Financial integration, trade, and productivity

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Tôi biết ơn ban lãnh đạo trường Đại học Ngân hàng, đặc biệt là khoa Tài chính, nơi tôi đã, đang, và sẽ làm việc. Mọi người đã khuyến khích và hỗ trợ tôi theo đuổi chương trình tiến sĩ ở Hà Lan và chào đón tôi trở về. Tôi cũng trân trọng cảm ơn anh Hùng, chị Minh, và em Mai thuộc phòng Tổ chức cán bộ vì những hỗ trợ quí giá. Tôi cũng trân trọng cảm ơn Phó giáo sư Tiến sĩ

Vương Đức Hoàng Quân và ông Phạm Bình An ở Viện nghiên cứu Phát triển Tp. Hồ Chí Minh vì đã tiếp đón tôi trong thời gian tôi thực hiện một phần nghiên cứu tại Việt Nam.

Trên hết, tôi muốn bày tỏ lòng biết ơn sâu sắc đến gia đình tôi, sự ủng hộ và tình yêu vô bờ bến của gia đình tôi- mẹ tôi, mẹ chồng tôi, anh Thịnh, chị Hiền, chị Hiên, anh Cảnh, anh Thống, chị Hà, anh An, chị Các, dì Huê, dì Hoa, chú Tám, các cô, chú, cậu, bác, và các cháu. Tất cả đã giúp tôi tiếp bước, và cuốn luận văn này sẽ không thể hoàn thành nếu không có họ. Cuối cùng, tôi muốn bày tỏ lòng biết ơn đối với chồng tôi, anh Hợp, đã ủng hộ cho giấc mơ của tôi. Tôi nợ anh sự kiên nhẫn và hi sinh cao cả. Sức mạnh của anh đã lèo lái con thuyền của chúng tôi vượt qua nhiều cơn bão. Tình yêu dành cho con gái tôi, Nhiên, đã cho tôi sức mạnh để hoàn thành cuốn luận văn này.

An Thi Thuy Duong

Ho Chi Minh city, May 2020

Contents

List of Tables

List of Figures

Chapter 1

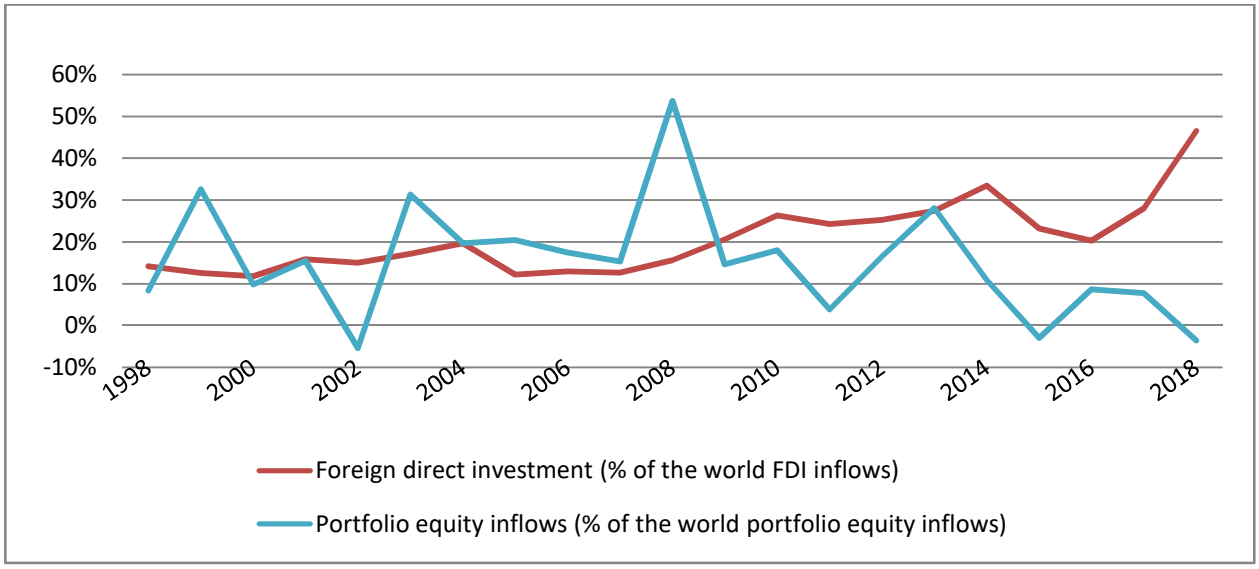
Introduction

1.1 Motivation and background

Over the past few decades, the world economy has been undergoing an unprecedented wave of economic integration, reflected by rapid growth in cross-border trade and capital flows. Between 1990-2010 global foreign direct investment (FDI) inflows rose by 862 percent, while export increased by 337 percent.[1]East Asia is no exception to this trend. This region has made significant progress towards deeper economic integration. The establishment of multilateral and bilateral trade agreements has significantly removed trade barriers, thus stimulated trade integration in the region. Several financial collaborations within the region have facilitated cross-border holding of financial assets and promoted regional financial stability. The share of the region in global FDI inflows rose from 14% in 1998 to nearly 50% in 2017 (Figure 1.1). Over the same period, its share in world exports increased from 23% to 31% (Figure 1.2). Deeper economic integration is attributed to the outward orientation policy that many East Asian economies have adopted since the 1960s.This policy has been the major enabler of flows of foreign investment and technology while it helped to expose the domestic industries to international competition, hence contributed to the premium economic growth of the region, even when China is not included (Martin, 2001; Ito, 2017; Minghui, 2018; Mason and Shetty, 2019).

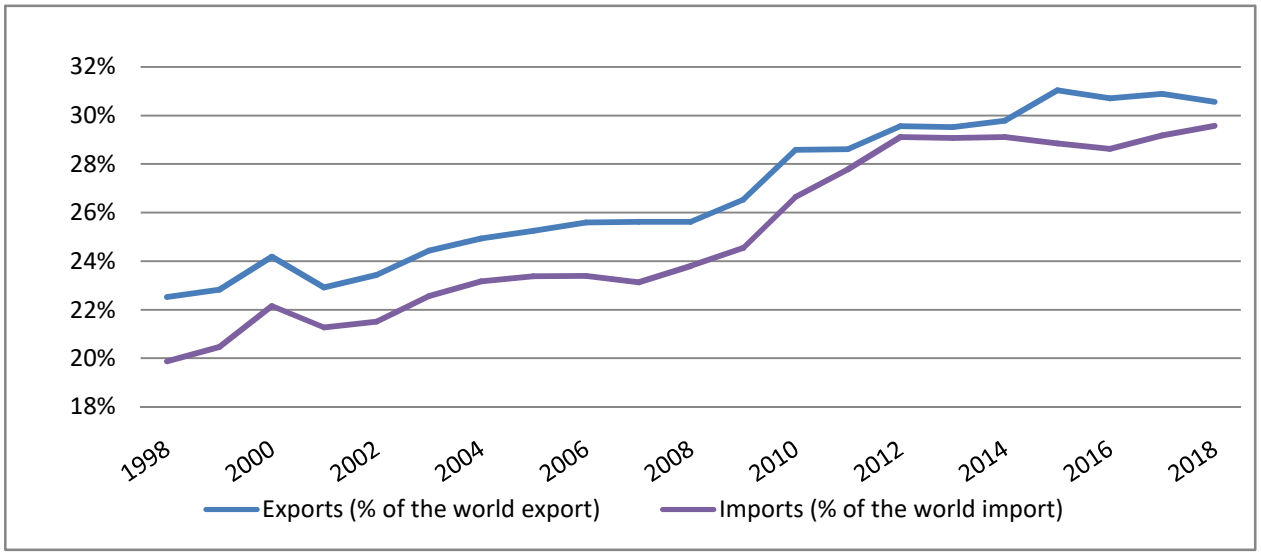
[11] Author's calculation from data provided by the World Development Indicators.

Figure 1.1: East Asia Pacific capital inflows



Source: World Development Indicators.

Figure 1.2: East Asia Pacific trade



Source: World Development Indicators.

Still, the economic development process in East Asia remains incomplete. Amid a highly successful transition of several economies, there are large gaps among the economies in terms of size, income, human capital, and skills. Japan and Singapore are at the top of the high-income

scale, while Viet Nam, the Philippines, and Indonesia are at the lower end of the middle-income scale. By 2017, Japan has a GDP per capita that was 26 times greater than that of Viet Nam, while the labor productivity of Singapore was 31 times greater than that of Viet Nam.[2]Against the economic heterogeneity backdrop, the recent stagnation in global trade, and the rapid technological change, coupled with the rise of nationalism, anti-globalization, and anti-immigration pose challenges to the sustainability of the past successful models. Of crucial importance is the thorough understanding of the macro- and micro-economic implication of economic integration in the transforming process. A more rigorous analysis of the precise role of openness of trade and finance on the success or failure of reforms in the transition economies can help reinforce the current understanding while open the new avenue of knowledge.

This thesis focuses on Viet Nam as this country provides an extremely interesting case to measure how economic integration has contributed to the transition process of the country. After decades of war and followed by years of economic stagnation, the country began a series of economic reforms that are so-called "Doi Moi" (Revolutionary) in 1986. The core of the reform was the abandoning of the central-planned system and its replacement by the "market-oriented with state guidance" economy. The economic take-off has been remarkable. Since the 1990s, Viet Nam has experienced an average GDP growth rate of 6.8 percent, which makes Viet Nam one of the fastest-growing countries in the world.[3] The macroeconomic success can be largely attributed to the implemented strategies with respect to export-orientation and the attraction of FDI since the early 1990s (Thoburn, 2009). At the same time, a relatively fast growth rate of labor productivity combined with the growing labor force has lifted the country from low-income to middle-income status within two and a half decades. Thoburn (2009) describes Viet Nam as a role model for development with the core of rapid integration into the world economy. Even though many elements in the development process of Viet Nam that this thesis will highlight are present in more than one economy's experience, the path to a successful transition is not singular but varies across country and depends on its circumstance and constraints

[2]Data for GDP, GDP per capita is from World Development Indicator, data for labor productivity is from the International Labor Organization.

