect			
	(1) Labour productivity		(2) TFP	
	ATT	Standard errors	ATT	Standard errors
A: Nearest neighbour matching	0.69**	0.31	0.30	0.51
B: Radius matching	0.82**	0.38	0.37	0.28
Total obs.	1,669		1,669	
Treated obs.	100		100	

Notes: Average treatment effect of the treated (ATT) using nearest neighbour matching (one match per observation) and radius matching (three matches per observation). Reported standards errors are consistent bias-correcteed estimator as proposed in Abadie & Imbens (2011). Dependent variable is labour/total-factor productivity two years after formalisation. Matching is done for one period prior to formalisation, with the following covariates (except for radius matching in column (2)): productivity; firm size; owner's characteristics; workforce skill level; property rights; road/rail/port access; province dummies; and MHT sector dummy. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.5.2 Informal costs

Table 3.7 presents the baseline estimates of the impact of formalisation on the percentage of management time that firms have to spend dealing with government regulations. Columns (1)-(3) show the pooled OLS estimates while columns (4)-(6) present the different FE specifications. The outcome variable is time costs of red tape, measured as percentage point. The key explanatory variable of interest is the formality status of firms (in lag one).

For the baseline OLS estimates, column (1) includes the lag firm size and a full set of dummies for year, location and sector as control variables, in addition to the formality status variable. Column (2) expands the list of control variables in (1) to incorporate the lag firm size, owner's characteristics

(sex, education, business networks), workforce skill level, possession of property rights, infrastructure access and year dummies. Column (3) contains all the variables in column (2) plus additional dummies for location and sector. Firm size is found to be significantly and positively correlated with the time costs of red tape. A 100 percent increase in employment corresponds to a 0.2 percentage point increase in the time costs of red tape. While this seems economically insignificant at first sight, one should note that the number of employees for most firms in the sample is below 20 and the average time costs of red tape is around 3 percent. Thus, a 100 percent increase in employment in this case may just mean a few more workers and the 0.2 percentage point increase in time costs is not irrelevant.

Further, in all specifications, the coefficients of the formality status variable are positive and significant at the 1 percent level. Specifically, firms becoming formal is associated with an increase in the time spent on dealing with red tape by 0.801-0.867 percentage point. Given that the average time costs of red tape is around 3 percent of total management time, an increase of 0.8-0.9 percentage point represents a significant amount.

Regarding the baseline FE specifications, column (4) presents the most simple set up with only lag firm size and the set of fixed effects for year, location and sector as covariates besides the formality status variable. Column (5) includes the full set of control variables but with only year fixed effects. Column (6) extends the column (5) specification by adding fixed effects for location and sector. In contrast to the OLS estimates, formalisation under the FE estimates does not have a positive and significant correlation with the time costs of red tape. The loss of statistical significance of formalisation under FE estimation suggests that formalised household businesses may already face higher time costs of red tape prior to formalisation compared with informal households. Such high time costs continue on after formalisation and therefore within-firm estimates show no significant effect of formalisation on the time costs of red tape.

Table 3.7: Formality and time costs of red tape – baseline estimates

Dep. var: **Time costs of red tape**	(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE
(Lag) Formal (Yes=1, No=0)	0.867***	0.801***	0.802***	0.0689	0.0511	0.0832
	(2.90)	(2.68)	(2.69)	(0.17)	(0.12)	(0.20)
Firm size	0.211***	0.216***	0.178***	0.0988	0.0967	0.103
	(3.79)	(4.18)	(3.12)	(0.79)	(0.77)	(0.82)
Gender of owner (male=1; female=0)		-0.0819 (-1.09)	-0.0481 (-0.62)		-0.0908 (-0.67)	-0.0882 (-0.65)
Education of owner (unskilled=0; vocational level=1; college or above=2)		0.159** (2.00)	0.147* (1.81)		0.126 (1.08)	0.123 (1.05)
Owner's business networks (No. business/govt contacts)		0.000692 (1.31)	0.000584 (1.17)		0.000544* (1.69)	0.000547* (1.69)
Workforce skill level (Share of unskilled prod. workers)		0.176** (2.01)	0.152* (1.70)		0.208* (1.92)	0.209* (1.93)
Property rights (Land use certificate=1; =0 otherwise)		-0.231** (-2.56)	-0.281*** (-3.13)		-0.0972 (-0.56)	-0.0950 (-0.55)
Road/Port/Rail access (None=0; All=3)		0.0451 (1.42)	0.0310 (0.95)		0.00970 (0.20)	0.0117 (0.25)
Constant	0.746*** (4.04)	0.858*** (5.65)	0.752*** (3.51)	0.730** (2.11)	0.983*** (3.39)	0.660 (1.60)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	No	Yes	Yes	No	Yes
MHT sector dummy	Yes	No	Yes	Yes	No	Yes
Observations	2,871	2,871	2,871	2,871	2,871	2,871
R^2	0.102	0.097	0.108	0.102	0.105	0.106

Notes: OLS and FE estimates. *t* statistics (reported in parentheses) are heteroskedascity robust. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In addition to the time costs of red tape, another common type of informal costs is bribery payments. According to the Provincial Competitiveness Index (PCI) survey in 2015, 66 percent of surveyed firms in Vietnam had to make some bribery payments to government officials and 11 percent had to spend 10 percent of revenues for such informal fees (Trung, 2016). Table 3.8 provides the baseline estimates of the impact of formalisation on the amount of bribery payments (in VND thousand). Columns (1)-(3) display the pooled OLS estimates while columns (4)-(6) show the different FE specifications. The outcome variable is bribery payments, while the key explanatory variable of interest is the formality status of firms (in lag one).

Similar to Table 3.7, column (1) is the most simple set up with the lag firm size and a full set of dummies for year, location and sector as control variables in addition to the formality status variable. Column (2) introduces the lag firm size, owner's characteristics (sex, education, business networks), workforce skill level, possession of property rights, infrastructure access and year dummies. Column (3) contains all the variables in column (2) plus additional dummies for location and sector. In all specifications, the coefficients of firm size are positive and significant at the 1-percent level. The economic significance, however, is negligible: a 100-percent increase in the number of employees corresponds to an additional VND2.4 million (about USD110) in bribery. This suggests that petty corruption, which typically involves the abuse of power by low-level public officials in exchange for small amounts of money, is the type of corruption household firms in Vietnam face most often.

The explanatory variable of interest, formality status, is also found to be positively correlated with bribery payments. Specifically, firms on average have to pay an extra VND1.35 million – VND1.43 million (USD60 – 70) after formalisation. This finding, together with the small economic significance of firm size, highlights the problem of petty corruption for household firms in Vietnam.

Taking into account the potential unobserved, time-invariant within-firm factors that may affect both the decision to formalise and the amount of bribery payments, FE estimates further confirm the findings from pooled OLS regressions. The variable set-ups in column (4)-(6) are similar to those under column (1)-(3). In all columns, the coefficients of both firm size and formality status are positive and significant. A 100 percent increase in firm size is associated with additional bribery payments of VND1.95 million – VND2.07 million. Similarly, household firms have to pay an extra VND2.4 million – VND2.7 million in informal fees after formalisation. The presence of such bribery, while not large, still sends a negative message about the formal business environment in Vietnam.

Table 3.8: Formality and bribery payments – baseline estimates

Dep. var: **Bribery payments**	(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE
(Lag) Formal (Yes=1, No=0)	1430.4*	1346.5*	1375.3*	2399.6**	2705.4**	2530.0**
	(1.83)	(1.81)	(1.83)	(2.21)	(2.16)	(2.17)
Firm size	2445.5***	2362.7***	2476.2***	1967.3***	2071.3***	1949.9***
	(3.56)	(3.77)	(3.28)	(3.24)	(2.90)	(3.31)
Gender of owner (male=1; female=0)		-337.3 (-0.52)	-330.9 (-0.54)		503.1 (0.73)	256.6 (0.47)
Education of owner (unskilled=0; vocational level=1; college or above=2)		-287.5 (-0.46)	-247.0 (-0.39)		-513.8 (-1.19)	-535.4 (-1.24)
Owner's business networks (No. business/govt contacts)		5.255* (1.70)	4.183 (1.41)		4.472* (1.71)	4.924** (2.05)
Workforce skill level (Share of unskilled prod. workers)		-386.2 (-0.50)	-591.6 (-0.60)		296.1 (0.71)	241.3 (0.57)
Property rights (Land use certificate=1; =0 otherwise)		346.9 (0.79)	373.5 (0.77)		1065.2 (1.16)	957.5 (1.07)
Road/Port/Rail access (None=0; All=3)		133.2 (0.92)	197.6 (1.64)		601.9** (2.32)	527.1** (2.48)
Constant	-1281.9* (-1.80)	-479.1 (-0.42)	-1210.6 (-1.15)	4451.0 (1.15)	-2510.8 (-1.21)	2684.9 (0.74)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	No	Yes	Yes	No	Yes
High-tech sector dummy	Yes	No	Yes	Yes	No	Yes
Observations	1,484	1,484	1,484	1,484	1,484	1,484
R^2	0.077	0.067	0.079	0.158	0.153	0.173

Notes: OLS and FE estimates. *t* statistics (reported in parentheses) are heteroskedascity robust. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.9 presents the matched DiD estimates of the effect of formalisation on informal costs. Similar to Table 3.6, the matching procedure is implemented one period prior to the time of formalisation, with outcome variable being the formality status indicator and the list of covariates includes continuous variables (productivity, firm size, informal costs, workforce skill level) and categorical variables (owner's education, possessions of property rights, infrastructure access and dummies for province and MHT sector). Time costs of red tape is selected as a matching covariate when examining the effect of formalisation on time costs of red tape, and bribery payments is used when the effect of formalisation on informal fees is of interest. Following Dettman, Becker and Schmeiβer (2011), the paper employs aggregated statistical distance functions for the matching procedure.

The dependent variable in column (1) is time costs of red tape, measured as percentage of management time spent on dealing with government regulations, and in column (2) is bribery payments (in VND million). For column (1), the ATT result from nearest neighbor matching shows that formalised firms' owners need to spend an additional 5.24 percent of their time to deal with government regulations compared to their informal counterparts, which is in line with the anecdotal evidence of informal firms' hesitancy to join the formal sector due to complex bureaucracies.

In column (2), the ATT of formalisation confirms another informal costs that formalised household firms have to bear, namely bribery payments. Specifically, formalisation leads to an increase in the amount of bribery payments by VND12 million (about USD500) compared to the untreated matches. The increase in bribery payments is in line with findings from the OLS and FE baseline estimates.

Table 3.9: Formality and informal costs – matched DiD estimates

	Formalisation treatment effect			
	Time costs of red tape		Bribery payments (VND million)	
	ATT	Standard error	ATT	Standard error
Nearest neighbour matching	5.24*	2.45	12*	5.4
Total obs.	1,422		1,669	
Treated obs.	96		100	

Notes: Average treatment effect of the treated (ATT) uses nearest neighbour matching (multiple matches with same statistical distance per observation). Reported standards errors are consistent bias-correcteed estimator as proposed in Abadie & Imben (2011). Dependent variables include times costs of red tape and bribery payments two years after formalisation. Matching is done for one period prior to formalisation, with the following control variables: informal costs; firm size; owner's characteristics; workforce skill level; province dummies; and MHT sector dummy.

3.6. Robustness checks

3.6.1 Formalisation and productivity

While the matched DiD approach is useful in handling endogeneity biases due to reverse causality and selection on observables, it does not address the potential problem of selection on *unobservables*. For example, the business aptitude and determination of owners/managers may be a firm-specific, time-variant factor that is not fully captured through the observed variables such as education attainment or business networks. Thus for robustness checks, the paper applies an IV identification strategy to alleviate the issue of selection on unobservables. The instrumental variable is the share of formal firms within the same province, two-digit sector and year, excluding the observation of interest. This instrument is valid for two reasons. First, the decision to formalise of a particular household firm is likely to be influenced by whether its nearby competitors are also formalising (relevance condition). Second, unobserved firm-specific factors are unlikely to correlate with the decisions to formalise of *other* firms, especially when 'business networks' have already been controlled for (exogeneity condition).

Table 3.10 presents the IV estimates of the impact of formalisation on productivity. The list of control variables in both columns (1) and (2) are similar to those in column (6) of Table 3.5. In column (1), the dependent variable is log of labour productivity, while for column (2) it is log TFP. The key explanatory variable of interest is formality status, instrumented by the share of formal firms within the same province, two-digit sector and year. The weak instrument test shows an F-statistics of 21.24, meaning that the selected instrument meets the relevance condition. Its coefficient in column (1) is positive and significant, which is in line with the baseline and matched DiD estimates and further confirms the positive impact of formalisation on labour productivity. In column (2), while the selected instrument is still relevant with an F-statistics of 19.68, the coefficient of formality status is not significant at the 10-percent level. This is in line with the OLS and matched DiD estimates, which do not find any effect of formalisation on TFP. Further, Appendix 3.2 shows that the story stays the same when using the proportion of formal firms outside the province of the firm of interest as the instrument. Together, results from Table 3.10 suggest that formalisation leads to better capital deepening, which raises labour productivity, but not efficiency improvement (no effect on TFP).

Table 3.10: Formalisation and productivity – IV estimates

	(1) Labour productivity	(2) TFP
Formality status	13.60***	16.63
	(4.65)	(1.29)
Firm size	-0.662***	-1.399
	(-4.25)	(-1.35)
Gender of owner (male=1; female=0)	0.165*	0.400
	(1.69)	(1.06)
Education of owner (unskilled=0; vocational level=1; college or above=2)	-0.241*	-1.033
	(-1.80)	(-1.09)
Owner's business networks (No. business/govt contacts)	-0.000530	-0.00854
	(-1.13)	(-1.08)
Workforce skill level (Share of unskilled prod. workers)	0.157*	0.326
	(1.66)	(1.14)
Property rights (Land use certificate=1; =0 otherwise)	0.316***	0.254
	(3.15)	(1.09)
Road/Port/Rail access (None=0; All=3)	0.0222	-0.112
	(0.59)	(-0.80)
Constant	10.36***	11.01***
	(17.61)	(3.76)
Province dummies	Yes	Yes
MHT sector dummy	Yes	Yes
First-stage F-stat	21.24	19.68
Observations	4,163	2,338

Note: t statistics in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The positive impact of formalisation on capital deepening is further confirmed in Table 3.11. Column (1) and (2) present the OLS and FE estimates, respectively, with the log of real capital stock as the dependent variable. Column (3) and (4) show OLS and FE estimates of formalisation impact on the amount of firm investment, measured in VND 1000. The list of control variables are similar to those in column (6) of Table 3.4, with the exception of the lag dependent variable being lag of capital stock (column (1)) and lag of investment (column (3)) instead of lag productivity. In all specifications, the explanatory variable of interest, formality status, is found to be positively and significantly correlated with both capital stock and investment. Specifically, joining the formal sector increases capital stock by 51-76 percent and raises the amount of investment by VND 310 million – 469 million (USD 15,000 - 23,000) after two years. This indicates that household firms have easier access to capital once joining the formal sector.