[3]Data is from the World Development Indicator for GDP growth (annual %) of 217 economies over the period 1990-2017.

(Martin, 2001). Therefore, experience in the transition process of Viet Nam can provide useful comparative advantage lessons to other economies in transition.

1.2 Aim of the thesis and place in the literature.

Understanding the process and consequences of economic integration is important. This thesis aims to contribute to our understanding of economic integration and its implication on finance, trade, and productivity. The focus on finance, trade, and productivity stems from the fact that the core of economic integration lies in mutual gains from cross-border trade and investments in potential increase in possibility of efficiency. Indeed, the neoclassical growth model predicts that economic integration promotes cross-border flows of trade and investments and alleviates capital constraints of countries. This results in more capital inflows and raises funds available for productive investments (Acemoglu and Zilibotti, 1997), hence contributes significantly to the economic welfare and constitutes a necessary condition for the convergence of income to occur (for example, Fischer, 1998; Summers, 2000; Prasad et al., 2003).This is particularly important for Viet Nam as this country has just rapidly increased its presence in international trade and recently removed the cross-border financial barriers.

The second chapter aims to provide a basic understanding of the transition process of Viet Nam's economy together with insightful discussions on the evolution of economic integration between Viet Nam and the other East Asia economies. This chapter contributes greatly to improving the understanding of trade and financial reforms in the East Asian transition economies.

Financial integration may be reflected in lower correlations between domestic savings and investments (Feldstein and Horioka, 1980), improved risk-sharing (Obstfeld, 1994), better consumption smoothing (Obstfeld and Rogoff, 1996), or decreasing international portfolio diversification benefits (Carrieri et al., 2007; Bekaert et al., 2009). A number of empirical papers aim to access the degree of financial integration in Asia and have not been able to provide conclusive evidence. Several studies indicate that regional financial integration has been strengthened (Guillaumin, 2009; Yu et al., 2010, and Hinojales and Park, 2011) while others claim that the East Asian financial markets are somewhat segmented (Kim et al., 2008; Park and Lee, 2011, Claus and Lucey, 2012). Chapter 3 aims to provide an assessment of the degree of

financial integration in East Asia. Given the vast diversity in the level of economic development in East Asia, coupled with changes in the global economic environment, the natural questions arise: Is the degree of regional financial integration identical among the East Asia economies? Is regional financial integration progressing, standstill or even regressing in light of recent financial cooperation efforts within the region? The contribution of this chapter mainly concentrates in providing comprehensive evidence of the development of the financial integration in Asia after the 1997 crisis. In addition, this chapter addresses to this literature by shedding more light on the speed of financial integration in East Asia during the turmoil period 2008-2009.

Economic integration brings a wider market. However, even with greater access to the international markets, firms may not be able to seize the opportunities due to the presence of high fixed (and variable) costs at the time of entry, resulting in the exit of low productivity firms (Metliz, 2003; Chaney, 2005). At the country level, the degree of financial development would promote trade finance and hence influence the trade patterns (Kletzer and Bardhan, 1987; Beck, 2002; Matsuyama, 2005). At the sector level, financial constraints negatively affect the number of export destinations, export variety, and aggregate trade volumes (Manova, 2013). Several empirical papers at the firm-level have found evidence that better access to finance enables firms to overcome the financial barriers to participate in exporting (Berman and Hericourt, 2010; Bellone et al, 2010; Amiti and Weinstrein, 2011; and Muuls, 2015, among others).Other papers find the reversed causality that exporting improves a firm's financial health (Greenaway et al., 2007).Yet researchers have not reached an agreement regarding the extent to which financial constraints shape export activities. This motivates the following questions: Has external finance accessibility been a critical determinant of the firm's exporting entry? How, if at all, does the limited access to external finance hamper firms' likelihood of exporting? Chapter 4 aims to answer these questions. In doing so I bridge the financial and real integration into one framework, that explores the interconnectedness of the two aspects of economic integration. Firms without financial constraints can pay the upfront costs in participating in the exporting market, thus are more likely to start exporting. My contribution in Chapter 4 lies in adding firm-level evidence to the literature on firm heterogeneity in trade, and which enriches our understanding of the impact of finance on trade at the firm level. Moreover, the finding of an inverse U-shape relationship between leverage and the export probability for private

manufacturers extends and complements the current literature that typically suggests a monotonic relationship regardless of ownership type. Lastly, Chapter 4 also offers evidence that medium and high productive firms are more sensitive to financial constraints than the low productive ones.

Studies on growth and development have shown that a large share of cross-country variation in economic development is explained by the differences in Total Factor Productivity (TFP), which is in turn largely affected by the degree of economic integration, especially trade.[4]Advancing economic integration involves interaction with international buyers or sellers that spurs the diffusion of advanced technology or know-how. For example, international buyers may offer technical assistance to the sellers to meet the buyers' quality standards (Grossman and Helpman, 1991; Evenson and Westphal, 1995). Competition with other international sellers to remain in the international market may also induce firms to increase productivity (Damijan and Kostevc, 2006; De Loecker and Koujianou, 2014; De Loecker and Van Biesebroeck, 2016). Nevertheless, Keller (2009) claims that there exists less empirical evidence on technology diffusion from exporting channels rather than importing channels. Therefore, it is important to further analyze the learning effect from exporting to augment Keller's arguments. Chapter 5 asks if trade integration has bolstered productivity. In detail, it asks how participating in export promotes TFP at the firm-level. This chapter contributes to the literature in three aspects. First, we test, for the first time, the learning-by-exporting（LBE） hypothesis for Vietnamese manufacturing firms to see if the LBE exists. By doing so, we add evidence at the firm-level to the current literature that seeks for the existence of LBE effect. Second, we use the state-of-art TFP estimation methods at the firm-level to correct for selection bias and endogeneity issues, which are typically found in the traditional TFP estimation method, and thus provide more accurate TFP estimates. Third, we account for selection bias, arising by the exit of less productive

[4] For empirical evidence, see Bonfiglioli (2008) at country-level, Henry and Sasson (2008) at industry-level. At aggregate level, a number of studies have found that the imported capital goods resulting from capital inflows from the advanced-economies usually embody technological progress and play a key role in determining domestic Total Factor Productivity (TFP) (Delong and Bradford, 2004; Keller, 2004). An alternative view suggests that financial integration has fostered international risk sharing so that riskier and more productive projects get financed at the country level, which ultimately raises aggregate TFP(Saint-Paul, 1992; Obstfeld, 1994). Financial integration is also associated with a drop in industrial markups and improved entry-exit dynamics, thereby increasing competition. This in turn improves aggregate productivity in the short-run (Levchenko et al.,2008).

exporters, by applying proper methods of measuring productivity and using a propensity score methodology with nearest-neighbor matching.

1.3 Thesis outline

This thesis entitled "Financial integration, trade, and productivity" consists of five chapters. After a brief introduction, Chapter 2 gives an overview of economic integration in East Asia with a focus on Viet Nam. Chapter 3 empirically assesses the degree and development of financial integration among the East Asia economies. Chapter 4 examines how the access to financial resources affects trade integration, more specifically exports at the firm-level. Chapter 5 further investigates the productivity impact of trade integration.

In Chapter 2, I begin by providing a comprehensive overview of the macroeconomic economic development of Viet Nam after the 1997 Asian Financial Crisis and stress contemporary challenges in terms of productivity and macroeconomic stability. I then examine the economic integration in two sides: the real side with a focus on the development of Vietnamese exports and the financial side with a focus on the inflow of FDI in Viet Nam. I find, first, that during the last two decades, Viet Nam has experienced fast income growth owing to a high productivity growth rate and a strong increase in the labor force as the result of substantial reforms. However, the income and labor productivity levels are still much lagging behind other East Asian economies, exposing the country to the middle-income-trap risk. I next show that East Asia's intra-regional economic integration has progressed steadily during the last two decades. For Viet Nam, international trade has taken off with two-digit growth rates per year since 1998. The current account has shifted from a deficit to a surplus since 2012, mainly supported by a positive trade account. Viet Nam's exports have not only grown in volume but also have changed in composition. The export basket has shifted somewhat from low-skill intensive goods to high-skill intensive goods. Notably, this trend has mainly led by the foreign sector. Other A10 economies are the most important trading partners and also investors of Viet Nam.

One important implication of this chapter is the convergence path of the country toward a higher-income status in which labor productivity plays the main role. The recent stagnation in economic growth has posed the country as a likely candidate for the middle-income trap. As the transformation process is ongoing, much effort could be put on promoting productivity growth.

Another important implication of this chapter is on the macroeconomic stability that inflation control is the main concern. Increasing integration into the world economy may exacerbate the adverse effect of the external shocks. This requires an effective management to guide the economic development process.