Table 3.11: Formalisation and capital deepening

	Capital stock (log real VND million)		Investment (in VND thousand)	
	(1) OLS	(2) FE	(3) OLS	(4) FE
Formality status	0.514***	0.768***	469182.7**	310313.8***
	(4.38)	(3.84)	(2.57)	(3.65)
Firm size		0.0796	183374.6***	114939.0***
		(1.06)	(5.99)	(3.55)
Gender of owner (male=1; female=0)	0.153***	-0.163**	51328.3	-21016.4
	(3.25)	(-1.99)	(1.59)	(-0.49)
Education of owner (unskilled=0; vocational level=1; college or above=2)	0.130**	0.643***	61265.3	-5784.6
	(2.10)	(7.89)	(1.37)	(-0.16)
Owner's business networks (No. business/govt contacts)	0.00142*	0.000758	1792.5	-42.49
	(1.84)	(1.12)	(1.17)	(-0.08)
Workforce skill level (Share of unskilled prod. workers)	0.104**	0.102*	-2453.8	-26915.2
	(2.02)	(1.86)	(-0.07)	(-0.74)
Property rights (Land use certificate=1; =0 otherwise)	0.139**	0.356***	-20529.4	8976.2
	(2.44)	(3.95)	(-0.48)	(0.21)
Road/Port/Rail access (None=0; All=3)	0.0579***	-0.0410	-14870.0	-5398.2
	(2.77)	(-1.18)	(-1.02)	(-0.35)
Constant	4.321***	10.22***	-350734.3***	87805.7
	(17.11)	(55.01)	(-3.36)	(1.08)
Year dummies	Yes	No	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes
High-tech sector dummy	Yes	Yes	Yes	Yes
Observations	2339	3299	1161	2047
R^2	0.592	0.066	0.228	0.035

Notes: OLS and FE estimates. *t* statistics (reported in parentheses) are heteroskedascity robust. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.6.2 Formalisation and informal costs

To address potential endogeneity bias due to selection on unobservables, the paper applies an IV identification strategy similar to that in Table 3.11. The key explanatory variable, formality status, is instrumented by the share of formal firms within the same province, 2-digit sector and year, excluding the observation of interest. The dependent variable is time costs of red tape in column (1) and bribery payments in column (2). The list of control variables includes: firm size; owner's characteristics; workforce skill level; possessions of property rights; quality of infrastructure access and dummies for location and sector.

The first stage F-statistics for column (1) and (2) are 17.99 and 10.41, respectively, indicating that the selected instrument meets the relevance condition. More importantly, the coefficients of formality status are positive and significant in both columns, meaning that household firms have to incur more informal costs when joining the formal sector. Specifically, formalisation is associated with an increase of 8 percent in the percentage of management time spent dealing with red tape and of VND 9 million (USD 450) in bribery payments. These results are in line with most baseline and matched DiD estimates and highlight serious burden that may discourage more informal firms from formalisation.

Table 3.12: Formalisation and informal costs – IV estimates

	(1) Time costs of red tape	(2) Bribery payments
Formality status	8.013***	9169.2*
	(3.87)	(1.70)
Firm size	-0.286**	1749.5***
	(-2.11)	(4.18)
Gender of owner (male=1; female=0)	0.0860 (0.81)	445.5 (0.93)
Education of owner (unskilled=0; vocational level=1; college or above=2)	0.00300 (0.02)	-357.1 (-0.56)
Owner's business networks (No. business/govt contacts)	0.000127 (0.29)	4.541 (1.03)
Workforce skill level (Share of unskilled prod. workers)	0.234** (2.11)	203.2 (0.34)
Property rights	-0.138	-743.7
Road/Port/Rail access (None=0; All=3)	-0.0508 (-1.17)	

Constant	1.988***	-300.0
	(5.99)	(-0.21)
Province dummies	Yes	Yes
MHT sector dummy	Yes	Yes
First-stage F-stat	17.99	10.41
Observations	2870	1204

Note: t statistics (reported in parenthesis) are heteroskedasticity robust. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.7. Conclusions

Many developing countries implement policies that encourage informal firms to participate in the formal sector. These policies will not work if the perceived costs of formalisation outweigh its expected benefits. Most empirical studies to date, however, have not analysed both the benefit- and cost side of formalisation. This study attempts to fill this gap by examining the relationship between formalisation, firm-level productivity and informal costs, using a panel dataset of Vietnamese firms during the period 2007-2015. Specifically, the paper focuses on two research questions: (i) Does formalisation bring about *higher productivity* for formalised firms? and (ii) Do informal firms incur *higher informal costs* after formalisation?

The findings show that formalisation is associated with a 23-82 percent increase in labour productivity but has no significant impact upon TFP. This means that the gain in labour productivity actually comes from capital deepening rather than efficiency improvement. Models with capital stock and investment as the dependent variables further confirm this view. These findings are understandable given that most informal household firms, even after formalisation, are micro firms with less than 10 employees; thus technological upgrade may not be as much of a priority for these firms as having easier access to credit.

In addition, the paper finds that household firms have to incur higher informal costs after joining the formal sector. Specifically, managers/owners have to allocate an additional 5-8 percent of their time dealing with government regulations and spend an extra VND 9-12 million for bribery payments after their household businesses become formal. The presence of such informal costs is in line with much anecdotal evidence from the Vietnamese media (Dinh, 2018; Quynh, 2019) and helps explain the low rate of formalisation in the SME dataset.

The main contribution of this paper is that it is, to the best of my knowledge, the first empirical study that sheds light on both the micro-level benefit and cost sides of formalisation. Previous micro-level studies, such as Farrel (2004), Fajnzylber, Maloney and Montes-Rojas (2009) or Rand and Torm (2011), only focus on the benefit side of

formalisation. This is understandable as information on the productivity and incurred informal costs of household firms are rarely available. Such a one-sided approach, however, does not help explain why informal firms are often hesitant to join the formal sector despite the potential benefits. This paper, on the other hand, is able to look at both the pros and cons of formalisation, thank to the unique SME surveys which are longtitudinal and contain a vast wealth of information on the operations of informal firms.

Findings from this paper should be relevant to policy makers. Since formalisation is found to raise labour productivity of informal firms, the Vietnamese government should continue its efforts of encouraging more household businesses to join the formal sector. In order to achieve this, the expected benefits of formalisation should clearly outweigh its expected costs. On the benefit side, the recent 2018 Law on Assistance for Small and Medium-Sized Enteprises is one step in the right direction. Article 16 of this Law stipulates the various forms of support for formalised businesses, such as free consultancy and guidance on enterprise establishment procedures, tax administrative and accounting procedures within three years from the date on which the first BRC is issued; exemption from business registration fees and licensing fees within 3 years from the issuing date of the first BRC; and remission of corporate income tax and land tax for a certain period of time. In addition, after formalisation, firms enjoy the general support for SMEs in terms of access to credit; production premise rental; market information; corporate governance training and legal assistance services. What is further needed is to ensure that these policies are actually implemented in practice.

Last but not least, the government should strive to tackle the persistent problem of informal costs, including the cost of time firms have to spend dealing with red tape as well as the informal fees of doing business in the formal sector. The presence of bureaucracy and corruption, albeit petty, is likely to reduce the trust of household business owners in the government's goodwill support for formalisation. It was the former Deputy Prime Minister and now Chair of National Assembly, Vuong Dinh Hue, who has aptly emphasised this point in 2019:

> "Petty corruption has brought about public discontent and pains for the people. It says much about the ethics of civil servants and public employees. Just because corruption is petty does not mean its harmful effects are trivial; a massive dyke can collapse from tiny termite nests."

Appendix 3.1

Quality checks for matching procedures

Labour productivity

1. Covariate imbalance test (nearest neighbor matching):

Variable	Mean			t-test		V(T)/V(C)
	Treated	Control	% bias	t	p>|t|	
Owner's education	1.0263	0.97368	7.8	0.34	0.736	1.00
Owner's business networks	29.921	29.842	0.3	0.01	0.990	0.55
Workforce skill level	0.35687	0.34834	2.6	0.11	0.910	0.91
Property rights	0.63158	0.65789	-5.4	-0.24	0.814	.
Infrastructure access	1.6316	1.5789	4.6	0.20	0.841	0.95
Province dummies	52.763	51.316	5.6	0.24	0.809	1.02
MHT sector dummy	0.60526	0.57895	5.3	0.23	0.818	.
Labour productivity	9.5101	9.5269	-1.5	-0.07	0.947	1.19

* if variance ratio outside [0.52; 1.92]

Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
0.004	0.47	1.000	4.1	5.0	15.5	1.02	0

* if B>25%, R outside [0.5; 2]

2. K-S tests (continuous variables) and chi-squared tests (categorical variables) for equality of distribution functions (nearest neighbor matching):

Variable	Combined K-S difference/Pearson chi-square	P-value
Owner's education	0.1176	0.943
Owner's business networks	0.1842	0.449
Workforce skill level	0.1053	0.973
Property rights	0.0574	0.811
Infrastructure access	0.1436	0.986
Province dummies	0.7733	0.999
MHT sector dummy	0.0545	0.815
Labour productivity	0.0789	1.000

TFP

1. Covariate imbalance test (nearest neighbor matching):

Variable	Mean			t-test		V(T)/V(C)
	Treated	Control	% bias	t	p>|t|	
Owner's education	1.1667	1.0833	15.2	0.37	0.713	1.26
Owner's business networks	44.25	31.5	42.8	1.05	0.306	1.30

Workforce skill level	0.40618	0.30537	31.1	0.76	0.454	1.15
Property rights	0.6667	0.6667	0.0	0.00	1.00	.
Infrastructure access	2	2.0833	-8.5	-0.21	0.836	0.92
Province dummies	45	34.083	39.9	0.98	0.339	1.07
MHT sector dummy	0.5833	0.4167	32.4	0.79	0.436	.
Labour productivity	7.4472	7.3353	12.0	0.29	0.772	1.18

* if variance ratio outside [0.29; 3.47]

2. K-S tests (continuous variables) and chi-squared tests (categorical variables) for equality of distribution functions (nearest neighbor matching):

Variable	Combined K-S difference/Pearson chi-square	P-value
Owner's education	0.2588	0.879
Owner's business networks	0.2500	0.769
Workforce skill level	0.2500	0.769
Property rights	0.0000	1.000
Infrastructure access	0.2222	0.974
Province dummies	4.8667	0.676
MHT sector dummy	0.6667	0.414
Labour productivity	0.2500	0.769

Labour productivity

1. Covariate imbalance test (radius matching):

Variable	Mean			t-test		V(T)/V(C)
	Treated	Control	% bias	t	p>|t|	
Owner's gender	0.77273	0.77273	0.0	-0.00	1.000	.
Owner's education	0.86364	0.86364	0.0	0.00	1.000	1.00
Owner's business networks	29.727	35.335	-22.2	-0.62	0.540	0.48
Workforce skill level	0.3423	0.35327	-3.1	-0.11	0.916	0.78
Property rights	0.77273	0.77273	0.0	-0.00	1.000	.
Infrastructure access	1.4091	1.4091	0.0	0.00	1.000	1.00
Province dummies	58	58	0.0	0.00	1.000	1.00
MHT sector dummy	0.59091	0.59091	0.0	0.00	1.000	.
Labour productivity	9.2643	9.5136	-21.1	-0.75	0.458	1.74

* if variance ratio outside [0.42; 2.41]

Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
0.020	1.19	0.999	5.2	0.0	32.3*	1.42	0

* if B>25%, R outside [0.5; 2]

2. K-S tests (continuous variables) and chi-squared tests (categorical variables) for equality of distribution functions (radius matching):

Variable	Combined K-S difference/Pearson chi-square	P-value
Owner's gender	0.0007	0.979
Owner's education	0.2160	0.898
Owner's business networks	0.1391	0.889
Workforce skill level	0.2672	0.159
Property rights	0.1823	0.669
Infrastructure access	2.4474	0.485
Province dummies	1.3908	0.966
MHT sector dummy	0.2230	0.637
Labour productivity	0.2030	0.456

TFP

1. Covariate imbalance test (radius matching):

Variable	Mean			t-test		V(T)/V(C)
	Treated	Control	% bias	t	p>|t|	
Owner's business networks	29.727	35.335	-22.2	-0.62	0.540	0.48
Workforce skill level	0.3423	0.35327	-3.1	-0.11	0.916	0.78
Province dummies	58	58	0.0	0.00	1.000	1.00
MHT sector dummy	0.59091	0.59091	0.0	0.00	1.000	.

* if variance ratio outside [0.43; 2.31]

Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
0.020	1.19	0.999	5.2	0.0	32.3*	1.42	0

* if B>25%, R outside [0.5; 2]

2. K-S tests (continuous variables) and chi-squared tests (categorical variables) for equality of distribution functions (radius matching):

Variable	Combined K-S difference/Pearson chi-square	P-value
Owner's business networks	0.1789	0.379
Workforce skill level	0.3193	0.012
Province dummies	13.8820	0.085
MHT sector dummy	0.4856	0.486

Time costs of red tape

1. Covariate imbalance test (nearest neighbor matching):

Variable	Mean			t-test		V(T)/V(C)
	Treated	Control	% bias	t	p>|t|	
Owner's gender	.8	.8	0.0	0.00	1.000	.

Owner's education	1.1	1.1	0.0	0.00	1.000	1.00
Owner's business networks	46.1	31.7	41.1	1.14	0.268	2.45
Workforce skill level	.31664	.24222	24.4	0.55	0.592	0.88
Inspection frequency	1.7	1.4	21.7	0.48	0.634	1.10
Firm size	11.484	10.002	77.9	1.74	0.099	0.98
Province dummies	45.9	48.3	-0.4	-0.21	0.836	0.84
MHT sector dummy	.5	.5	0.0	0.00	1.000	.
Time costs of red tape	2.71	3.15	-17.5	-0.39	0.701	0.28

* if variance ratio outside [0.25; 4.03]

Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
0.322	8.94	0.443	22.4	17.5	141.1*	0.51	0

* if B>25%, R outside [0.5; 2]

2. K-S tests (continuous variables) and chi-squared tests (categorical variables) for equality of distribution functions (nearest neighbor matching):

Variable	Combined K-S difference/Pearson chi-square	P-value
Owner's gender	0.0000	1.000
Owner's education	0.0000	1.000
Owner's business networks	0.3000	0.660
Workforce skill level	0.3000	0.660
Inspection frequency	1.5333	0.821
Firm size	0.4000	0.294
Province dummies	1.3333	0.970
MHT sector dummy	0.0000	1.000
Time costs of red tape	0.3000	0.660

Bribery payments

1. Covariate imbalance test (nearest neighbor matching):

Variable	Mean			t-test		V(T)/V(C)
	Treated	Control	% bias	t	p>|t|	
Owner's gender	0.4444	0.8889	-100.8	-2.14	0.048	.
Owner's education	1.3333	1.3333	0.0	0.00	1.000	1.00
Owner's business networks	34.111	29.667	27.0	0.57	0.574	1.55
Workforce skill level	0.4939	0.2688	67.2	1.43	0.173	3.06
Firm size	11.492	11.087	23.5	0.50	0.626	0.95
Province dummies	52.333	64.667	-43.9	-0.93	0.365	0.76

Bribery payments	4777.8	4466.7	7.8	0.17	0.870	0.89

* if variance ratio outside [0.23; 4.43]

Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
0.417	10.40	0.167	38.6	27.0	132.8*	0.74	0

* if B>25%, R outside [0.5; 2]

2. K-S tests (continuous variables) and chi-squared tests (categorical variables) for equality of distribution functions (nearest neighbor matching):

Variable	Combined K-S difference/Pearson chi-square	P-value
Owner's gender	4.0000	0.046
Owner's education	0.0000	1.000
Owner's business networks	0.2222	0.960
Workforce skill level	0.5556	0.075
Firm size	0.2222	0.960
Province dummies	7.6667	0.363
Bribery payments	0.3333	0.593

Appendix 3.2

Formalisation and productivity – IV estimates

	(1) Labour productivity	(2) TFP
Formality status	4.472**	-2.330
	(2.44)	(-0.55)
Firm size	-0.0701	0.0530
	(-0.95)	(0.44)
Gender of owner (male=1; female=0)	-0.00291	-0.104
	(-0.04)	(-0.92)
Education of owner (unskilled=0; vocational level=1; college or above=2)	0.0729	0.0930
	(1.07)	(1.23)
Owner's business networks (No. business/govt contacts)	-0.000161	-0.000268
	(-0.61)	(-0.27)
Workforce skill level (Share of unskilled prod. workers)	-0.0424	-0.0354
	(-0.73)	(-0.59)
Property rights (Land use certificate=1; =0 otherwise)	0.0391	0.00161
	(0.50)	(0.02)
Road/Port/Rail access (None=0; All=3)	0.0201	0.00308
	(0.72)	(0.10)
Constant	9.897***	7.777***

	(63.75)	(33.71)
Province dummies	Yes	Yes
MHT sector dummy	Yes	Yes
First-stage F-stat	14.68	11.80
Observations	4173	3299

Note: t statistics in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Formalisation and informal costs – IV estimates

	(1) Time costs of red tape	(2) Bribery payments
Formality status	11.25***	3058.9
	(3.03)	(0.38)
Firm size	0.0298	3939.3***
	(0.11)	(3.59)
Gender of owner (male=1; female=0)	0.0756 (0.22)	2429.0 (1.51)
Education of owner (unskilled=0; vocational level=1; college or above=2)	0.443* (1.72)	-1462.1 (-1.26)
Owner's business networks (No. business/govt contacts)	0.000232 (0.19)	2.270 (0.28)
Workforce skill level (Share of unskilled prod. workers)	-0.0575 (-0.22)	-136.0 (-0.08)
Property rights	-0.229	1362.8
	(-0.64)	(0.72)
Road/Port/Rail access (None=0; All=3)	0.0388 (0.31)	
Constant	1.556**	-6354.0**
	(2.48)	(-2.24)
Province dummies	Yes	Yes
MHT sector dummy	Yes	Yes
First-stage F-stat	19.19	2.37
Observations	4187	667

Note: t statistics (reported in parenthesis) are heteroskedasticity robust. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Chapter 4 Capital misallocation and state ownership policy in Vietnam

ABSTRACT This paper examines capital misallocation of manufacturing firms in Vietnam during the period 2008 to 2017. Three sources of capital misallocation are investigated: adjustment costs, uncertainty and policy distortions. The findings reveal modest contribution of adjustment costs to total misallocation. In contrast, policy distortions account for 81 percent of capital misallocation in Vietnam and lead to a TFP gap of 110 percent in the manufacturing sector relative to the undistorted first-best level. The paper examines one specific type of policy distortions – preferential treatments of SOEs – and finds that these policies cause a 38 percent loss in aggregate manufacturing TFP.

A body of men are unfit to be both judges and parties at the same time.
James Madison

Nothing is so permanent as a temporary government program.
Milton Friedman

4.1. Introduction

Productivity differences account for most of the variation in cross-country per capita income (Hall & Jones, 1999; Hsieh & Klenow, 2010; Prescott, 1998; Restuccia & Rogerson, 2017). Recent literature is building the case that a significant fraction of total factor productivity (TFP) gaps are due to the 'misallocation' of productive resources across firms, particularly in developing countries (Gopinath et al., 2017; Guner, Ventura & Yi, 2008; Hsieh & Klenow, 2009; Restuccia & Rogerson, 2017). Misallocation refers to the dispersion in marginal revenue product of inputs, which dampens aggregate productivity. The underlying assumption is that in the undistorted first-best level, firms with higher productivity should be allocated more capital and labour to the point where their (diminishing) marginal revenue product of inputs equalises that of lower-productivity firms. For developing countries, the prevalence of misallocation sows hopes that the path of becoming more productive is not out of their reach: by re-allocating production inputs more efficiently, these economies can substantially raise productivity and consequently incomes.

While the literature has identified resource misallocation as a cause of aggregate productivity losses, relatively few papers have tried to pin down the severity of different sources of misallocation in a unified framework. Misallocation can be broadly attributed to three distortionary sources: (i) Adjustment costs; (ii) Informational uncertainty; and (iii) Other 'distortions' stemming from economic institutions and policies; for example, picking winners or providing preferential treatments to state-owned enterprises (SOEs) (David & Venkateswaran, 2019). It is hard to implement policies to reduce productivity losses from misallocation without knowing the nature of these losses in the first place.

For capital inputs, adjustment costs arise from investment expenditures of the firm. On the one hand, *internal* adjustment costs are related to the adjustment of capital and labour *within* the firm due to the installation of new capital equipment. For instance, the installation of new machinery may cause a temporary decrease in productivity due to the restructuring of production line, the time required to master new skills or the stresses imposed upon managerial capabilities of existing staff. On the other hand, *external* adjustment costs arise when the installation of new capital equipment imposes costs that do *not* directly involve the firm's existing factors of production. Examples include the cost of hiring experts to implement the changes, or the high initial prices of new capital assets due to the price-skimming practice of capital-supplying firms. Adjustment costs are a form of investment distortion that propels firms to smooth out investment over time.

Informational uncertainty refers to the imperfect knowledge about business fundamentals such as future profitability or productivity. Recent research suggests that uncertainty serves as a distortion on firms' investment activities. Handley and Limão (2015) showed that uncertainty over trade policy depresses firms' export investment. Bloom (2009) found that uncertainty causes firms to temporarily pause their investment and hiring. This pause in investment activity freezes efficient input reallocation across firms, which in turn slows down aggregate productivity growth.

Capital misallocation is also the result of other distortions stemming from economic policies and other institutional features (hereafter 'policy distortions'). For example, Guner, Ventura, and Xu (2008) examined government policies that impose restrictions on the size of large firms and/or promote small ones, such as Japan's restrictions on the amount of physical space that a retailer may operate or the EU's supports for small and medium enterprises. The authors concluded that policies which reduced the average firm size by 20 percent lowered output per firm by up to 26 percent. Brandt, Tombe, and Zhu (2013) found that policy distortions across state and non-state

enterprises and across provinces in China reduced aggregate TFP of the non-agricultural sector by 20 percent during the period 1985 to 2007.

This paper seeks to contribute to the literature on capital misallocation in two ways. First, it is one of the few empirical studies able to pin down the severity of different sources of misallocation in a unified framework. The usual practice in the literature has been to analyse each specific source separately, which can lead to biased assessment since misallocation data often reflect a *combined* influence of multiple sources. Only recently have there been studies that analyse multiple distortionary sources in combination. Song and Wu (2015) combined adjustment costs and policy distortions to investigate capital misallocation in China, ignoring the role of uncertainty. Gopinath et al. (2017) examined the impacts of capital adjustment costs and size-dependent financial frictions on capital allocation in Spain, leaving aside uncertainty and other policy distortions. David and Venkateswaran (2019) investigated the contributions of adjustment costs, uncertainty and policy distortions to capital misallocation in the US and China. Their study however did not quantify the impact of any specific policy that resulted in such distortions. Further, the theoretical model in this paper incorporates both capital distortions and labour distortions and is an extension of the capital-distortion model in David and Venkateswaran (2019).

Second, this paper takes advantage of a rich firm-level dataset to examine one specific type of policy distortions in Vietnam: preferential treatments of SOEs relative to non-state firms (hereafter 'state ownership policy'). Previous studies on the misallocation effect of state ownership policy, such as Brandt, Tombe, and Zhu (2013) and Bach (2019), have mostly examined this policy in isolation and failed to account for other sources of capital misallocation such as adjustment costs or uncertainty. To the best of my knowledge, this is the first paper that quantifies the impact of state ownership policy distortions on aggregate TFP in the presence other sources of misallocation.

The paper seeks to address the following research questions:

(a) To what extent is capital misallocated in the Vietnamese manufacturing sector?
(b) What are the contributions of adjustment costs, uncertainty and policy distortions to total capital misallocation and aggregate TFP losses?
(c) Among different policy distortions, how severe is state ownership policy distortion to capital misallocation and aggregate TFP losses?

The findings reveal modest contributions of adjustment costs to total misallocation (1.1 percent) and aggregate TFP losses (1.5 percent). Uncertainty is found

to cause a 35.4 percent loss in aggregate TFP, which should not be surprising given that the studied period covers the Global Financial Crisis, the 2008 oil price shock and their aftermaths. The most severe source of capital misallocation, however, comes from policy distortions, accounting for 81 percent of capital misallocation in Vietnam and causing an aggregate TFP loss of 110 percent relative to the undistorted first-best level. Among different policy distortions, state ownership policy accounts for a significant 38 percent loss in aggregate manufacturing TFP.

The remainder of the paper is structured as follows. Section 2 reviews the related literature on misallocation in general and State ownership policy distortions in particular. Section 3 provides a background of state ownership policy in Vietnam. Section 4 presents the theoretical motivation of the paper. Section 5 explains the identification strategy and parameterisation. Section 6 describes the dataset and variable selection. Section 7 discusses the results and robustness checks. The last section concludes.

4.2. Related literature

This paper relates to a growing body of literature on measuring resource misallocation. The earliest works include Restuccia and Rogerson (2008) and Hsieh and Klenow (2009), who sought to quantify the overall effects of resource misallocation without analysing its different sources.

Another strand of the misallocation literature includes studies that examine a single source of misallocation. On adjustment costs, Cooper and Haltiwanger (2006) explained the observed non-linear correlation between investment and profitability found in plant-level data by developing a model that combines both convex and non-convex adjustment costs. Asker, Collard-Wexler, and De Loecker (2014) studied intra-industry capital misallocation for 40 countries by using a standard investment model with adjustment costs. The authors found that industries with greater variability in productivity have a larger dispersion of the marginal revenue product of capital.

Regarding financial frictions, Buera, Kaboski, and Shin (2011) explained the relationship between financial frictions and aggregate TFP by using a quantitative framework. The authors showed that financial frictions comprise a significant proportion of cross-country differences in output per worker, aggregate TFP and capital-to-output ratios. Developing a model of firm dynamics, Midrigan and Xu (2014) explained that financial frictions reduce aggregate TFP via two channels: (i) Distorting decisions on entry and technology adoption; (ii) Generating a misallocation of capital across existing

producers. Moll (2014) studied the effect of financial frictions on capital misallocation and aggregate TFP by developing a general equilibrium model in which heterogeneous producers encounter collateral problems.

On uncertainty, Bloom (2009) found that uncertainty leads to a temporary pause of firms investment and hiring. This pause freezes efficient input reallocation across firms, thereby slowing down aggregate TFP growth. Bachmann and Elstner (2015) found that manufacturing firms systematically over- or under-predict their production growth by a quarter. Larger and exporting firms are likely to have more realistic expectations while more leveraged firms are likely to have more optimistic expectations. David, Hopenhayn, and Venkateswaran (2016) estimated aggregate productivity and output losses due to informational uncertainty in the US, China and India. The results showed that productivity losses ranged from 7 to 10 percent and output losses ranged from 10 to 14 percent for the cases of China and India. For the US, the figures were smaller but still significant.

On policy interventions, Buera, Moll and Shin (2013) showed that well-intended policy interventions often have large negative long-term effects on aggregate productivity and output because they are difficult to change once in place. Their theory sheds light on two empirical observations about developing countries: idiosyncratic distortions disproportionately affecting productive firms, and temporary growth miracles coming after growth failures. Bartelsman, Haltiwanger, and Scarpetta (2013) studied how a significant variation in the covariance between productivity and firm size across countries can be caused by policy-induced distortions and how this helps explain observed differences in aggregate productivity. Bento and Restuccia (2017) assessed the quantitative impact of policy distortions on aggregate output and average establishment size using a model of heterogeneous firms with endogenous entry and productivity investment. Buera and Fattal-Jaef (2018) found that a policy on removing barriers to firm entry leads to persistent growth in TFP and a decrease in average firm size, while a policy on addressing resource misallocation bring about more protracted TFP paths and a rise in average firm size.

Recent research has begun to shift attention towards analysing a combination of distortionary sources. Song and Wu (2015) investigated capital misallocation in China by combining adjustment costs and policy distortions, without taking into account the role of uncertainty. Gopinath et al. (2017) examined the influence of capital adjustment costs and size-dependent financial frictions on capital allocation in Spain, ignoring uncertainty

and other policy distortions. Kehrig and Vincent (2017) investigated the impacts of financial distortions and adjustment costs on misallocation in the US, leaving aside the impact of uncertainty. David and Venkateswaran (2019) investigated the role of adjustment costs, uncertainty and policy distortions on capital misallocation in the US and China, neglecting specific policy that may contribute to such distortions. Tang (2021) found that removing capital/policy distortions among state and non-state firms would raise aggregate manufacturing TFP of China by 18-29 percent. Her model however does not include uncertainty as a source of misallocation and also does not consider the labour-distorting impact on aggregate TFP from the preferential treatment of SOEs.

The paper also relates to the literature on state ownership policy distortions. Song, Storesletten, and Zilibotti (2011) found that a key source of productivity losses is the misallocation of resources in manufacturing between private and state-owned enterprises in China. Brandt, Tombe, and Zhu (2013) indicated that more than half of TFP loss was due to within-province misallocation of capital between state and non-state sectors. Bach (2019) used the general framework of Hsieh and Klenow (2009) to examine SOEs and capital misallocation in Vietnam, thus ignoring the roles of adjustment costs, uncertainty and non-permanent policy distortions.

4.3. State ownership policy in Vietnam

State-owned enterprises have long been present in the Vietnamese economy. This enterprise form first appeared in Ordinance 104 in 1948 under the term National Enterprise, which was defined as 'enterprise owned and controlled by the nation'. National enterprises were the main engine of the Vietnamese economy during the Vietnam War and were divided into state-owned farms and forest enterprises (in agriculture), state-owned enterprises (in the industry sector) and state-owned shops (in the service sector).

Later, SOEs continued to be given important roles during Vietnam's transition from a centrally-planned economy towards a 'socialist-oriented' market economy. In 1994, inspired by the Japanese *keiretsus* and South Korean *chaebols*, the late Prime Minister Vo Van Kiet introduced Decision 90 and Decision 91 to establish two types of state general corporations (GCs), often referred to as GC 90s and GC 91s (Perkins and Vu-Thanh, 2011). GC 91s are vertically organised; have higher legal capital requirements than GC 90s; and can operate in multiple industries with focus on key industrial areas.

GC 90s, on the other hand, are horizontally organised and each firm can operate in only one industry outside the key areas of Decision 91.

In 1995, the first Law on SOE was introduced which defined SOE as an economic organisation which is capitalised, set up, organised and managed by the State, and carries out business or public utility operations aimed at achieving the socio-economic objectives assigned by the State. SOEs, according to this Law, included only enterprises in which the State invested and owned 100 percent of their charter capital, and were considered the leading force in a multi-sector economy.

From 2003 to 2014, Vietnam made several revisions to the legal framework on SOEs. The 2003 Law on SOE broadened its definition of SOEs to include not only enterprises in which the State owned 100 percent charter capital, but also those in which the State held *dominant* shares or capital contribution. These firms were categorised into three types: state-owned companies, shareholding companies or limited liability companies. Non-state firms were regulated under a separate Enterprise Law issued in 1999.