Having established some stylized facts regarding trade and financial integration in East Asia, Chapter 3 further explores the financial integration process in East Asia. It also incorporates the 2008 global financial turmoil in the analysis to analyze how financial integration evolves in light of the crisis. To do so, I use daily data from 11 Asian equity markets from 31 May 2002 to 1 June 2018 and divide the sample period into periods before, during, and after the 2008 Global financial crisis. I also divide the 11 markets into high-, upper-middle-, and lower-middle-income groups. I apply four different commonly used methodologies to assess the degree of financial integration: beta-convergence, sigma-convergence, the Markov regime-switching model, and the Dynamic Conditional Correlation (DCC) model. The result of this study indicates that the measures of financial integration based on equity price and return have progressed steadily at divergent pace across economies. To some degree, the degree of financial integration of these three groups mirrors their differences in economic development. Japan, Singapore, Korea, Hong Kong, and Taiwan are among the most integrated economies, followed by China, and Thailand. Indonesia shows evidence of integration at a modest level. Malaysia and the Philippines appear to be largely segmented from the region though the level of integration has picked up recently. Viet Nam displays no evidence of integration albeit there is evidence of increasing return co-movement.

Accessing the degree of financial integration in the East Asia region has several important implications. For investors, portfolio diversifications across economies in the same income group should bring little benefits to investors. In contrast, portfolio diversifications across income groups bring more benefits. Moreover, the presence of weak correlation and slow convergence between the Vietnamese stock market and the benchmark market points to the potential portfolio diversification gains. For policymakers, understanding the degree of regional financial integration is important in evaluating the potential benefits of consumption smoothing and risk sharing as well as its potential financial contagion risks.

Chapter 4 bridges financial and trade integration by focusing on the role of finance on trade at the firm-level. I examine how limited access to external finance, in conjunction with low productivity hinders the opportunity to participate in exporting using a comprehensive firm-level database for Viet Nam over the period 2009-2014. I start the analysis by documenting some stylized facts about exporters in term of productivity, size, age, and level of capital intensity. I then examine the effect of financial constraints on a firm's export participation, i.e. the extensive margin of trade. The analysis distinguishes between types of exporters, which are new-exporters and continuous-exporters; and between types of firm ownership, which are foreign-owned (FOE), state-owned (SOE), and private-owned (POE) firms. Finally yet importantly, I investigate the role of financial constraints in conjunction with productivity in shaping the extensive margin of trade.

Our results suggest that borrowing constraints significantly affect the export decision for POEs. Different from other literature, I find that private manufacturers face a non-constant effect of borrowing constraints on the export decision. That is, the relationship between leverage and export probability for POEs manufacturers is concave. At low leverage levels, more borrowing increases a firm's exporting probability. At high leverage, more borrowing decreases this probability. For SOEs and FOEs, leverage does not play a significant role, probably due to softer financing constraints, but tangible assets remain important. Furthermore, the results indicate that borrowing constraints matter both for the decision to start exporting and for the decision to continue exporting, and more so for the latter. In addition to that, the high and medium productive firms generally depend more on borrowing constraints than the low productive ones.

The implication of this study for government policy is clear: to promote trade integration at the firm level, the government has to ease the credit access to the firms that want to engage in international trade, especially the private firms.

While chapters 2, 3, and 4 focus on the processes of economic integration and the interaction between finance and trade, chapter 5 takes a look at the implication of trade on productivity. I study the learning-by-exporting effect, which postulates that firms increase productivity as a result of exporting. Selection bias is the main challenge in estimating such an effect. This chapter accounts for selection bias by applying proper methods of measuring productivity and

using a propensity score methodology with nearest-neighbor matching. The first part of the empirical section deals with the econometric issues in estimating the firm-level TFP, which are the simultaneity of input decisions and unobserved productivity, inducing endogeneity issues, and the selection bias which arises since low productivity firms are more likely to exit from the sample. To this end, I use Olley-Pakes (1996) approach as this approach controls for endogeneity and selection bias. I also measure TFP using the Levinsohn and Petrin (2000) approach and De Loecker (2013) approach for robustness checks. I analyze a comprehensive dataset on Vietnamese private manufacturers covering 2009 to 2014. I find that the LBE effect exists for Vietnamese firms during the 2009 to 2014 period. It is significant, large in magnitude, and robust across matching methodologies and approaches to estimating total factor productivity (TFP). The productivity premium is positive and statistically significant at the 5% level, not only in the year a firm starts to export but also in the following year.

These results have important implications. Much recent policy debate on strategies of export-led growth has questioned the effectiveness of the export-oriented policy on firm productivity. This paper suggests that exporting can positively improve firm-level productivity and hence drive aggregate productivity.

1.4 Limitations and directions for future research

This thesis is subject to several limitations. In Chapter 3, the limitations are related to data. First, we used stock indices from 11 economies in East Asia, but do not cover the stock market of Brunei Darussalam, Cambodia, Lao, Myanmar due to these being either non-existent or under-developed markets.[5][6]

Second, since the degree of financial integration is compared to the regional benchmark index, the choice of a regional index may affect the results. For the analysis, we choose Morgan Stanley Capital International All Countries Frontier Market Asia (MSCI ACFM Asia) index as the benchmark regional index. This index is constituted by 15 economies, among which India,

[5] The 11 economies covered in Chapter 3 are China, Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Thailand, Taiwan, and Viet Nam.

[6] By 2018, the market capitalization of listed domestic companies in Cambodia, or Lao, or Myanmar is 442, 128, and 393 million U.S. dollars, respectively. The stock market in Brunei Darussalam has not existed. Source: Author calculation.

Bangladesh, Sri Lanka, and Pakistan, which are not included in our study. Bearing in mind that the MSCI ACFM Asia index is cap-weighted, therefore a big market capitalization like India may partly dominate the index.[7]

Third, I limit myself to equity market integration. Accessing financial integration using the money market, bond market, or currency market may yield interesting results, albeit these markets may be subject to government intervention, especially in developing/emerging markets. Future research aiming at accessing the degree integration of other financial markets could provide a broader picture of financial integration in East Asia.

Another possible extension of this study is to identify factors that govern the integration process and to examine whether those factors have different impacts across countries. The income level of countries is important in this context, given that the level of economic development often associates with the level of financial development that in turn may determine the degree of financial integration. Other factors such as institutional quality, economic policy are likely to play an important role in explaining the hetorogenous degree of financial integration.

Since Chapters 4 and 5 use the same data set, they are subject to similar caveats. First, the data set we use is very comprehensive, as Vietnamese firms must supply data to the General Statistics Organization of Viet Nam. Admittedly, although rich, this data set is for a single country. Therefore, our results cannot be readily generalized to other emerging markets. Next, the data set does not distinguish between processing traders and ordinary traders. Manova and Yu (2012) show that financial frictions may induce firms choosing pure-assembly or processing-with-imports and preclude them from choosing higher value-added and more profitable trade activities such as ordinary trade.[8]In a country where processing trade is prevalent like Viet Nam (WTO and IDE-JETRO, 2008), processing traders may constitute a large number of exporters. Noteworthy, there is another type of exporters in Viet Nam called “authorized trader” that is the

[7] By 2018, India ranks 6th of the world in terms of stock market capitalization. Source: WDI

[8]Manova and Yu (2012) investigate the case of Chinese firms and provide the following category of exporters: Firms with ordinary trade may combine foreign and local inputs and sell domestic or/and abroad; Firms with pure-assembly trade may import inputs at no cost from the foreign trade partners to whom they also send the final product; Firms with processing-with-imports will independently source and pay for imported inputs.

third-party trade service provider.[9] The presence of these exporters may affect the estimated relationships between financial constraints and export decisions in Chapter 4 and export and productivity in Chapter 5. Therefore, differentiating among types of exporters is an interesting extension for future research. Another important limitation related to the data that is specific for Chapter 4 is the private-owned enterprises' group. Our data does not enable us to separate the private firms that originated from the state due to privatization or/and with private relationships related to officials. These firms may have more advantages to access credit, therefore suffer less borrowing constraints than other privately owned firms.

There are at least two directions in which Chapter 4 could be extended. First, although the literature tries to capture the most likely important factors in an export decision such as productivity and financial conditions, other factors such as managerial experience are proved as essential in the decision and success of the international expansion process. In this context, international experience, education, and personality traits of the manager shall be accounted for. Second, as the global financial crisis affects the cost and availability of external finance (Foley and Manova, 2014), future research could focus on the impact of the crisis on the relationship between borrowing constraints and export to gauge a more robust picture of this nexus.

Apart from sharing common data limitations with chapter 4, chapter 5 has some specific limitations. First, data limitations restrict the analysis to learning effects for up to three years after firms start exporting only. Consequently, whether the learning effects decrease after the third year remains unclear. Future research could extend the time dimension of the dataset to study the learning effects for a longer term. Furthermore, future research could aim to compare the learning effects across economies. As suggested by Keller (2004), the learning effect may not be solely limited to low- and middle-income countries' firms but also present in advanced countries' firms. More evidence is necessary to understand the nature of learning effects across firms in both emerging and advanced countries. Comparing the learning processes of firms from different economies yields a better understanding of the systematic and idiosyncratic determinants of the learning processes.

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[9]According to Vietnamese law, an authorized trader is the third partner helps the seller (domestic) to sell their products to the buyers (abroad) with a cost. This activity is inherited from the past when export and import activity was limited to some legal entities and the scope of registered business activities. To date, all legal entities can do export and/or import activity regardless of their business license.

In addition, the impact of institutional settings on the magnitude and length of the learning process could also be different. Another avenue for future research is to extend the analysis to the possible causes or factors affecting the size of the productivity premium, whether these may be export intensity, export destination, or firms' absorptive capacity for technology.

Another prominent direction is to investigate how the export destination/diversification affects the learning effects. Firms may gain higher productivity by shipping their products to relatively advanced economies' buyers, who may demand high quality and possess know-how about how to achieve such quality. This is a particularly relevant channel in which trade integration affects firm productivity growth.