Two years later, in preparation for the country's accession to the World Trade Organisation (WTO) in 2007, Vietnam enacted the first unified Enterprise Law for state- and non-state firms. SOEs in the 2005 Enterprise Law were defined as firms for which over 50 percent of charter capital is owned by the State. In addition, the Enterprise Law required state-owned companies established in accordance with the 2003 Law on SOE to be converted into limited liability or shareholding companies (with state-owned capital) in no later than four years. Because of this, after 2010 SOEs formally included one-member limited liability firms in which the State held 100 percent charter capital; shareholding companies and two-member or more limited liability companies with more than 50 percent charter capital owned by the State (Decree 99/2012/ND-CP). Large-scale SOEs are generally administered by the line ministries at the central level, while medium and small SOEs are typically managed at the provincial level.

In 2005, the government also piloted the conversion of several strategic GC 91s into state economic groups (SEGs) with the aim of creating powerful domestic firms capable of competing with multinational enterprises and serving as the foundation of the Vietnamese economy after WTO accession. Later, Decree 69 in 2014 stipulated the six criteria that a GC 91 must meet in order to become an SEG: (i) Having profits for three consecutive years preceding the year when it is selected; (ii) Having financial status assessed by the firm's owner as being at a safe level; (iii) Having higher labour

productivity than the average levels of other enterprises in the same sector; (iv) Possessing advanced equipment and technologies and having sound management practices; (v) Effectively managing its shares and capital contributions in other enterprises; and (vi) Having international operations. By 2020, among the ten largest enterprises in Vietnam by revenues, six are SEGs operating in the resources, utilities and ICT sectors (Thanh, 2019).

While viewing SOEs as the leading force of the economy, Vietnam has also been experimenting with the 'equitisation' of these firms for the past three decades. The term 'equitisation' is adopted in legal documents and refers to both *minor* privatisation, in which the State still owns the majority of shares in equitised SOEs, and *majority/full* privatisation, in which the State owns *minor/no* share in the equitised firms. It should be noted that in Vietnam, even after the major privatisation of SOEs, the State can still retain a dominating influence over these so-called private firms. For this reason, the term 'equitisation' will be used in this paper when referring to Vietnam's SOE privatisation process.

The equitisation of SOEs in Vietnam can be divided into three periods. Period 1 (1992-1998) was the *experimenting* stage, with the government carrying out a pilot equitisation program for small-and medium-sized SOEs meeting the following criteria: (i) Having profits; (ii) Non-strategic, i.e. the State did not need to own 100 percent of charter capital; and (iii) Voluntary participation by the firms. The pilot program lasted from 1992 to 1996 and aimed to equitise smaller, non-strategic SOEs before moving on to larger and more strategic firms. Due to its voluntary nature, the program was able to equitise only five SOEs. From 1996 to early 1998, the government tried to expand the pilot equitisation program; yet again the results were modest with only 28 firms being equitised among nearly 6000 existing SOEs at the time.

Period 2 (1998-2007) was the *accelerating* stage, marked by the introduction of Decree 44/1998 on the transformation of SOEs into shareholding companies – the first legal document on SOE equitisation in Vietnam. This Decree removed the voluntary nature of previous equitisation programs and classified SOEs into three groups based on their strategic importance to the State. The *first* group included SOEs of strategic importance over which the State retained full ownership and control. The *second* group contained strategic SOEs in which the State retained dominant or special shares after equitisation. The *third* group included the remaining non-strategic SOEs which were the main subjects of equitisation. From June 1998 to May 2002, there were 845 SOEs being

equitised – most of which were in the third group – accounting for 15 percent of the total number of SOEs but only 2.5 percent of total state-owned capital.

As Vietnam was preparing for WTO accession, the pace of equitisation was further accelerated with the issuance of Decree 64/2002 to replace Decree 44/1998. Decree 64 introduced the formation of welfare funds to provide financial supports and re-training for redundant labourers after equitisation. Non-strategic SOEs with less than VND 5 billion, if they failed to equitise, were required to be transferred, sold, commercially contracted or leased. In addition, the maximum value of shares that foreign investors could buy in equitised SOEs was raised from 20 percent to 30 percent of total charter capital. Two years later, Decree 64/2002 was replaced by Decree 187/2004, which paved the way to the application of market mechanisms in SOE valuation; for example, public auction of shares, independent auditing with foreign professional services firms. As a result of these policies, the number of equitised SOEs rose sharply during the period 2001 to 2007, reaching 3021 firms or 70 percent of the total number of existing SOEs at the time. Yet it should be noted that these equitised firms altogether accounted for less than 10 percent of total state-owned capital.

Period 3 (2008-present) is the *backsliding* stage, with a marked decline in the number of equitised firms. There were only 692 SOEs being equitised from 2008 to 2017, less than 18 percent of the number of equitisation in Period 2 (Nguyen & Trinh, 2019). This was because while the first 15 years of equitisation dealt mostly with small-scale and non-strategic SOEs, equitisation in Period 3 involved large and strategic SOEs with multiple lines of business and in which the State decided to retain dominant or special shares after equitisation. The valuation of these SOEs was often prolonged due to disagreement between the firms' board of directors and the valuation organisations (Le, Nguyen & Taghizadeh-Hesary, 2020).

Further, since the majority of profitable SOEs had been equitised in previous periods, the remaining loss-making SOEs found it hard to attract investors interested in their initial public offerings (IPOs). For instance, in 2018 the Vietnam National Shipping Lines (Vinalines) conducted an IPO for 488.8 million shares, equivalent to 34.8 percent of the total number of shares. There were only 42 investors who registered to the event, most of whom were individual investors. The IPO sold only 1.1 percent of the amount of offered shares, or 0.38 percent of the corporation's charter capital. The poor outcome of the IPO was due partly to the lacklustre financial performance, with key indicators such as return on assets or return on equity falling far below the industry average and the

corporation having an accumulated loss of USD170 million. That the State decided to keep a 65 percent stake in Vinalines was another impediment to its equitisation.

Box 4.1: The prolonged equitisation of the Vietnam Feature Film Studio (VFS)

Founded in 1953, VFS is the largest and oldest state-owned movie studio in Vietnam. The company has produced about 400 feature films and documentaries, many of which won international acclamation, such as '17th Parallel, Nights and Days' (1973), 'The Girl from Hanoi' (1975) or 'When October Comes' (1983).

In 2010, the Ministry of Culture, Sports, and Tourism (MCST) announced the plan to equitise the studio. Following this decision, VFS was weaned off State funds and became mired in financial difficulties. The equitisation of VFS was expected to be completed by 2015, but it was not until 2017 that the first shareholders' meeting of the now Vietnam Feature Film Development & Investment JSC was held.

The slow equitisation was due to both the sizeable financial losses the studio has suffered, including a 20-year accumulating land lease debt that cost almost USD1 million, and the controversial valuation of the studio's intangible assets. For example, despite its historical prestige, the brand value of VFS was valued at *zero*. In addition, the studio's new owner – WaterWay Transport JSC – is a cargo and freight company that has nothing to do with arts, thus raising public concerns that the real purpose of this acquisition was not to resurrect the once-prestigious film studio, but rather to exploit VFS' prime location with highly-valued land in the central business districts of Hanoi and Hochiminh city.

In October 2017, the Deputy Prime Minister Vu Duc Dam ordered an overhaul of the entire VFS equitisation process for further investigation. In March this year, the Government Office directed MCST to reclaim all the previously-sold shares of VFS and return money to the studio's investors.

Source: Ba (2018).

Overall, three points should be noted about state ownership policy in Vietnam. First, the government has never given up on the idea that SOEs should play a 'leading role' in the economy. In Period 1 of equitisation, the 1995 Law on SOE was introduced to promote the leading role of the state sector. In Period 2, the Communist Party of Vietnam (CPV) issued a Resolution in 2001 stating that "State-owned enteprises [are] … the core force, the main contributor for the state economic sector to perform the leading

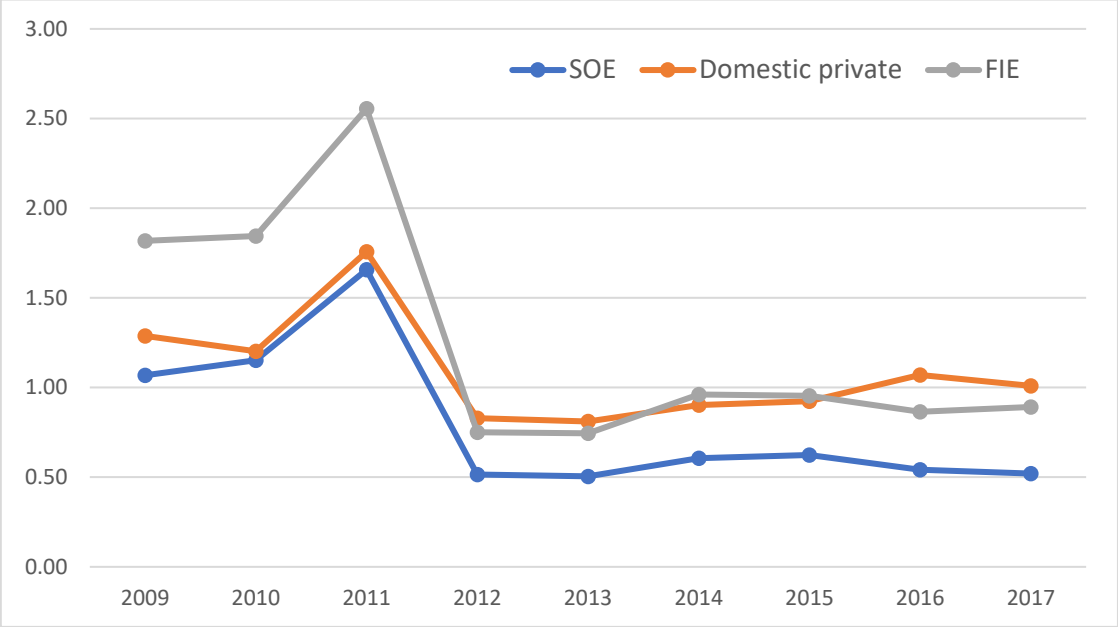
role in the socialist-oriented market economy, and …the main force in international economic integration." Earlier this year, Nguyen Van Binh – the head of the Party Central Committee's Economic Commission – doubled down on the leading role of SOEs in socio-economic development, while the Prime Minister Nguyen Xuan Phuc affirmed the indispensible roles of SEGs as the 'iron fists' of the economy (Nguyen, 2020). The incessant faith in SOEs was further reflected in the fact that after three decades of equitisation and market-oriented reforms, just over 10 percent of total state-owned capital in these enterprises was replaced with private investment.

Second, with their mission to become the leading force of the economy, SOEs have been granted preferential treatment over domestic private firms. In 2017, SOEs made up 0.5 percent of the total number of firms, employed 9 percent of the labour force but held 29 percent of total assets in the economy (Tu, 2019). Compared with domestic private firms, SOEs have preferential access to credit and foreign currencies from the Vietnam Development Bank and the four state-owned commercial banks which are the largest financial institutions in the country. The State also allocated or leased out prime-location land to these corporations at much lower prices than the prevailing market price, which SOEs could in turn use as collateral to obtain even more bank loans (Vu, 2011). Further, the State has often organised the exemption, extension or restructuring of debt repayment obligations for strategic SOEs that are in financial troubles.

Third, different from domestic private firms, SOEs do not see profit maximisation as the ultimate objective. In periods of high inflation, for example, the government often attempts to reduce the sale prices of essential inputs/commodities such as electricity and petroleum below their marginal costs via its guidance of the Vietnam Electricity (EVN) and the Vietnam National Petroleum Group (Petrolimex). In addition, to maintain social equality, the government directs SOEs to invest in poor, remote or mountainous areas despite the high costs and low profit expectations.

The above points mean that State ownership policy are a potential source of capital misallocation. As an important instrument of the State, these enterprises receive preferential access to productive inputs, including capital. However, since SOEs follow a number of socio-economic objectives other than profitability, their productive inputs are unlikely to be utilised efficiently. This can be seen in Figure 4.1, which shows that SOEs' average revenue product of capital is about half the values for domestic private firms and FIEs in recent years, while the average capital stock per firm is the highest among the three firm types.

Figure 4.1: Average revenue (value-added) product of capital by ownership forms



Source: Author's compilation from the VES 2009-17.

It should be noted that this paper examines state ownership policy from a purely *efficiency* viewpoint. Whether the formation of SOEs is beneficial in terms of reducing inequality or maintaining macroeconomic stability is out of the scope of this research. Specifically, the paper explores the impact of Vietnam's state ownership policy on the country's aggregate manufacturing TFP during the period 2008 to 2017. The following section introduces a theoretical framework to address this question.

4.4. Theoretical framework

The framework for examining sources of capital misallocation is an extension of the model in David and Venkateswaran (2019). While their model assumes that distortions *only* affect capital choice, this paper allows for both capital distortions and labour distortions of the same nature to be present in the firm's optimal investment problem. Further, different from David and Venkateswaran (2019) which did not look into any specific policy distortion driving the misallocation of capital, this paper quantifies the distortionary impacts of state ownership policy in Vietnam, taking into account other sources of misallocation.

The model features a discrete-time, infinite-horizon economy populated by a representative household and a continuum of firms of fixed measure one that produce intermediate goods using capital and labour according to a Cobb-Douglas technology:

$$Y_{it} = K_{it}^{\widehat{\alpha_1}} N_{it}^{\widehat{\alpha_2}}, \ \widehat{\alpha_1} + \widehat{\alpha_2} \leq 1 \qquad (1)$$

Intermediate goods are used to produce a single final good according to the constant elasticity of substitution (CES) aggregator:

$$Y_t = \left(\int \hat{A}_{it} Y_{it}^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}}, \qquad (2)$$

where $\theta \in (1, \infty)$ is the elasticity of substitution between intermediate goods and $\hat{A}_{it}$ represents a firm-specific idiosyncratic component in production/demand. $\hat{A}_{it}$ is assumed to be the source of *uncertainty* in the economy.

Applying the cost minimisation condition and Shephard's Lemma to (2) yields the demand function for intermediate good *i*[18],

$$Y_{it} = P_{it}^{-\theta} \hat{A}_{it}^{\theta} Y_t$$

$$P_{it} = \left(\frac{Y_{it}}{Y_t} \right)^{-\frac{1}{\theta}} \hat{A}_{it} \qquad (3)$$

where P_{it} means the relative price of good *i* in terms of the numeraire final good. From (1) and (3), we have the revenues for firm *i* at time *t*:

$$P_{it} Y_{it} = Y_t^{\frac{1}{\theta}} \hat{A}_{it} Y_{it}^{1-\frac{1}{\theta}} = Y_t^{\frac{1}{\theta}} \hat{A}_{it} K_{it}^{\alpha_1} N_{it}^{\alpha_2}, \qquad (4)$$

where

$$\alpha_j = \left(1 - \frac{1}{\theta}\right) \widehat{\alpha_j}, \quad j = 1,2.$$

Input choices. At the end of each period, firms choose investment in new capital, which becomes available for production in the following period. Gross investment is given by $I_{it} = K_{it+1} - (1 - \delta) K_{it}$ where δ denotes depreciation rate. Investment is also subject to quadratic *adjustment costs* – the costs associating with the level of newly installed capital:

$$\phi(K_{it+1}, K_{it}) = \frac{\hat{\xi}}{2} \frac{I_{it}^2}{K_{it}} = \frac{\hat{\xi}}{2} \left(\frac{K_{it+1}}{K_{it}} - (1 - \delta) \right)^2 K_{it},$$

where $\hat{\xi}$ represents the severity of adjustment costs. The underlying idea is that abrupt changes in the level of newly installed capital creat disproportionately higher costs of adjustment for businesses.

[18] Appendix 4.1 contains the proof.