Chapter 2
Integration between Viet Nam and the A10 economies 1998-2017

2.1 Introduction

The last 20 years have witnessed the rapid economic development of Asian economies. One of the key characteristics in the development process is the increasing economic integration, including trade and financial integration. On the one hand, deep economic integration facilitates greater risk-sharing and more efficient resource allocation via labor specialization and capital flows, fosters economic growth, and ultimately improves the quality of life and the standards of living. On the other hand, economic integration is associated with greater vulnerabilities as foreign shocks and contagion risks may harm especially weaker economies (Cowen et al. 2006; Park and Lee, 2011; Nicolo and Juvenal, 2014; Didier et al., 2017; Chevallier et al., 2018). While the debate on the costs and benefits of economic integration is still ongoing, Asia continues to display "a steady, yet modestly strengthening, trend of regional integration over the period 2006–2016" (Asian Economic Integration Report 2018).

In response to the (regional) economic integration, Viet Nam has increased economic cooperation with other economies and trade blocs, reflected by joining the Association of Southeast Asian Nations (ASEAN) in 1995[10], World Trade Organization (WTO) in 2007, many bilateral free trade

[10]ASEAN was formed in 1967 and currently includes 10 countries, namely Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.

agreements, and most recently the Eurasian Economic Union (VN-EAEU FTA) in 2016. The ASEAN itself has also joined many bilateral free trade agreements with its dialogue partners, for example, Japan, Korea, China, Hong Kong, Australia, New Zealand, and India. The ASEAN economies and its dialogue partners occupy a strategic position in Viet Nam's economic development process. Their geographical proximity to Viet Nam has encouraged the rapidly deepening of economic relationships. By actively participating in regional economic collaboration, Viet Nam is strengthening its economic links and political position.

This chapter examines the development of economic integration between Viet Nam and nine of its main trading partners in East Asia during the last two decades. This group of countries constitutes the majority of the ASEAN economies and its dialogue partners, including Malaysia, Thailand, the Philippines, Singapore, Indonesia, Viet Nam, China, Hong Kong, Japan, and Korea. In the remainder of this chapter, I will refer to this group as the A10 to distinguish it from other trading blocs.[11]

More specifically, in this chapter, I first analyze Viet Nam's macroeconomic development in comparison to other A10 economies. Next, I explore the development of trade and financial integration of Viet Nam during 1998-2017. Last, I provide an overview of the evolution of the economic integration process of Viet Nam from the Balance-of-Payments perspective. To analyze trade integration, I focus on Vietnamese exports. And for financial integration, I focus on the inflow of FDI to Viet Nam.[12] The final section summarizes and concludes.

I take data from multiple sources. The macroeconomic data consisting GDP, inflation, and credit, are from the World Development Indicators (WDI). Data related to labor and productivity is retrieved from the International Labor Organization (ILO). Data on the real effective exchange rate and bilateral trade are taken from the DataStream. Data on government revenue, expenditure, public debt, bilateral FDI, and Balance of Payment items are obtained from the multiple datasets of the IMF and the Coordinated Direct Investment Survey (CDIS). I take data on the sources of FDI inflows to Viet Nam from the United Nations Conference on Trade and Development (UNCTAD).

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[11]Several ASEAN countries, namely Cambodia, Myanmar, Brunei, and Laos are not included in the analysis due to data limitations.

[12]Price integration is delegated to the next chapter in this book.

2.2 Economic development in Viet Nam: a comparative overview

2.2.1 Recent economic developments

The 6th National Congress of the Communist Party of Viet Nam which took place in December 1986, abandoned the centralized planning economy. It also marked the launch of the "market-oriented socialist economy under state guidance", also known as Doi Moi (Renovation) which paved the way for Viet Nam today. Since then, Viet Nam has implemented out significant economic reforms that lifted one of the world's poorest nations to the level of a lower-middle-income country.

Table 2.1 shows some stylized economic characteristics of Viet Nam and other A10 countries, including GDP growth, GDP per capita, labor productivity, and labor productivity growth for two periods, 1998-2007 and 2008-2017. I divide the A10 countries into three groups, namely high-income economies, upper middle-income economies and lower middle-income economies. Overall, I observe substantial cross-country heterogeneity in these indicators. In terms of GDP growth, China and Japan stand out. China has the highest average growth in both periods, while Japan has the lowest. Viet Nam is the runner-up in the region, surpassed only by China, with an average growth rate of 6.6 percent during the period 1998-2007 and 6 percent during the period 2008-2017.

The disparity in GDP per capita is even larger, especially reflected by the gap between the high-income countries and the rest. For example, the average GDP per capita for Singapore during 2008-2017 is US$49,269, which is almost five times that of Malaysia, and 14 times that of the Philippines. Note that Singapore has overtaken Japan in the second sub-period and now has the highest GDP per capita. Viet Nam has a relatively low GDP per capita and lags behind its neighboring countries within the group. By the end of 2017, GDP per capita of Viet Nam is $1,835, which is comparable to the level of the Philippines in 2005, and the level of China around 2000. In all countries, GDP per capita has risen from the first to the second period, but the growth differences are too small to result in substantial income convergence. This poses a concern that the low and middle-income A10 economies - including Viet Nam- will not be able to catch up the advanced ones soon and may be trapped in the middle-income status (Ito, 2017; WB report, 2010).

Table 2.1: Some stylized statistics for the A10 economies

	GDP growth		GDP cap		Labor productivity		Labor productivity growth	
	1998-2007	2008-2017	1998-2007	2008-2017	1998-2007	2008-2017	1998-2007	2008-2017
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
High income economies								
Japan	1.0	0.5	43,047	45,833	85,099	91,024	1.2	0.5
Singapore	5.5	4.4	35,945	49,269	72,654	90,807	2.4	2.0
Korea	4.9	3.1	16,757	23,410	35,008	46,463	3.8	2.0
Hong Kong	3.9	2.7	25,018	34,451	51,268	67,277	2.7	1.9
Upper middle income economies								
China	10.0	8.3	2,296	5,537	4,034	9,857	9.3	7.9
Thailand	3.9	3.1	3,908	5,408	7,007	9,458	2.6	3.2
Malaysia	4.3	4.7	7,397	9,933	18,319	22,254	1.6	1.5
Lower middle income economies								
Philippines	4.2	5.6	1,713	2,378	4,593	5,920	1.6	3.8
Indonesia	2.8	5.5	2,339	3,482	5,496	7,638	1.3	3.3
Viet Nam	6.6	6.0	889	1,484	1,681	2,556	4.2	4.3

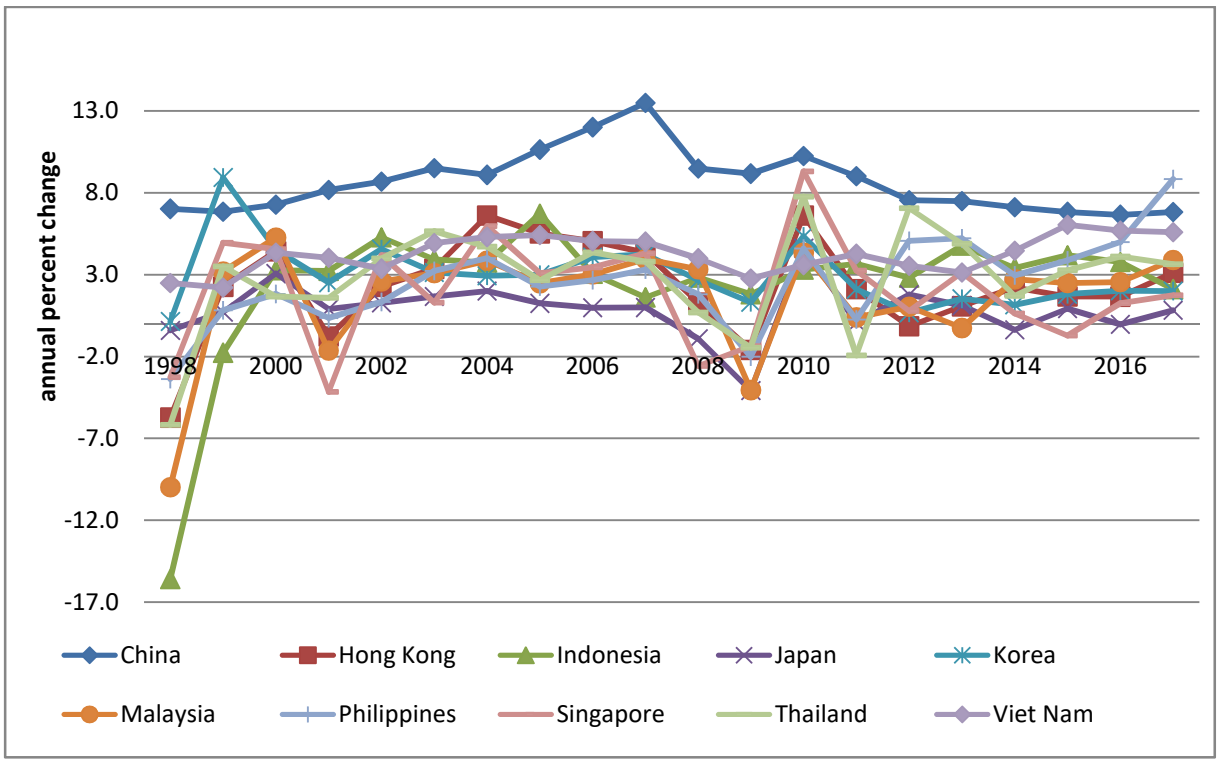
Note: Data for GDP is from the World Development Indicators. Data for productivity is from International Labor Organization (ILO). Labor productivity is output per worker (GDP constant 2010 US $). This measure of labour productivity is calculated using data on GDP in constant 2010 US dollars derived from the World Development Indicators database of the World Bank. To compute labour productivity as GDP per worker, ILO estimates for total employment are used. Labor productivity growth is calculated by the author.