Labour is assumed to experience the same distortion as capital. Firms hire labour period-by-period in a spot market at a competitive wage W. Gross payment to hire incremental labour is given by $M_{it} = WN_{it+1} - (1-\delta)WN_{it}$ where δ in this case denotes employee turnover rate. Labour investment is subject to quadratic adjustment costs similar to capital investment:

$$W\phi(N_{it+1}, N_{it}) = \frac{\hat{\xi}}{2} W \frac{M_{it}^2}{N_{it}} = \frac{\hat{\xi}}{2} W \left(\frac{N_{it+1}}{N_{it}} - (1-\delta) \right)^2 N_{it},$$

where $\hat{\xi}$ represents the severity of adjustment costs. The underlying idea is that abrupt changes in the number of labour cause disproportionately higher costs of adjustment; for example, the costs of training new employees or changing corporate governance structure. In addition, New-Keynesian models with quadratic labour adjustment cost have been shown to generate outcome more in line with empirical observation (Lechthaler & Snower, 2003).

Besides adjustment costs and uncertainty, investment decisions are also affected by policy distortions such as taxes, size-restriction regulations, or preferential treatments to certain regions or firm ownership forms. Following Hsieh and Klenow (2009), the paper models these distortions as firm-specific proportional taxes on the flow cost of capital and labour, denoted T_{it+1}. The firm's dynamic optimisation problem in a stationary equilibrium can be represented in recursive form as:

$$\begin{aligned} \mathcal{F}(K_{it}, N_{it}, \aleph_{it}) = \max_{K_{it+1}, N_{it+1}} & E_{it}[\, Y_t^{\frac{1}{\theta}} \hat{A}_{it} K_{it}^{\alpha_1} N_{it}^{\alpha_2}] \\ & - E_{it}\left[T_{it+1} K_{it+1}\left(1 - \beta(1-\delta)\right) + \phi(K_{it+1}, K_{it})\right] \\ & - E_{it}\left[T_{it+1} W N_{it+1}\left(1 - \beta(1-\delta)\right) + W\phi(N_{it+1}, N_{it})\right] \\ & + E_{it}[\beta \mathcal{F}(K_{it+1}, N_{it+1}, \aleph_{it+1})] \end{aligned} \quad (5)$$

$E_{it}[.]$ denotes the firm's expectations, conditional on its information set at the time of making period *t* investment choices, denoted $\aleph_{it}$. β is the discount rate and βW is the present discounted value of wages. Since the wedge T_{it+1} distorts both capital and labour investment, it affects the stock of capital and labour but not the capital-labour ratio.[19]

PROPOSITION 1: The firm's dynamic optimisation problem can be rewritten as:

[19] For robustness check, the paper considers a simpler model with only capital distortions, in which case T_{it+1} affects both the level of capital and the capital-labour ratio.

$$\tilde{\mathcal{F}}(K_{it}, \aleph_{it}) = \max_{K_{it+1}} E_{it}[\, GA_{it}K_{it}^{\alpha} - T_{it+1}K_{it+1}(1-\beta(1-\delta)) - \phi(K_{it+1}, K_{it})]$$
$$+\beta E_{it}[\tilde{\mathcal{F}}(K_{it+1}, \aleph_{it+1})], \qquad (6)$$

where $\alpha = \alpha_1 + \alpha_2$ is the curvature of operating profits (value-added net of wages); $A_{it} = \hat{A}_{it}$ represents firm productivity; $G = \frac{\eta^{\alpha_2} Y^{\frac{1}{\theta}}}{1+W\eta}$ captures the effects of aggregate variables, with $\eta = \frac{\alpha_2}{W\alpha_1}$.

Proof: See Appendix 4.2.

Stationary equilbrium. Solving for the stationary equilibrium in this economy entails identifying: (i) a set of value and policy functions, $\mathcal{F}(K_{it}, \aleph_{it}), N_{it}(K_{it}, I_{it}), K_{it+1}(K_{it}, I_{it})$; (ii) a wage W; and (iii) a joint distribution over (K_{it}, I_{it}) such that (a) taking as given wage W and I_{it}, the value and policy functions solve the firm's optimisation problem; and (b) the labour market clears.

Adjustment costs. The presence of quadratic adjustment costs means that there is no analytical (exact) solution. The model is solved using pertubation method. The log-linearised Euler equation of investment has the following form:

$$k_{it+1}\big((1+\beta)\xi + 1 - \alpha\big) = E_{it}[a_{it+1} + \tau_{it+1}] + \beta\xi E_{it}[k_{it+2}] + \xi k_{it}, \qquad (6)$$

where lowercase variables denote natural logs of the corresponding uppercase variables, e.g. $k_{it+1} = lnK_{it+1}$. ξ and τ are rescaled and natural-log versions of the *adjustment cost* parameter, $\hat{\xi}$, and the distortion, T_{it+1}, respectively.

Policy distortions. The distortion τ_{it} is assumed to be jointly normal with the natural logs of productivity, a_{it}. Firm-specific productivity A_{it} follows an AR(1) process with normally distributed i.i.d innovations σ_{μ}^2, i.e.

$$a_{it} = \rho a_{it-1} + \mu_{it}, \qquad \mu_{it} \sim N(0, \sigma_{\mu}^2) \qquad (7)$$

Distortion has the following representation:

$$\tau_{it} = \gamma a_{it} + \epsilon_{it} + \chi_i, \qquad \epsilon_{it} \sim N(0, \sigma_{\epsilon}^2), \qquad \chi_i \sim N\big(0, \sigma_{\chi}^2\big)$$

Where γ indexes the extent to which distortion is correlated with firm productivity (correlated distortion), while ϵ_{it} and χ_i are uncorrelated with a_{it}. t. If $\gamma < 0$, the distortion discourages (encourages) investment by more (less) productive firms – arguably, the empirically relevant case. The opposite is true if $\gamma > 0$. ϵ_{it} captures transitory distortion while χ_i is firm-specific distortion that is uncorrelated with productivity. For the purpose of measuring the distortionary impacts of state ownership policy, χ_i is the main factor of

interest. The severity of correlated-, transitory- and permanent distortions is summarised by three parameters: $(\boldsymbol{\gamma, \sigma_\epsilon^2, \sigma_\chi^2})$.

Uncertainty. The information set $\aleph_{it}$ of the firm at the time of choosing period *t* investment includes the entire history of past productivity up to period *t*. Since productivity is assumed to follow an AR(1) process, this history can be summarised by the most recent observation a_{it}. The firm also observes a noisy signal of future productivity/demand:

$$s_{it+1} = \mu_{it+1} + e_{it+1}, \qquad e_{it+1} \sim N(0, \sigma_e^2)$$

where e_{it+1} is an i.i.d, mean-zero and normally distributed 'news shock' that contains information about the following period's productivity/demand. Finally, firms are assumed to be able to observe the transitory distortions ϵ_{it+1} and the fixed component χ_i at the time of choosing period *t* investment.

The firm's information set is given by $\aleph_{it} = (a_{it}, s_{it+1}, \epsilon_{it+1}, \chi_i)$. Applying Bayes' rule to obtain the conditional expectation of future productivity a_{it+1}:

$$a_{it+1} | \aleph_{it} \sim N(E_{it}[a_{it+1}], V) \quad \text{where}$$

$$E_{it}[a_{it+1}] = \rho a_{it} + \frac{V}{\sigma_e^2} s_{it+1}; \qquad V = \left(\frac{1}{\sigma_u^2} + \frac{1}{\sigma_e^2}\right)^{-1}$$

The measure of *uncertainty*, V, has a one-to-one mapping with the quality of future news about productivity/demand. In the absence of any useful news, i.e. $\sigma_e^2 \to \infty$, V = σ_u^2, or the firm has no idea about future shocks to productivity/demand. On the contrary, with full information, i.e. $\sigma_e^2 \to 0$, V = 0 and the firm is perfectly informed about μ_{it+1} and $E_{it}[a_{it+1}] = a_{it+1}$.

Aggregation. Aggregate output can be expressed as

$$logY = y = a + \alpha_1 k + \alpha_2 n,$$

where *k* and *n* represent the logs of aggregate stock of capital and labour inputs, respectively.

In addition, the firm's optimisation problem shown in (5) can be rewritten into (6), which is essentially the optimisation problem in David and Venkateswaran (2019) but with different conjecture and parameter values: $N_{it} = \eta K_{it}$, $\eta = \frac{\alpha_2}{\alpha_1 W}$. Applying their results to the model in this paper using $N_{it} = \eta K_{it}$ and $\eta = \frac{\alpha_2}{\alpha_1 W}$, I obtain aggregate TFP, denoted *a*:

$$a = a^* - \frac{1}{2}\theta \sigma_{mrpk}^2, \quad \frac{da}{d\sigma_{mrpk}^2} = -\frac{\theta}{2}$$

where a^* is the undistorted first-best level of aggregate TFP in the absence of all distortions; that is, $\sigma^2_{mrpk} = 0$.

4.5. Identification strategy

The paper aims to explore the sources of capital misallocation, measured as *mrpk* dispersion, within a unified framework combining adjustment costs, uncertainty and policy distortions. The usual practice in the literature has been to measure each distortionary source with a single statistical moment, which can lead to biased assessment since each moment may reflect a *combined* influence of multiple sources. For instance, the impact of adjustment costs on aggregate productivity is commonly measured by the cross-sectional variance of investment (Asker, Collard-Wexler & De Loecker, 2014), in the sense that higher costs of installing new capital goods tend to reduce investment variance among firms. However, the low investment variance may also reflect the severity of correlated distortions, which encourage investment from low-productivity firms while discouraging investment from high-productivity ones. In this case, the variance of investment alone provides an upward biased assessment of the impact of adjustment costs.

The strategy for untangling these forces is based on the insight that while each moment, such as investment variance, is influenced by multiple distortionary sources, these sources do not have similar effects on *all* moments. Specifically, the paper selects five moments: (i) investment variance; (ii) investment autocorrelation; (iii) the correlation of investment with past productivity; (iv) the covariance of *mrpk* with productivity; and (v) the variance of *mrpk*, to identify the impacts of adjustment costs, uncertainty and policy distortions (correlated, transitory and uncorrelated distortions) on aggregate productivity of the Vietnamese manufacturing sector.

To disentangle *adjustment costs* from *correlated distortions*, for example, the paper uses two moments: investment variance and investment autocorrelation. In the model, under a tractable random-walk case with $\rho = 1$,[20] these two moments can be expressed as:

$$\boldsymbol{\sigma_k^2} = \left(\frac{\psi_2^2}{1-\psi_1^2}\right)(1+\gamma)^2\sigma_\mu^2 + \frac{2\psi_3^2}{1+\psi_1}\sigma_\epsilon^2; \quad \boldsymbol{\rho_{k,k_{-1}}} = \psi_1 - \psi_3^2\frac{\sigma_\epsilon^2}{\sigma_k^2}$$

[20] When $\rho \neq 1$, there is no analytical solution and the paper uses numerical method to show that the intuition from the random walk case still applies.

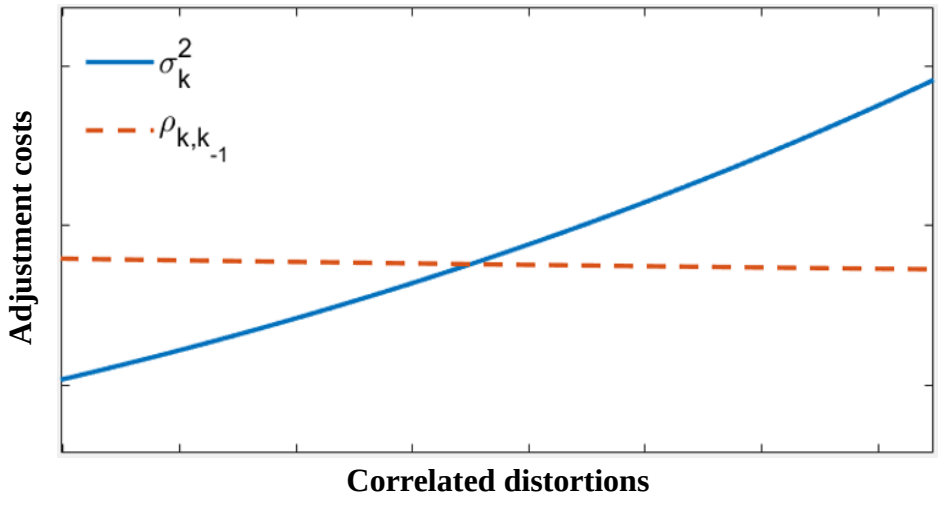
where $\sigma_k^2, \rho_{k,k_{-1}}$ denote investment variance and its autocorrelation, respectively, and

$$\xi\left(\beta\boldsymbol{\psi_1^2}+1\right)=\boldsymbol{\psi_1}\left((1+\beta)\xi+1-\alpha\right);\ \boldsymbol{\psi_2}=\frac{\psi_1}{\xi(1-\beta\rho\psi_1)};\ \boldsymbol{\psi_3}=\frac{\psi_1}{\xi}$$

The coefficient ψ_1 increases in the severity of adjustment costs, ξ, while ψ_2 and ψ_3 decrease in ξ. Thus, an increase in adjustment costs ξ lowers investment variance σ_k^2, holding other parameters fixed. Similarly, an increase in the severity of correlated distortions (more negative γ) reduces σ_k^2. However, adjustment costs and correlated distortions have *opposite* effects on investment autocorrelation $\rho_{k,k_{-1}}$. An increase in ξ is associated with higher ψ_1, lower $\frac{\psi_3^2}{\sigma_k^2}$, and consequently higher $\rho_{k,k_{-1}}$. On the other hand, an increase in correlated distortions lowers σ_k^2 and consequently reduce $\rho_{k,k_{-1}}$.

The above properties are useful in the identification of adjustment costs and correlated distortions. Following David and Venkateswaran (2019), this is done by tracing out two 'isomoment' curves for investment variance σ_k^2 and investment autorcorrelation $\rho_{k,k_{-1}}$ (Figure 4.2). Each isomoment curve indicates the various combinations of (ξ,γ) that give the same value of the relevant moment. Since both higher ξ and more negative γ reduce σ_k^2, the isomoment curve for σ_k^2 is upward sloping. On the contrary, because ξ and γ have opposite effects on $\rho_{k,k_{-1}}$, the isomoment curve for $\rho_{k,k_{-1}}$ is downward sloping. Due to the opposite direction of their slopes, the two isomoment curves cross at the unique combination of (ξ,γ) consistent with the empirical values of both moments.

Figure 4.2: Adjustment costs and correlated distortions



Source: Adapted from David and Venkateswaran (2019).

In a similar fashion, *correlated distortions* are distinguished from *uncertainty* through two moments: the covariance of *mrpk* with productivity and the correlation of investment with past productivity. From the theoretical model, these two moments can be expressed as:

$$\boldsymbol{\rho_{k,a_{-1}}} = \left[\frac{V}{\sigma_\mu^2}(1-\psi_1)+\psi_1\right]\frac{\sigma_\mu\psi_2(1+\gamma)}{\sigma_k}$$

$$\boldsymbol{\lambda_{mrpk,a}} = 1-(1-\alpha)(1+\gamma)\psi_2(1-\frac{V}{\sigma_\mu^2})$$

where $\rho_{k,a_{-1}}, \lambda_{mrpk,a}$ denote the correlation of investment with past productivity and the covariance of *mrpk* with productivity, respectively. Both higher correlated distortions (more negative γ) and higher uncertainty V means larger $\lambda_{mrpk,a}$. This indicates an upward-sloping isomoment curve for $\lambda_{mrpk,a}$. However, correlated distortions and uncertainty have opposite effects on the correlation of investment with past productivity $\rho_{k,a_{-1}}$. Higher correlated distortions lower $\rho_{k,a_{-1}}$ since investment is influenced more by the amount of distortions. Higher uncertainty, on the other hand, increases $\rho_{k,a_{-1}}$ because firms have to rely more on past information to make investment decisions. The opposite effects of correlated distortions and uncertainty on $\rho_{k,a_{-1}}$means that the isomoment curve for $\rho_{k,a_{-1}}$is downward-sloping. Similar to the previous case, because of the opposite direction of their slopes, The two isomoment curves cross at the unique combination of (ξ, V) consistent with the empirical values of both moments.