Economists attribute variation in income levels across countries to two main factors: increases in the capital stock due to large-scale capital investments (financed by domestic savings and foreign investment) and productivity (see Easterly and Levine, 2001; Hall and Jones, 1999; Prescott, 1998, among others). Columns 4 and 5 in Table 2.1 also present evidence on labor productivity. I observe a similar pattern of cross-country heterogeneity as for the GDP measures. For example, the average output per worker in Japan during 1998-2007 is US$85,099, which is twice that of Korea, four times that of Malaysia, and 35 times that of Viet Nam. The pattern of labor productivity levels roughly follows the ranking of GDP per capita in column (3) and (4), while the same holds for labor productivity growth compared to GDP growth. In the high-income group, Singapore has (almost) overtaken Japan in the second sub-period due to relatively high productivity growth. In the upper-middle-income group, Malaysia still has the best performance in terms of per capita income and labor productivity, but China is approaching due to faster growth. In the lower-middle-income group, Viet Nam has the lowest income and productivity

levels, but faster growth rates, resulting in slow convergence. Viet Nam's low levels of productivity can be attributed to inefficient SOEs, poor domestic private sector performance, and fragmented, small-farmer-dominated agriculture with heavy state involvement (World Bank and Ministry of Planning and Investment of Viet Nam, 2016- henceforth WB and MPI, 2016).

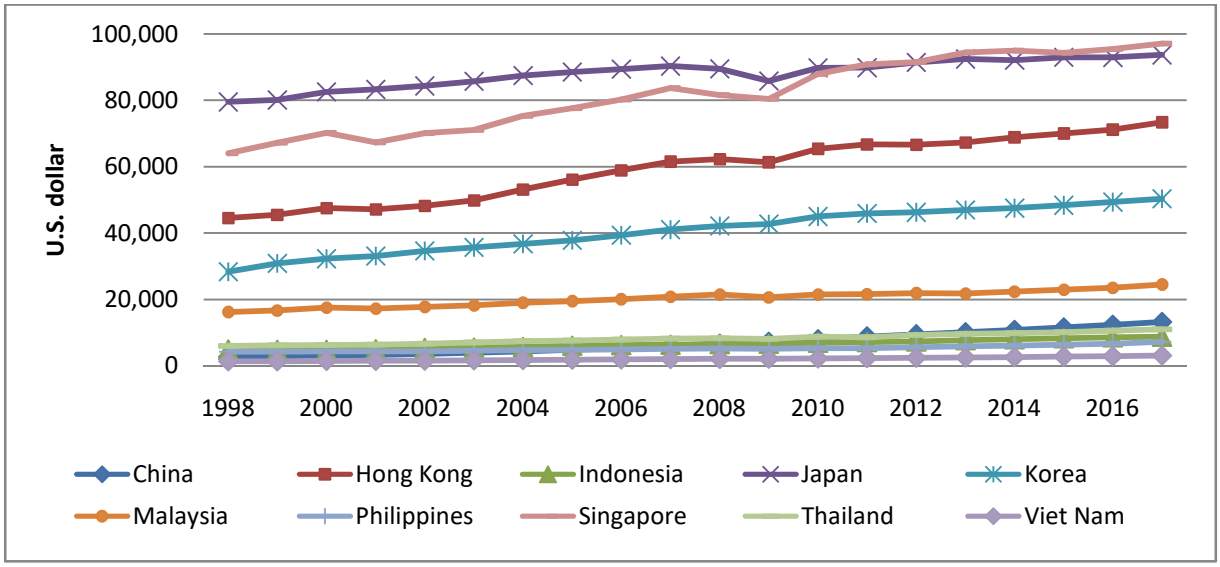
Figure 2.1plots the development of labor productivity growth and figure 2.2 plots the evolution of the labor productivity level for the A10 economies during 1998-2017. Most economies experienced positive productivity growth, except in the 1998 Asian crisis and the 2007-2009 global financial crisis periods. Overall, China is the best performer in terms of productivity growth, only surpassed by Korea in 1999 and the Philippines in 2017. Among the high-income countries, Singapore has enjoyed the fastest productivity growth and now is the most productive country in the A10 group, surpassing Japan from 2011 onward.

Figure 2.1: Annual growth rate of output per worker (in percentage, measured as GDP in constant 2010 US $)



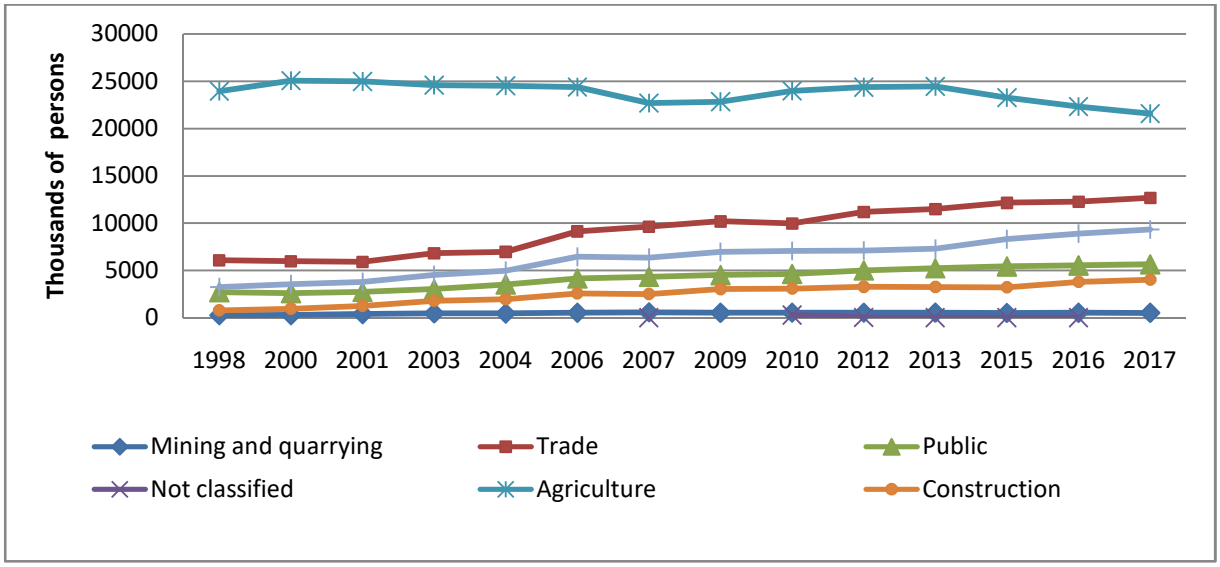
Note: This indicator conveys the annual growth rates of labour productivity. Labour productivity represents the total volume of output (in percentage, measured as GDP in constant 2010 US dollars) produced per unit of labour (measured in terms of the number of employed persons) during a given time reference period. Source: International Labor Organization.

Figure 2.2: Output per worker (GDP constant 2010 US $) 1998-2017



Note: Labour productivity is calculated using data on GDP in constant 2010 US dollars derived from the World Development Indicators database of the World Bank. To compute labour productivity as GDP per worker, International Labor Organization estimates for total employment are used. Source: International Labor Organization

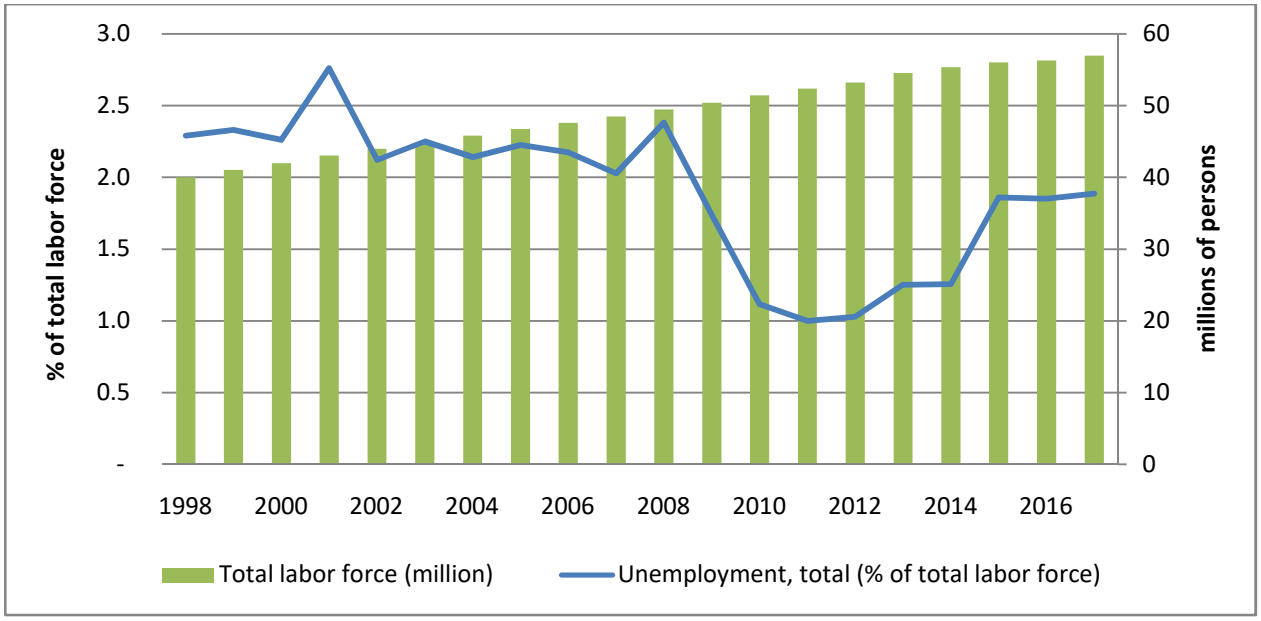
Figure 2.3: Viet Nam Employment by economic activity (thousands) 1998-2017



Note: The employed comprise all persons of working age who, during a specified brief period, were in the following categories: a) paid employment (whether at work or with a job but not at work); or b) self-employment (whether at work or with an enterprise but not at work). Data are disaggregated by economic activity according to the latest version of the International Standard Industrial Classification of All Economic Activities (ISIC) available for that year. Economic activity refers to the main activity of the establishment in which a person worked during the reference period and does not depend on the specific duties or functions of the person's job, but on the characteristics of the economic unit in which this person works. Public includes Public Administration, Community, Social and other Services and Activities. Trade includes Trade, Transportation, Accommodation and Food, and Business and Administrative Services. Mining and quarrying includes Mining and quarrying; Electricity, gas, and water supply. Source: International Labor Organization.