Transitory distortions (σ_ϵ^2) are disentangled from *correlated distortions* (γ) through two moments: investment autocorrelation $(\rho_{k,k_{-1}})$ and the covariance of *mrpk* with productivity $(\lambda_{mrpk,a})$. Recall the formulas for these two moments:

$$\boldsymbol{\rho_{k,k_{-1}}} = \psi_1 - \psi_3^2\frac{\sigma_\epsilon^2}{\sigma_k^2}$$

$$\boldsymbol{\lambda_{mrpk,a}} = 1-(1-\alpha)(1+\gamma)\psi_2(1-\frac{V}{\sigma_\mu^2})$$

Both higher σ_ϵ^2 and more negative γ reduce investment autocorrelation $\rho_{k,k_{-1}}$, indicating an upward-sloping isomoment curve for $\rho_{k,k_{-1}}$. On the other hand, $\lambda_{mrpk,a}$ is

increasing in the severity of correlated distortions (more negative γ) while independent of transitory distortions σ_ϵ^2. This indicates a straight isomoment curve for $\lambda_{mrpk,a}$. Due to the different direction of their slopes, the two isomoment curves cross at the unique combination of $(\sigma_\epsilon^2, \gamma)$ consistent with the empirical values of both moments.

Finally, *permanent distortions* (σ_χ^2) are matched with the variance of *mrpk* (σ_{mrpk}^2). Higher permanent distortions leads to higher capital distortions τ_{it} and consequently higher dispersion in *mrpk*.

Two points should be noted from this identification strategy. First, the use of different pairwise parameter identification shown above has been proved to *uniquely* identify the four parameters ξ, γ, V and σ_ϵ^2 (David and Venkateswaran, 2019). Second, due to the lack of analytical mapping between moments and parameters in the general case ($\rho \neq 1$) and possible measurement error, the sum of contributions from adjustment costs, uncertainty and policy distortions to aggregate productivity is close but not precisely equal to one. The issue of measurement error will be addressed in the robustness check section.

State ownership policy. Possible candidates for permanent distortions include policies that favour certain ownership forms, regions, or priority sectors. One should note that the term 'permanent' is used with respect to the time period of the study, in this case 2008 to 2017. Without a time frame, it is most likely that no policy can be considered permanent.

Since permanent distortions are matched with the variance of *mrpk* (σ_{mrpk}^2), the contribution of state ownership policy to overall permanent distortions can be proxied by the contribution of state ownership status to σ_{mrpk}^2. In other words, if I express *mrpk* as a linear function of state ownership status, denoted *ownership*, and remaining terms, X:

$$mrpk_{it} = \alpha ownership_i + \boldsymbol{X}$$

The variance σ_{mrpk}^2 can then be expressed as:

$$\sigma_{mrpk}^2 = \left[\alpha^2 \sigma_{ownership}^2 + 2\alpha Cov(ownership, \boldsymbol{X})\right] + \sigma_X^2$$

or

$$1 = \frac{\left[\alpha^2 \sigma_{ownership}^2 + 2\alpha Cov(ownership, \boldsymbol{X})\right]}{\sigma_{mrpk}^2} + \frac{\sigma_X^2}{\sigma_{mrpk}^2}$$

The first term on the right hand side is the contribution of state ownership status in σ_{mrpk}^2, and can be measured as:

$$\frac{\left[\alpha^2\sigma^2_{ownership} + 2\alpha Cov(ownership, \boldsymbol{X})\right]}{\sigma^2_{mrpk}} = 1 - \frac{\sigma^2_X}{\sigma^2_{mrpk}}$$

While it is difficult to measure the left hand term directly, the right hand term can be easily captured through regressing *mrpk* on ownership status and obtaining the variance of the residual (σ^2_X). Since σ^2_{mrpk} is observable from the dataset, $1 - \frac{\sigma^2_X}{\sigma^2_{mrpk}}$ can be measured and used as the proxy for the contribution of state ownership policy to overall permanent distortions.

Parameterisation. The paper sets a period length of one year since the data comes at an annual frequency and assumes a constant discount factor β = 0.95 and an annual depreciation rate $\delta = 0.10$ as standard in the misallocation literature (Hsieh and Klenow, 2009; David, Schmid and Zeke, 2019). In the main model, elasticity of substitution is set at $\theta = 3$, similar to what was used for China and India in Hsieh and Klenow (2009). For robustness checks, the paper also uses $\theta = 6$ as in David and Venkateswaran (2019).

In addition, labour's share of payments to factors of production is measured as the average share of total labour compensation in total manufacturing value-added during the period 2008 to 2017 and equals $\hat{\alpha}_2 = 0.60$. Capital's share is calculated as the residual of labour's share, $\hat{\alpha}_1 = 1 - \hat{\alpha}_2 = 0.40$, as in Bai, Hsieh and Qian (2006), and $\alpha = \hat{\alpha}_1 + \hat{\alpha}_2 = 1$.

The persistence of productivity, ρ, and the volatility of productivity shocks, σ^2_μ, are estimated from the autoregressive equation (7), controlling for industry-year fixed effects. The log of firm-level productivity can be directly computed as $a_{it} = va_{it} - \alpha k_{it}$.

To estimate adjustment costs ($\hat{\xi}$), uncertainty (V), correlated distortions (γ), transitory distortions (σ^2_ϵ) and persistent distortions (σ^2_χ), the paper targets the five moments as described in the previous section: (i) investment variance; (ii) investment autocorrelation; (iii) the correlation of investment with past productivity; (iv) the covariance of *mrpk* with productivity; and (v) the variance of *mrpk.* Since unobserved firm-level fixed effects have been shown to affect firm-level investment data (Morck, Shleifer and Vishny, 1990), investment *growth* rates are used instead of levels in the empirical analysis.

The impact of state ownership policy on aggregate productivity is estimated in five steps: (1) Regressing *mrpk* on ownership dummy using a random-effect regression to extract the residual; (2) Calculating the variance of the residual; (3) The proportional

impact of state ownership policy in permanent distortions is calculated as one minus the ratio of residual variance over *mrpk* variance; and (4) Multiplying the proportional impact of state ownership policy in permanent distortions with the impact of permanent distortions on aggregate productivity.

The parameters are estimated via the moment matching technique (MM), developed by Mcfadden (1989). MM uses simulations to find moments as a function of model parameters, instead of trying to solve the moment conditions analytically as the classical method of moments does. For this paper, MM is selected because there is no analytical mapping from moments to parameters in the model. To implement MM, the paper starts with four equations:

Investment policy function: $k_{it} = \psi_1 k_{it-1} + \psi_2(1+\gamma)E_{it-1}[a_{it}] + \psi_3 \epsilon_{it+1} + \psi_4 \chi_i$

Investment: $\iota_{it} = k_{it} - k_{it-1}$

Productivity: $a_{it} = \rho a_{it-1} + \mu_{it}$

Conditional expectation of productivity: $E_{it-1}[\, a_{it}] = \rho a_{it-1} + \frac{V}{\sigma_e^2} s_{it+1}$

$$= \rho a_{it-1} + (1 - \tfrac{V}{\sigma_\mu^2})\mu_{it} + \left(1 - \tfrac{V}{\sigma_\mu^2}\right) e_{it}$$

These equations can be rewritten in matrix form:

$$BX_{it} = CX_{it-1} + DU_{it} \text{ where } X_{it} = \begin{bmatrix} k_{it} \\ \iota_{it} \\ a_{it} \\ E_{it-1}a_{it} \end{bmatrix};\ U_{it} = \begin{bmatrix} \mu_{it} \\ e_{it} \\ \epsilon_{it} \\ \chi_i \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & 0 & 0 & -\psi_2(1+\gamma) \\ -1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad C = \begin{bmatrix} \psi_1 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & \rho & 0 \\ 0 & 0 & \rho & 0 \end{bmatrix} \quad D = \begin{bmatrix} 0 & 0 & \psi_3 & \psi_4 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 - \frac{V}{\sigma_\mu^2} & 1 - \frac{V}{\sigma_\mu^2} & 0 & 0 \end{bmatrix}$$

Pre-multiplying by B^{-1} gives:

$X_{it} = B^{-1}CX_{it-1} + B^{-1}DU_{it} = \tilde{C}X_{it-1} + \tilde{D}U_{it}$

The steady-state covariance matrix of X_{it}, denoted $\sum_X$, is then obtained by solving the Lyapunov equation:

$\sum_X = \tilde{C} \sum_X \tilde{C}' + \tilde{D} \sum_U \tilde{D}'$, where $\sum_U$ denotes the covariance matrix of U_{it}.

A non-linear solver is then used to search over the parameter vector $(\xi, V, \gamma, \sigma_\epsilon^2, \sigma_\chi^2)$ to minimise the equally weighted distance between the simulated values and observed values for the targeted moments.

Table 4.1: Summary of key parameters

Parameter	Description	Target/Value
t	Time period	1 year
$\hat{\alpha}_1$	Capital share	0.40
$\hat{\alpha}_2$	Labour share	0.60
β	Discount rate	0.95
ρ	Persistence of productivity	Estimates of (7):
σ_μ	Shocks to productivity	$a_{it} = \rho a_{it-1} + \mu_{it}$
V	Uncertainty	$\rho_{i,a_{-1}}$
$\hat{\xi}$	Adjustment costs	$\rho_{i,i_{-1}}$
γ	Correlated distortions	$\rho_{mrpk,a}$
σ_ϵ^2	Transitory distortions	σ_i^2
σ_χ^2	Permanent distortions	σ_{mrpk}^2

4.6. Data

The data on Vietnamese manufacturing firms are from the annual Vietnam Enterprise Surveys (VES) conducted by the General Statistics Office (GSO). The paper uses data spanning the period 2008 to 2017, which corresponds to Period 3 of SOE equitisation in Vietnam. In this period, the remaining SOEs are mostly large in size and operate in what the State deems as strategic sectors. Thus the State often exerts dominant influence over these firms even after majority privatisation.

The VES provides the most comprehensive and authoritative firm-level survey in Vietnam, covering all SOEs and FIEs as well as domestic private firms exceeding certain employment thresholds. For domestic private firms below the employment thresholds, a subsample is selected based on stratified random sampling across sectors and provinces (see Appendix 4.3). All registered firms, if selected, are required to participate in the VES according to the Statistics Law 2015.

The paper measures nominal firm-level capital stock in each period as the year-end value of physical assets, e.g. buildings, tools, machineries. The real value of capital stock is calculated as nominal capital divided by capital deflators. Capital deflators are computed by dividing the value of gross fixed capital formation at current prices by that at 2010 constant prices.

Real value-added is measured as the difference between real output and real intermediate inputs. Under the double deflator method, gross output and intermediate inputs are deflated using different deflators. Real output is computed through deflating

gross outputs by the producer price index of industrial products at 2010 baseline at the two-digit VSIC level from the GSO. Following Athukorala & Nguyen (2019), the deflator for each sector's intermediate inputs is computed as the weighted shares of the deflators of products used as intermediate inputs in that sector. The weighted shares are calculated using the 2012 Input-Output table, where the 164 sectors are aggregated.

Marginal revenue product of capital (*mrpk*) is measured by subtracting the log of real capital inputs from the log of real value-added and adding the log of the constant term α. Net investment growth and productivity growth are computed by first differencing the log of real capital and the log of TFP, respectively. In addition, the paper extracts the industry-by-year fixed effects from net investment growth and productivity growth and use the residuals of each series. This is equivalent to the assumption that all firms within a 5-digit manufacturing industry operate identifical production technologies and have identical markups.

Further, firms with missing or negative data on value-added, capital/labour inputs are excluded from the sample. The paper also removes duplicate observations and outliers, i.e. eliminating firms with annual investment growth rate more than 100 percent in absolute values, and trimming the 3-percent tails of *mrpk* series. The final sample contains 76988 firm-year observations.

4.7. Results

Table 4.2 reports the target moments for manufacturing firms in Vietnam. The first two columns show firm-fundamental processes, including persistence of productivity and the volativity of productivity shocks. The remaining five columns show the five key moments used to pin down the severity of adjustment costs, uncertainty, correlated-, transitory- and permanent distortions: correlation of investment with past productivity ($\rho_{i,a_{-1}}$); autocorrelation of investment ($\rho_{i,i_{-1}}$); correlation of *mpk* with productivity ($\rho_{mpk,a}$); variance of investment (σ_i^2); and variance of *mrpk* (σ_{mrpk}^2).

Table 4.2: Target moments for manufacturing firms in Vietnam

Persistence (ρ)	Volatility (σ_μ^2)	Corr. of investment with past productivity ($\rho_{i,a_{-1}}$)	Autocorr. of investment ($\rho_{i,i_{-1}}$)	Corr. of *mpk* with productivity ($\rho_{mpk,a}$)	Variance of investment (σ_i^2)	Variance of *mrpk* (σ_{mpk}^2)
0.77	0.33	0.23	-0.42	0.70	0.42	0.91

Source: Author's compilation.

Table 4.3 contains the main results. The top panel displays the parameter estimates. The second panel reports the contribution of each distortionary source to dispersion in *mrpk*, denoted $\Delta\sigma^2_{mrpk}$. The third panel expresses the contribution as a percent of the total *mrpk* dispersion measured in the data, denoted $\frac{\Delta\sigma^2_{mrpk}}{\sigma^2_{mrpk}}$. Because of the approximation method and possible measurement error, these relative contributions do not necessarily sum to one. Finally, in the bottom panel of the table, the paper computes the implied losses in aggregate TFP stemming from each factor relative to the undistorted first-best level ($\Delta a = a^* - a$).

Table 4.3: Sources of capital misallocation

			Distortions			
	Adjustment costs	Uncertainty	Correlated	Transitory	Permanent	State ownership policy
Parameters	ξ	V	γ	σ^2_ϵ	σ^2_χ	$\frac{\sigma^2_{ownership}}{\sigma^2_\chi}$
	0.07	0.24	-0.64	0.00	0.40	0.64
$\Delta\sigma^2_{mpk}$	0.01	0.24	0.33	0.00	0.40	
$\frac{\Delta\sigma^2_{mpk}}{\sigma^2_{mpk}}$	1.1%	26.1%	36.9%	0.0%	43.9%	
$\boldsymbol{\Delta a}$	**1.5%**	**35.4%**	**50.2%**	**0.0%**	**59.7%**	**38.2%**

Source: Author's compilation.

Overall, distortions create a productivity gap of 147 percent relative to the undistorted first-best level, meaning that productivity can more than double the current level if capital is efficiently allocated. Among the difference sources of misallocation, adjustment costs and transitory policy distortions play a relatively modest role, accounting for 1.1 percent and 0.0 percent of total capital misallocation. This translates to a negligible TFP loss of 1.5 and 0 percent relative to the first-best level. Uncertainty makes up 26.1 percent of capital misallocation and causes a TFP loss of 35.4 percent. This is not surprising as the studied period covers the Global Financial Crisis, the 2008 oil shock and their aftermaths.