Viet Nam stands out for having consistently high labor productivity growth over the whole sample period. Although labor productivity growth has declined during the period prior to the global financial crisis, it displayed an upward trending after the crisis. In the 1990s, labor productivity growth in Viet Nam can be largely attributed to productivity growth within different economic sectors, while in the 2000s it is mainly caused by a structural shift in the movement of labor from (lower productivity) agriculture to (higher productivity) services and industry (WB and MPI, 2016). Figure 2.3 show the distribution of employment across economic activities in Viet Nam during the period 1998-2017.Indeed, employment in agriculture has been decreasing while that in industry and service has been increasing.

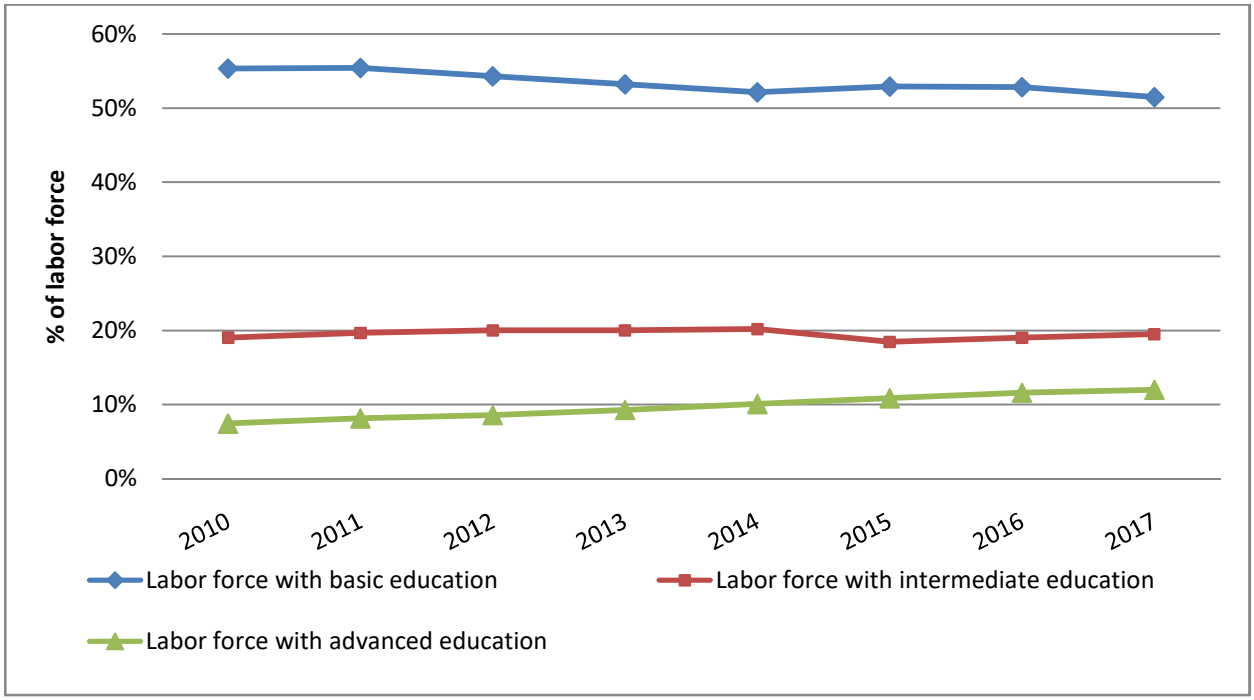
Figure 2.4: Labor force and unemployment rate



Note: The labour force comprises all persons of working age who furnish the supply of labour for the production of goods and services during a specified time-reference period. It refers to the sum of all persons of working age who are employed and those who are unemployed but seeking work as well as first-time job-seekers. The working age population is commonly defined as persons aged 15 years and older. The official unemployment rate only measures officially reported unemployment in the formal sector, therefore does not capture the extent of unemployment either in the informal sector or in the agriculture-based rural areas. Source: International Labor Organization.

Viet Nam has reaped a significant demographic dividend during the last two decades. About one-third of Viet Nam's historical average GDP growth rate can be attributed to the expanding labor

Figure 2.5: Professional/technical skills of the labor force (% of labor force)



Note: This figure displays the professional or technical skills of the labor force, in percentage of total labor force. Labor force with advanced education is the percentage of the working age population with an advanced level of education that is in the labor force. Advanced education comprises short-cycle tertiary education, a bachelor's degree or equivalent education level, a master's degree or equivalent education level, or doctoral degree or equivalent education level according to the International Standard Classification of Education 2011. Labor force with intermediate education is the percentage of the working age population with an intermediate level of education that is in the labor force. Intermediate education comprises upper secondary or post-secondary non-tertiary education according to the International Standard Classification of Education 2011. Labor force with basic education is the percentage of the working age population with a basic level of education that is in the labor force. Basic education comprises primary education or lower secondary education according to the International Standard Classification of Education 2011 (ISCED 2011). Source: International Labor Organization.

force while the rest came from labor productivity growth (WB and MPI, 2016). Figure 2.4 displays the development of the labor force and unemployment rate of Viet Nam during 1998-2017. The labor force has expanded and the unemployment rate has been low owing to the favorable macroeconomic conditions and stability (ILO and ILSSA, 2018). The size of the labor force increased from 40 million people in 1998 to nearly 57 billion people by the end of 2017.[13]The official unemployment rate is relatively low, averaging around 2.3 percent in the first

[13] According to the International Labor Organization, the labor force comprises all persons of working age who furnish the supply of labor for the production of goods and services during a specified time-reference period. It refers to the sum of all persons of working age who are employed and those who are unemployed but seeking work as well as first-time job-seekers. The working age population is commonly defined as persons aged 15 years and older.

sub-period and 1.5 percent in the second sub-period.[14] However, the quality of the labor force remains modest. Figure 2.5 displays the composition of the labor force by education attainment.

Overall, the quality of the labor force is slowly increasing. The percentage of the labor force with advanced education is increasing and that with basic education is decreasing, while that with intermediate education remains largely unchanged. The number of workers with advanced education accounted for 7 percent of the labor force in 2010, and gradually increased to 12 percent of the labor force in 2017.

2.2.2 Financial sector reform and exchange rate policy

In the financial sector, Viet Nam has implemented several reforms related to separating the commercial and central banking functions in the early 1990s, deregulating the money market since the mid-1990s, setting up the proper legal framework to regulate the banking sector in 1997, allowing the entry of foreign commercial banks since 2008, and restructuring the banking sector since 2011.[15]

The financial reforms have deepened financial developments in Viet Nam. Figure 2.6 shows the development of domestic credit to the private sector during 1998-2017, measured both in terms of growth rates and as a percentage of GDP.[16]To cope with the stagnation of economic growth in the aftermath of the 1997 Asian financial crisis, Viet Nam has rapidly expanded credit. As a result, the credit growth rate reached on average 27.3% in the first sub-period 1998-2007. Meanwhile, the credit to GDP ratio continuously expanded from 20 percent of GDP in 1998 to 86 percent of GDP in 2007.In the second sub-period, the credit to GDP ratio continued to grow while credit growth rates declined to around 10%.

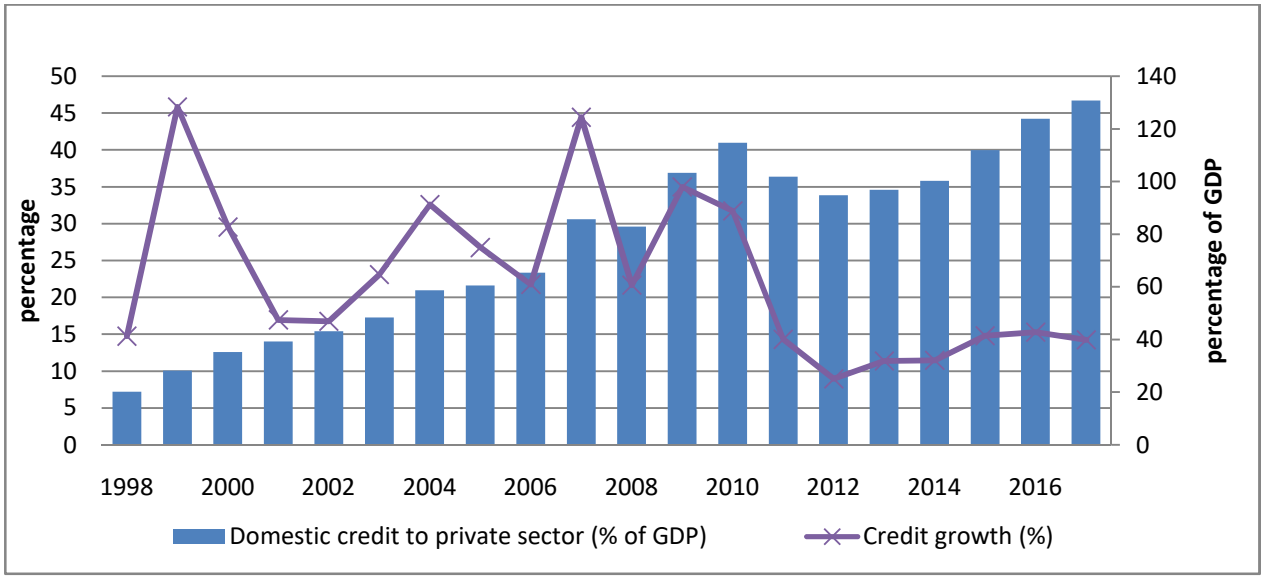
Figure 2.7 displays the development of inflation during 1998-2017. Inflation was relatively low during 1998-2002 despite high credit growth. This reflects the disconnection between inflation

[14] The official unemployment rate only measures officially reported unemployment in the formal sector, therefore does not capture the extent of unemployment in either the informal sector or in the agriculture-based rural areas.