The largest source of capital misallocation in Vietnam comes from policy distortions, particularly correlated and permanent distortions. The former account for 36.9 percent of total misallocation and generate a TFP gap of 50.2 percent relative to the first-best level. Permanent distortions are even worse, making up 43.9 percent of total

misallocation and causing a TFP loss of 59.7 percent. These figures should be alarming to Vietnamese policy makers.

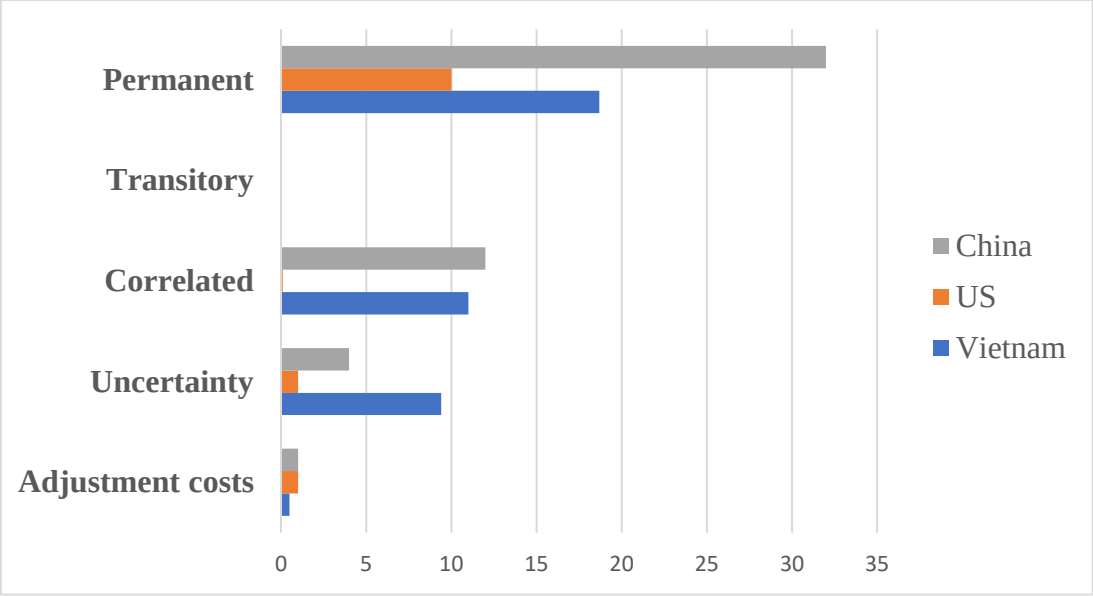
Further, among many possible policy distortions, state ownership policy alone makes up 64 percent of permanent distortions and accounts for 38.2 percent loss of manufacturing TFP relative to the first-best level. This indicates the urgency of reforming SOEs and letting these firms operate according to market principles.

4.8. Robustness checks

4.8.1. Benchmarking misallocation

To ensure that the result from previous section remains robust to different specifications, the paper estimates the model with only capital distortion and elasticity of substitution $\theta = 6$ as in David and Venkateswaran (2019). Further, outcomes for Vietnam are benchmarked against the results for China and the US from their study (see Figure 4.3 below). It should be noted that the time period for China and the US is from 1998 to 2009, while that for Vietnam is from 2008 to 2017.

Figure 4.3: Comparisons of TFP losses from misallocation (%)



Source: Author's compilation.

From figure 4.3, it is clear that assuming away distortions in the labour market greatly reduces the magnitude of misallocation sources. For example, with distortions in the labour market, correlated and permanent distortions cause TFP losses of 50.2 percent and 59.7 percent, respectively, in Vietnam. In figure 4.3, however, these two distortionary sources generate respective TFP losses of 11 percent and 18.7 percent relative to the first-

best level.

Among the three countries, China incurs the highest TFP losses from capital misallocation. Its largest source of misallocation comes from permanent policy distortions, suggesting that China's state ownership policy and its picking-winner industrial policy distort the efficient allocation of capital. In contrast, the US is the most efficient economy in the benchmarking group, with TFP loss from permanent policy distortions less than a third that of China.

For Vietnam, while the magnitudes of distortions differ from those in table 4.3, the implications stay the same. Adjustment costs and transitory distortions cause a negligible TFP losses of 0.5 percent and 0 percent, respectively. The largest source of capital misallocation comes form policy distortions, which altogether account for 80 percent of capital misallocation and leads to a 28.7 percent loss of aggregate manufacturing TFP. In addition, Vietnam has higher TFP loss from informational uncertainty than China and the US, suggesting the presence of higher barriers to information for firms in Vietnam.

4.8.2. Measurement error

Measurement error is an important and challenging concern for the misallocation literature. First, marginal revenue product of capital is proportional to average revenue product of capital only under a Cobb-Douglas production assumption. Second, revenues or inputs from different subsidiaries within an enterprise may be omitted or double-counted. Third, some revenues or inputs may be recorded not in the year they actually occurred, a problem known as transitory mismeasurement. In an important recent contribution, Bils, Klenow and Ruane (2021) propose a method to estimate the role of additive measurement error[21], which essentially involves estimating the following regression:

$$\Delta va_{it} = \phi mrpk_{it} + \psi \Delta k_{it} - \psi(1-\lambda) mrpk_{it}.\Delta k_{it} + D_{jt} + \epsilon_{it}$$

where Δva_{it} and Δk_{it} denote changes in log value-added and capital respectively; D_{jt} indicates industry-year fixed effects and $mrpk_{it}$ is the log of the marginal revenue product of capital. According to Bils, Klenow and Ruane (2021), λ represents the ratio of the true σ^2_{mrpk} to the observed σ^2_{mrpk}. Estimating this regression in the data yields

[21] The *difference* between true values and observed/measured values.

estimates for $\lambda = 0.82$ in Vietnam (see Appendix 4.4), suggesting that 18 percent of the observed σ^2_{mrpk} can be accounted for by additive measurement error. Thus, the lower bound for state ownership policy distortion is 0.82*0.382 = 31.3 percent loss of aggregate TFP relative to the first-best level.

4.9. Conclusion

In this paper, I have examined the misallocation of capital among manufacturing firms in Vietnam during 2008-17 and how state ownership policy contributed to such misallocation. The analysis specifically focused on three questions: (i) To what extent is capital misallocated in Vietnam's manufacturing sector? (ii) What are the contributions of adjustment costs, uncertainty and policy distortions to total misallocation and aggregate productivity losses? (iii) How does state ownership policy contribute to total capital misallocation and aggregate productivity losses?

The paper seeks to contribute to the literature on capital misallocation in two ways. First, it is one of the few empirical studies able to pin down the severity of different sources of misallocation in a unified framework. The usual practice in the literature has been to analyse each specific source separately, which can lead to biased assessment since misallocation is often influenced by multiple sources simultaneously. Second, the paper, to the best of my knowledge, provides the first study that quantifies the impact of state ownership policy distortions on aggregate productivity in the presence other distortionary sources. Previous studies on the misallocation effect of state ownership policy have mostly examined this policy in isolation and failed to account for other sources of capital misallocation such as adjustment costs or uncertainty.

The findings reveal that capital is significantly misallocated in Vietnam's manufacturing sector. Altogether, distortions create a TFP gap of 147 percent relative to the undistorted first-best level, meaning that productivity can more than double the current level if capital is efficiently allocated. Among the difference sources of misallocation, adjustment costs play a negligible role compared with uncertainty and policy distortions. The latter in particular account for 81 percent of capital misallocation in Vietnam and a TFP gap of 110 percent relative to the first-best level. State ownership policy alone accounts for a 38 percent loss of aggregate productivity in the country's manufacturing sector. While it is unlikely that the undistorted first-best level can ever be achieved, the severity of TFP losses due to state ownership policy highlights the urgency

of reforming current SOEs and ensuring a level-playing field regardless of ownership forms.

Last but not least, the theoretical framework in this paper leaves ample room for future research. Since correlated distortions play a significant role in capital misallocation, studies that examine specific size-dependent policies would contribute to our understanding of this distortionary source. Another promising direction is to investigate how labour market rigidity leads to labour misallocation and aggregate productivity losses. For example, India's 1947 Industrial Disputes Act required companies to seek government approval to fire employees or to shut down – a bureaucratic process that often takes years and disincentivises entrepreneurs to formally register new firms and hire additional workers. This year, the Indonesian government introduced the Jobs Creation Law aiming to reduce labour market rigidity, which created a nationwide protest from students and labour unions. To what extent such policies affect aggregate productivity is an important question for policy makers and academics alike and can be addressed using the framework proposed in this paper.

Appendix 4.1

Here we provide a brief proof for the specific case of two intermediate goods Y_{1t} and Y_{2t} under a CES production function:

$$Y_t = \left[\hat{A}_{1t} Y_{1t}^{\frac{\theta-1}{\theta}} + \hat{A}_{2t} Y_{2t}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} \qquad \theta \in (1, \infty) \qquad (1)$$

Marginal productivity of inputs:

$$MP_{Y_{1t}} = \frac{\partial Y_t}{\partial_{Y_{1t}}} = \frac{\theta}{\theta - 1} Y_t^{\frac{1}{\theta}} \left(\hat{A}_{1t} Y_{1t}^{-\frac{1}{\theta}}\right)$$

$$MP_{Y_{2t}} = \frac{\partial Y_t}{\partial_{Y_{2t}}} = \frac{\theta}{\theta - 1} Y_t^{\frac{1}{\theta}} \left(\hat{A}_{2t} Y_{2t}^{-\frac{1}{\theta}}\right)$$

Applying the cost minimisation condition, where P_{1t} is price of Y_{1t} and P_{2t} is price of Y_{2t}:

$$\frac{MP_{Y_{1t}}}{MP_{Y_{2t}}} = \frac{P_{1t}}{P_{2t}} = \frac{\hat{A}_{1t}}{\hat{A}_{2t}} \left(\frac{Y_{1t}}{Y_{2t}}\right)^{-\frac{1}{\theta}} \rightarrow Y_{2t} = Y_{1t}\left[\frac{P_{1t}^{\theta}}{P_{2t}^{\theta}} \frac{\hat{A}_{2t}^{\theta}}{\hat{A}_{1t}^{\theta}}\right] \qquad (2)$$

Plug (2) into (1) to obtain:

$$Y_{1t}(P_{1t}, P_{2t}, Y_t) = Y_t \left(\frac{\hat{A}_{1t} c(P_{1t}, P_{2t})}{P_{1t}}\right)^{\theta} \quad (3)$$

$$Y_{2t}(P_{1t}, P_{2t}, Y_t) = Y_t \left(\frac{\hat{A}_{2t} c(P_{1t}, P_{2t})}{P_{2t}}\right)^{\theta} \quad (4)$$

where $c(P_{1t}, P_{2t})$ is the unit cost function:

$$c(P_{1t}, P_{2t}) = \frac{P_{1t}Y_{1t} + P_{2t}Y_{2t}}{Y_t} = \left(\hat{A}_{1t}^{\theta} P_{1t}^{1-\theta} + \hat{A}_{1t}^{\theta} P_{1t}^{1-\theta}\right)^{\frac{1}{1-\theta}} \quad (5)$$

Without loss of generality, let $c(P_{1t}, P_{2t})$ serve as the numeraire. From (3) and (4), we have: $Y_{it} = P_{it}^{-\theta} \hat{A}_{1t}^{\theta} Y_t$ (i=1,2)

or

$$P_{it} = \left(\frac{Y_{it}}{Y_t}\right)^{-\frac{1}{\theta}} \hat{A}_{1t}$$

Revenues for firm *i* at time *t* are: $P_{it}Y_{it} = Y_t^{\frac{1}{\theta}} \hat{A}_{1t} Y_{it}^{1-\frac{1}{\theta}} = Y_t^{\frac{1}{\theta}} \hat{A}_{1t} K_{it}^{\alpha_1} N_{it}^{\alpha_2}$

where $\alpha_j = (1 - \frac{1}{\theta})\hat{\alpha}_j$, j=1,2.

Appendix 4.2

From equation (5), we can derive the first-order conditions with respect to K_{it+1} and N_{it+1}:

$$E_{it}\left[T_{it+1}\left(1 - \beta(1-\delta)\right) + \phi_1(K_{it+1}, K_{it})\right] = E_{it}[\beta\alpha_1 Y^{\frac{1}{\theta}} \hat{A}_{it+1} K_{it+1}^{\alpha_1 - 1} N_{it+1}^{\alpha_2} - \beta\phi_2(K_{it+2}, K_{it+1})]$$

$$WE_{it}\left[T_{it+1}\left(1 - \beta(1-\delta)\right) + \phi_1(N_{it+1}, N_{it})\right]$$

$$= E_{it}[\beta\alpha_2 Y^{\frac{1}{\theta}} \hat{A}_{it+1} K_{it+1}^{\alpha_1} N_{it+1}^{\alpha_2 - 1} - \beta W\phi_2(N_{it+2}, N_{it+1})]$$

The set up can be solved by conjecture method. Specifically, let us suppose that the firm's labour choice takes the form $N_{it+1} = \eta K_{it+1}$. Equation (5) can be rewritten as:

$$\mathcal{F}(K_{it}, \aleph_{it}) = \max_{K_{it+1}} E_{it}[\frac{\eta^{\alpha_2}}{1 + W\eta} Y^{\frac{1}{\theta}} \hat{A}_{it} K_{it}^{\alpha_1 + \alpha_2} - T_{it+1} K_{it+1}(1 - \beta(1-\delta))]$$

$$+ E_{it}[-\phi(K_{it+1}, K_{it}) + \beta\mathcal{F}(K_{it+1}, \aleph_{it+1})] \quad (4.2.1)$$

Denote $\{K_{it}^*\}$ to be the solution to the above optimisation problem. The first order condition yields:

$$E_{it}\left[T_{it+1}\left(1 - \beta(1-\delta)\right) + \phi_1(K_{it+1}^*, K_{it}^*)\right] = E_{it}[\frac{\beta(\alpha_1 + \alpha_2) Y^{\frac{1}{\theta}} \hat{A}_{it+1} K_{it+1}^{*\alpha_1 + \alpha_2 - 1} \eta^{\alpha_2}}{1 + W\eta}]$$

$$-E_{it}[\beta\phi_2(K^*_{it+2}, K^*_{it+1})] \qquad (4.2.2)$$

Substituting $N^*_{it} = \eta K^*_{it}$ into the first-order condition for labour, we have:

$$E_{it}\left[T_{it+1}\left(1-\beta(1-\delta)\right) + \phi_1(K^*_{it+1}, K^*_{it})\right] = E_{it}\left[\frac{\beta\alpha_2 Y^{\frac{1}{\theta}}\hat{A}_{it+1}K^{*\alpha_1+\alpha_2-1}_{it+1}\eta^{\alpha_2}}{W\eta}\right]$$

$$-E_{it}[\beta\phi_2(K^*_{it+2}, K^*_{it+1})] \qquad (4.2.3)$$

Equation (4.2.3) will be identical to equation (4.2.2) if and only if

$$\frac{\alpha_1+\alpha_2}{1+W\eta} = \frac{\alpha_2}{W\eta} \text{ or } \eta = \frac{\alpha_2}{W\alpha_1} \qquad (4.2.4)$$

In this case, the sequence $\{K^*_{it}, N^*_{it}\}$ also satisfies the first-order condition for capital from equation (5):

$$E_{it}\left[T_{it+1}\left(1-\beta(1-\delta)\right) + \phi_1(K^*_{it+1}, K^*_{it})\right] = E_{it}\left[\beta\alpha_1 Y^{\frac{1}{\theta}}\hat{A}_{it+1}K^{*\alpha_1+\alpha_2-1}_{it+1}\eta^{\alpha_2} - \beta\phi_2(K^*_{it+2}, K^*_{it+1})\right]$$

$$= E_{it}\left[\frac{\beta\alpha_2 Y^{\frac{1}{\theta}}\hat{A}_{it+1}K^{*\alpha_1+\alpha_2-1}_{it+1}\eta^{\alpha_2}}{W\eta} - \beta\phi_2(K^*_{it+2}, K^*_{it+1})\right]$$

What I have demonstrated is that the firm's optimisation problem shown in (5) can be rewritten into (4.2.1), which is similar to the optimisation problem in David and Venkateswaran (2019), with $\alpha = \alpha_1 + \alpha_2, G = \frac{\eta^{\alpha_2} Y^{\frac{1}{\theta}}}{1+W\eta}$ and $A_{it} = \hat{A}_{it}$.