[15] The Law on Credit Institutions and the Law on the State Bank of Viet Nam approved in 1997 have set the legal framework for the operating of the banking system. The first wholly foreign-owned bank is granted a license in 2008. By 2009, the first state-owned commercial bank was privatized. By 2017, the three over four biggest state-owned banks had been privatized.

[16] Note that the series credit to GDP ratio derived from World Development Indicator includes the credit to state sectors.

Figure 2.6: Domestic credit to private sector

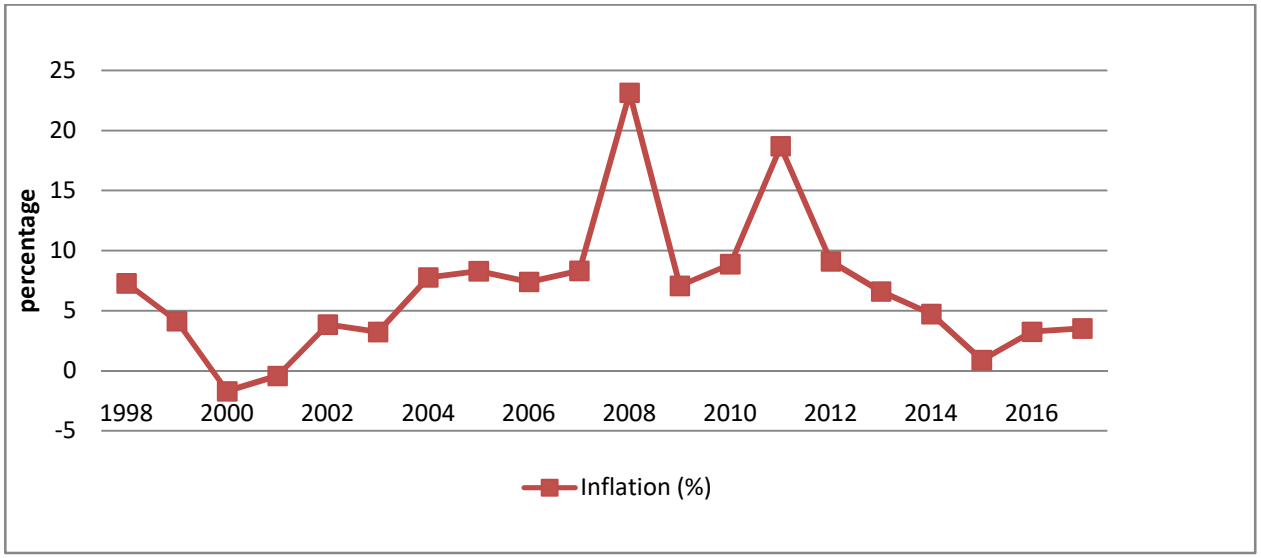


Note: This figure shows time series of credit growth, and domestic credit to the private sector (as a percentage of GDP) during 1998-2017. The right axis measures the domestic credit to the private sector as a percentage of GDP, the left axis measures annual credit growth in percentages. Domestic credit to private sector (% of GDP) includes domestic credit to state-owned enterprises. Source: World Development Indicators.

and money growth, which was attributed to the "rapid rate of monetization in Viet Nam as reflected in a strong decline in velocity" (Camen, 2006). Since 2003, inflation started to increase and abruptly accelerated to a peak in 2008 and another peak in 2011. Recent empirical studies such as Camen (2006), Riedel (2008), Bahttacharya (2014), and Nguyen et al. (2019) conclude that rapid credit expansion was the main cause of inflation, while other studies suggested other causes such as exogenous price shocks (Nguyen et al., 2012), low investment efficiency (Harvard/Fulbright Asia Programs 2008), and short-term movements in the nominal exchange rate (Bahttacharya, 2014). These papers do not address the failure of the SBV in controlling inflation. During 2007-2008, the SBV purchased a large amount of foreign exchange without fully sterilizing this intervention (Nguyen and Nguyen, 2010; Pham and Riedel, 2012, IMF report, 2012).

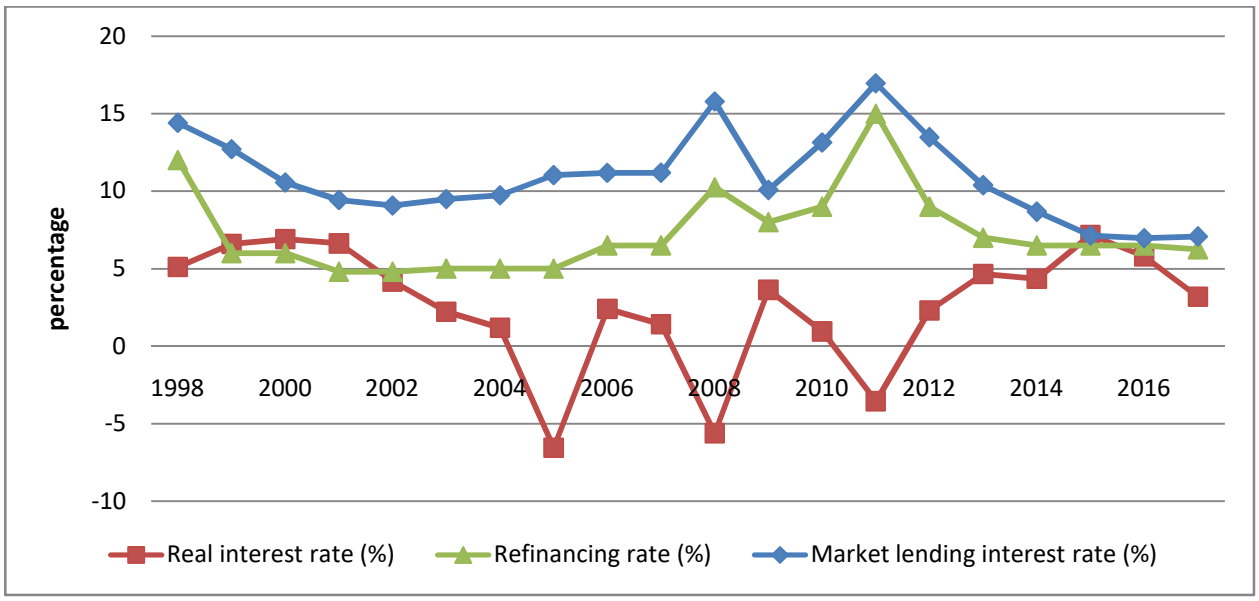
The SBV attempted to contain inflation by reining in credit growth from 2010 onward. This was done by various measures including raising reserve requirements and the policy rate, putting caps

Figure 2.7: Inflation



Note: This figure shows time series of inflation during 1998-2017, in percentage. Source: World Development Indicators.

Figure 2.8: Refinancing rate, Market lending rate and Real interest rate



Note: This figure displays the time series of refinancing rate, market lending rate, and real interest rate over 1998-2017. Refinancing rate is the interest rate, which banks have to pay when they borrow money from the SBV. Market lending rate is the lending rate offered by commercial banks to borrowers. Real interest rate is the market lending rate minus inflation. Source: World Development Indicators

on the interest rate, and squeeze credit to the real estate and stock market. These measures appeared to have been effective as inflation was tamed down during 2009-2010. However, the

risk of future inflationary pressure remained because of two possible reasons. The first is the long-term consequences of the fiscal stimulus program in 2009 to counter the effect of the global recession. The second is the increasing demand for foreign currency due to the reversal of the short-term capital inflows during 2008-2009. As a result, inflation increased again in 2011, exposing the economy to macro instability. The authorities had to make a hard decision to sacrifice growth for stability as stated in Resolution 11 promulgated in 2011, including restricting credit growth, reining in the policy interest rate, and cutting government spending (Pham and Riedel, 2013). Inflation was considerably tamed down to one percent in 2015 and remained relatively low afterward.