Appendix 4.3

Coverage of the VES during 2008-2017

VES	Survey 100% enterprises	Sampling	Exceptions
2008-2009	- State-owned enterprises (100% state capital or equitized state-owned enterprises with over 50% state capital); - Foreign direct investment enterprises; - Non-state enterprises with 10 or more employees; - 24 provinces with little number of enterprises (*).	Sampling 15% of all non-state enterprises with < 10 employees	- Hanoi: 15% of all non-state enterprises with <20 employees; - Ho Chi Minh city: 15% of all non-state private enterprises with <30 employees.
2010-2013	- State-owned enterprises (100% state-owned or equitized state-owned enterprises with over 50% state capital); - Foreign direct investment enterprises; - Non-state enterprises with 20 or more employees; - 16 provinces with little number of enterprises (**).	Sampling 20% of all non-state enterprises with < 20 employees	- Dong Nai, Binh Duong and Hai Phong: 20% of all non-state enterprises with < 30 employees; - Ho Chi Minh City, Hanoi: 10% of all non-state enterprises with <20 employees and 20% of all non-state enterprises with 20-49 employees.
2014-2017***	- State-owned enterprises (100% state-owned or equitized state-owned enterprises with over 50% state capital); - Foreign direct investment enterprises; - Non-state enterprises with 100 or more employees; - 16 provinces with little number of enterprises (**).	50% of non-state enterprises with 50-99 employees; 20% of those with 10-49 employees; 10% of those with <10 employees	- Da Nang, Dong Nai, Binh Duong and Hai Phong: 30% of all non-state enterprises with 50-99 employees; 10% of those with 10-49 employees; 7% of those with <10 employees; - Ho Chi Minh City, Hanoi: 20% of all non-state enterprises with 50-99 employees; 10% of those with 10-49 employees; 3% of those with <10 employees.

Source: Author's compilation from the VES 2008-2017. Table format is adapted from Athukorala & Nguyen (2019).

Note: (*) 24 provinces with little number of enterprises include Ha Nam, Ninh Binh, Ha Giang, Cao Bang, Lao Cai, Bac Kan, Lang Son, Tuyen Quang, Yen Bai, Lai Chau, Dien Bien, Son La, Hoa Binh, Quang Tri, Phu Yen, Kon Tum and Gia Lai , Dak Lak, Dak Nong, Ninh Thuan, Binh Phuoc, Hau Giang, Tra Vinh, Bac Lieu.

(**) 16 provinces with little number of enterprises include Ha Giang, Cao Bang, Bac Kan, Tuyen Quang, Lao Cai, Dien Bien, Lai Chau, Son La, Yen Bai, Lang Son, Ninh Thuan, Kon Tum, Dak Nong, Tra Vinh, Hau Giang, Bac Lieu

(***) 2016 is the census year so all registered firms are surveyed.

Appendix 4.4

Estimating additive measurement error

	(1) Δva
$mrpk$	0.182***
	(0.002)
Δk	0.331***
	(0.005)
$mrpk * \Delta k$	-0.059***
	(0.004)
Constant	0.161***
	(0.002)
Industry-year FE	Yes
Observations	76,988
R-squared	0.24

Note: standard errors in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Chapter 5 Conclusion

5.1. Main themes and findings

Productivity differences account for most of the variation in cross-country per capita income. Since the early 2000s, the question of what determines productivity has become a major subject of research. The thesis aims to contribute to this literature through examining the sources of productivity growth in Vietnam, an emerging country that has been transitioning from a centrally-planned economy to a more market-oriented one since 1986. Three sources of productivity growth are investigated: the persistence of export activities and the transition of informal firms into the formal sector (within sources); and capital misallocation (between source).

Vietnam provides a meaningful setting to study these three topics. First, the country is one of the most globalised economy in the world, with total trade exceeding 200 percent of GDP since 2017. A growing number of firms have been engaging in global production networks, thanks to the massive inflow of foreign direct investment. Second, the informal sector still plays a pivotal role in the country's economy. Informal firms however are limited in their competitiveness, technology application, formal credit access and management skills, leading to low productivity. Third, Vietnam's political regime makes it an interesting case to study the influence of state ownership policy distortions on aggregate productivity. Last, the country has rich panel datasets that can be employed to address the above-mentioned topics.

The thesis is structured in five chapters. The introductory chapter presents the motivation for the thesis; why Vietnam is selected; the datasets; and a preview of the research questions, methodology and key findings of the three core chapters.

Chapter 2 examines the relationship between export and firm learning, with evidence provided on the learning mechanisms of exporters in Vietnam during the period 2010 to 2017. Using the dynamic random effect probit estimation with unobserved heterogeneity, the findings confirm the self-selection hypothesis that exporters are more productive than non-exporters prior to export entry. In terms of learning by exporting, the chapter employs a dynamic panel data model, estimated by the generalised method of moments technique, to reveal opposite patterns of learning between exporters who pursue their export activities persistently and intermittent exporters whose export is merely a temporary activity. The former experience a U-shaped pattern of ex-post productivity, while the latter exhibit an inverted U-shaped learning pattern. The paper also finds that

compared with intermittent exporters, persistent exporters are more likely to receive technology transfer from foreign buyers and are more likely to invest in technology, infrastructure and staff training in order to meet the requirements of export contracts. Altogether, the evidence suggests a commitment of persistent exporters to expand product variety or improve quality standards which is often a costly and time-consuming process. The short-lived gain in ex-post productivity of intermittent exporters, on the other hand, implies that the quality of their export goods is not far from the quality of what they already sell domestically. These findings help explain why previous studies that treated exporters as a homogeneous group tend to find ambiguous evidence of learning by exporting.

Chapter 3 examines the transition of Vietnam's informal household businesses into formal firms and its impacts upon firm-level productivity and incurred informal costs. Based on a panel dataset of formal and informal firms during 2007-2015, the chapter employs a matched difference-in-difference model to find that such transition, known as 'formalisation', leads to higher investment, greater capital stock and an increase in labour productivity, which ranges between 23 and 82 percent. Formalisation however does not bring about statistically significant improvement in total factor productivity. What this means is that the gain in labour productivity comes from capital deepening rather than true innovation. For robustness checks, the chapter instruments the formality status variable with the share of formal firms within the same sector, province and time period excluding the firm of interest. The results stay robust when using IV estimator and different model specifications.

Furthermore, the chapter finds that household firms have to incur higher informal costs after joining the formal sector. Specifically, managers have to allocate an additional 5 to 8 percent of their time to deal with government regulations and spend an extra VND 9 to 12 million for bribery payments after their household businesses become formal. The presence of such informal costs is in line with anecdotal evidence from the local media and helps explain the low rate of formalisation in the dataset.

Chapter 4 examines capital misallocation of manufacturing firms in Vietnam during the period 2008 to 2017. The paper adopts a general equilibrium model to disentangle the roles of the three sources of capital misallocation: adjustment costs, informational uncertainty and policy distortions. The theoretical model is then estimated via the moment matching technique, which seeks to minimise the equally weighted distance between simulation model values and observed values of the targeted moments.

Based on data from the annual Vietnam Enterprise Surveys 2008-2017, the paper finds that overall, distortions create a productivity gap of 147 percent relative to the undistorted first-best level, meaning that productivity can more than double the current level if capital is efficiently allocated. Among the difference sources of misallocation, adjustment costs play a negligible role compared with uncertainty and policy distortions. The latter account for 81 percent of capital misallocation in Vietnam and a productivity gap of 110 percent relative to the first-best level. State ownership policy alone accounts for a 38-percent loss of aggregate manufacturing productivity, indicating the urgency of reforming state-owned enterprises and ensuring a level-playing field regardless of ownership forms. Even after accounting for potential measurement error, state ownership policy still generates a lower-bound distortion of 32 percent loss of manufacturing productivity.

5.2. Contributions and policy implications

The thesis makes several contributions to the literature on productivity. First, it shows that the extent of exporters' learning varies with their persistence, intensity and duration of export activities. Ignoring these factors can lead to ambiguous findings of learning-by-exporting effects. These findings contribute to the recent empirical literature that explores how heterogeneity in firms' characteristics and behaviours affects their export decisions and learning outcomes.

Second, the analysis in Chapter 2 distinguishes between FIEs and local firms. The former tend to be 'born-global' businesses that are export-oriented by birth and whose export-entry decisions may differ markedly from those of local exporters.

Third, the thesis sheds light on the the role of export contracts in facilitating exporters' learning. Two specific channels are examined, namely technological transfers from foreign buyers, and self-investment in technology, infrastructure and staff training in order to meet requirements of export contracts. Despite their importance, these two learning channels have rarely been explored in the literature due to the scarcity of relevant data.

Fourth, the thesis provides one of the first empirical studies to examine both the micro-level benefits and cost sides of formalisation. Most previous studies only focus on its potential benefits. This is understandable as information on the incurred informal costs of household firms are often nonexistent. Such a one-sided approach is, however, limited in its ability to explain why informal firms are often hesitant to join the formal sector, despite the potential benefits.

Fifth, the thesis incorporates one of the very few empirical studies that is able to pin down the severity of different sources of misallocation in a unified framework. The usual practice in the literature has been to analyse each specific source separately, which can lead to biased assessment since misallocation is often influenced by multiple sources simultaneously.

Sixth, the thesis, to the best of my knowledge, provides the first study that quantifies the impact of state ownership policy distortions on aggregate productivity in the presence of other distortionary sources. Previous studies on the misallocation effect of state ownership policy have mostly examined this policy in isolation and failed to account for other sources of capital misallocation such as adjustment costs or uncertainty.

Three policy implications are raised in the thesis. First, exporting *does* benefit learning, but only if it is maintained for a number of years. This result is robust for both persistent- and intermittent exporters. It is thus important for export promotion agencies to pay careful attention on this persistence aspect, in addition to getting more firms to export. Policies that can reduce the costs of export should be welcome. At the moment, Vietnam is still facing many connectivity challenges that raise the costs of exporting, such as uneven quality of transport infrastructure; underdeveloped logistics services, particularly those for domestic markets; under-utilised trade corridors in some areas while congested corridors in others (Oh et al., 2019). Logistics costs in Vietnam, for example, are estimated to range from 20.9 percent to 25 percent of the country's GDP, more than double the world average figure of 12 percent. In light of this, infrastructure development should become a policy priority for the Vietnamese government.

Second, despite the numerous preferential treatments in terms of credit access or land grant, SOEs do not show any superior performance in terms of export orientation or learning compared with private domestic firms. Worse yet, as the analysis in Chapter 4 has shown, state ownership policy creates significant aggregate productivity losses relative to the first-best level. This highlights the urgency of reforming current SOEs and ensuring a level-playing field regardless of ownership forms.

To do this, the government should consider accelerating the pace of SOE equitisation and letting these enterprises operate according to market principles. Currently, SOEs do not have the autonomy to make profit-maximising decisions. For example, in periods of high inflation, the government often instructs SOEs to reduce the sale prices of essential inputs/commodities such as electricity and petroleum below their marginal costs. In addition, although the Law on Investment of State Capital in Production

and Business of Enterprises entitles SOEs the freedom to lease, mortgage and pledge fixed assets on the principle of efficiency, preservation and development of capital, in practice mortgage and pledge contracts must go through the managing state agencies for approval. Such procedures bring about inefficiency and should be removed.

Third, since formalisation is found to raise labour productivity of informal firms, the Vietnamese government should continue its efforts of encouraging more household businesses to join the formal sector. In order to achieve this, the expected benefits of formalisation should clearly outweigh its expected costs. On the benefit side, the recent 2018 Law on Assistance for Small and Medium-Sized Enteprises is one step in the right direction. Article 16 of this Law stipulates the various forms of supports for formalised businesses, such as free consultancy and guidance on enterprise establishment procedures, tax administrative and accounting procedures within 3 years from the date on which the first BRC is issued; exemption from business registration fees and licensing fees within 3 years from the issuing date of first BRC; and remission of corporate income tax and land tax for a certain period of time. In addition, after formalisation, firms also enjoy the general support for SMEs in terms of access to credit; production premise rental; market information; corporate governance training and legal assistance services. What is further needed is to ensure that these policies are actually implemented in practice.

Fourth, the government should strive to tackle the persistent problem of informal costs, including the cost of time firms must spend dealing with red tape as well as the informal fees of doing business in the formal sector. The presence of bureaucracy and corruption, albeit petty, is likely to reduce the trust of household business owners on the government's goodwill support for formalisation. Policymakers should strive to reduce the risk of corruption through simplifying administrative procedures, digitalising public services, monitoring and enforcing anti-corruption laws to deter engagement in corruption practices by both public officials and firm managers.

5.3. Suggestions for future research

Besides making contributions to the literature on productivity, the thesis also leaves ample room for future research. First, on the topic of exporting and productivity gains, an interesting question is whether export destinations matter. Baliamoune-Lutz (2019), for example, found that exporting to developed countries improved the sophistication of exports by developing economies. The author also found an income effect for export sophistication, that is, the gain in sophistication became larger when the income gap

between export destination and exporting country grew wider. One can test this idea at the micro level using the TCS datasets as in Chapter 2.

Second, another topic that is related to learning by exporting is learning by *importing*. Here lie numerous opportunities for research. Similar to the analysis in Chapter 2, one can explore the presence of learning by importing and whether there is any difference between persistent importers and intermittent importers, or between domestic private firms and FIEs. In addition, an investigation into the potential channels of learning by importing will make a great contribution to the literature on firm learning.

Third, on the topic of formalisation, it would be interesting to see if the results for Vietnam still hold true in another developing country's setting. As informality is a prevalent feature in virtually all developing economies, the SME surveys used in Chapter 3 should be carried out in other emerging countries in order to understand the characteristics and dynamics of the informal sector.

Fourth, another interesting direction of research is the impact of formalisation on labour welfare and environmental practices. Informal firms are often associated with a lack of social protection for employees and an unawareness of environmental standards. The SME surveys contain two sections on employment and environment that can shed light on these two meaningful topics.

Finally, since correlated distortions play a significant role in capital misallocation, studies that examine specific size-dependent policies would contribute to our understanding of this distortionary source. Another promising direction is to investigate how labour market rigidity leads to labour misallocation and aggregate productivity losses. For example, India's 1947 Industrial Disputes Act required companies to seek government approval to fire employees or to shut down – a bureaucratic process that often takes years and disincentivises entrepreneurs to formally register new firms and hire additional workers. This year, the Indonesian government introduced the Jobs Creation Law aiming to reduce labour market rigidity, which created a nationwide protest from students and labour unions. To what extent such policies affect aggregate productivity is an important question for policy makers and academics alike and can be addressed using the framework proposed in this paper.

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