An important aspect monetary market deregulation in Viet Nam is the gradual liberalization of the interest rate. Since the mid-1990s, the SBV has gradually diminished the control over the interest rate by first abandoning the fixed deposit and lending rate at commercial banks, to be replaced by floor and ceiling rates.[17] By 2000, the deposit rate was liberalized and the lending rate was capped by a base interest rate plus a regularly adjusted stipulated margin.[18] By 2002, the SBV removed the stipulated margin but still used the base interest rate to influence market interest rate. Notwithstanding, the base interest rate was less effective in navigating the market deposit and lending interest rate as well as the indicator of monetary policy (IMF report 2005; Camen, 2006). Between 2011-2012, the SBV reintroduced caps on deposit rate and caps on lending rate to some prioritized industries. Since 2012, cap on short-term deposit and lending rate are still prevalent. [19]

Figure 2.8 shows the evolution of the refinancing rate, market lending rate, and real interest rate for Viet Nam during 1998-2017. The fairly stable and low refinancing rate during 1998-2005 reflects the efforts of the authorities boosting economic growth, while the rising refinancing rate during 2006-2012 reflects the policy response to rising inflation. Nevertheless, empirical studies hardly find any conclusive evidence on the role of interest rates in transmitting monetary policy in Viet Nam (Camen, 2006; Le and Pfau, 2008; Nguyen and Nguyen, 2010), at least before 2006

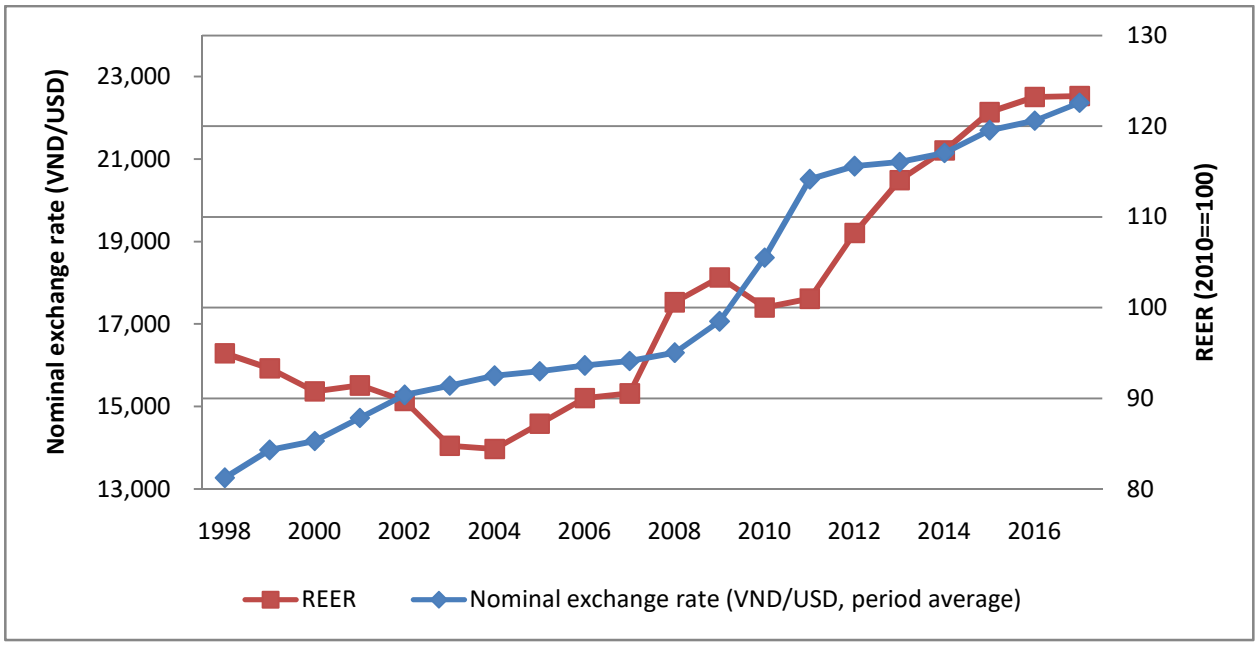
[17] Deposit and lending rate of commercial banks are regulated by the SBV. This is different from the market deposit and lending rate, which are the market rate at which commercial banks offer to customers.

[18] During 2000-2010, the SBV monthly calculated and announced the base rate plus stipulated margin based on economic performance and commercial interest rates. Commercial banks refer to the base interest rate to determine the deposit and lending rate within the stipulated margin. The SBV has unofficially stopped announcing the base rate since 2010.

[19] The author recapitulates from documents issued by the SBV regarding interest rate policy during 1998-2017.

(Bhattacharya, 2014). Possible explanations include the dominance of state-owned commercial banks in the credit market (Camen, 2006), or the non-market administrative measures of the SBV, for example, caps on interest rates (Pham and Riedel, 2012). Also, the interest rate policy of the SBV is passive, and to suit the current inflation, rather than a "forward-looking" response to inflation (Nguyen and Nguyen, 2010; Bahttacharya, 2014). Since 2012, the authorities maintain a low-interest rate policy. Regarding the real interest rate, it was positive during 1998-2004, which is attractive for depositors. During the high inflation periods, the real interest rate was negative. Since the last quarter of 2011, the real interest rate reverted back to positive (IMF report, 2012).

Figure 2.9: Official exchange rate and Real effective exchange rate of VND



Note: This figure shows the official exchange rate VND/USD (up is depreciation) and the real effective exchange rate REER (up is appreciation) during 1998-2017. Source: REER is from DataStream, the official exchange rate is from World Development Indicator.

In line with the financial reforms, foreign exchange policy has gone through major changes. During 1999-2004, the exchange rate regime was a de jure "managed float" under the SBV classification, but de facto "crawling peg" under the IMF exchange rate regime classification (Camen, 2006). According to Decision No.64 issued in 1999 by the SBV, the SBV directly controls the exchange rate by announcing the official exchange rate for VND/USD and the fluctuation range of the interbank rate. Accordingly, the official exchange rate was the weighted

average of the exchange rates quoted in the interbank market the previous day. Since 1 January 2005, the IMF has reclassified the exchange rate regime of Viet Nam to the category of "conventional pegged arrangement" from the category "Managed floating with no pre-determined path for the exchange rate" (IMF, 2006).

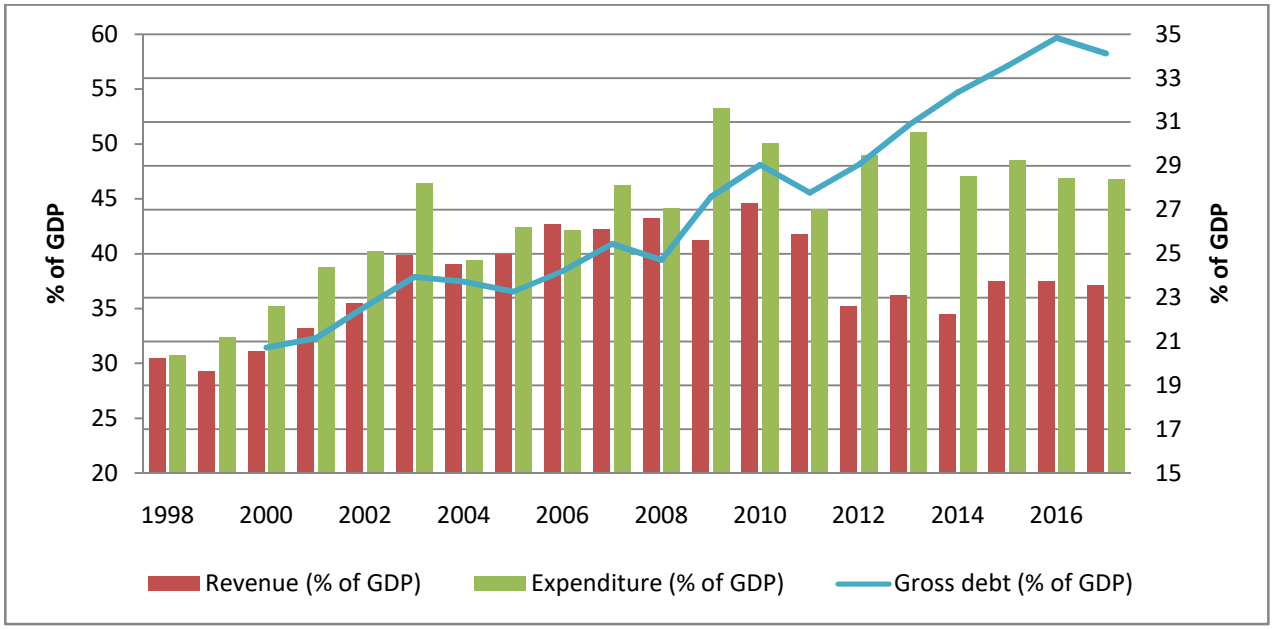
Figure 2.9 shows the official exchange rate VND/USD and the real effective exchange rate (REER). During 1998-2007, the official exchange rate has followed a path of a gradual devaluation of around 2% per year. Since 2007, in response to the surge in capital inflows, the exchange rate has been more flexible with larger and more frequent adjustments. Empirical studies covering the period 1998-2007 find modest explanation power of the changes in nominal exchange rate on inflation (IMF, 2006; Camen, 2006), whereas research that covers the periods after 2007 finds a significant role of exchange rate changes, in particular devaluations, in affecting inflation (Nguyen and Nguyen, 2010; Bhattacharya, 2014). This is no surprise given that the interventions of the authorities on foreign exchange markets related to foreign reserves have been more frequent in the later years. Especially, the intervention during the year 2007-2008 was not fully and timely sterilized, which caused the excess supply of domestic currency that drove up the inflation in 2008 (Nguyen and Nguyen,2009; Riedel, 2008; Nguyen and Nguyen, 2010). Figure 2.9 also shows the series of the real effective exchange rate (REER). The REER decreased during 1998-2003, but reversed after that, attributed to rapid trade openness strategy, rising inflation differential relative to major trading partners, and the movements in major currencies (IMF, 2006; Pincus, 2009, IMF, 2019). Since 2015, the authorities have adopted a new flexible exchange rate regime with more focus on the changes in other currencies and the macroeconomic situation.[20]

In parallel with the financial reform, the authorities started reforms in public finances in the mid-1990s. The State Budget Law passed in 1996 and its revisions in 1998 and 2002 have enabled the fiscal decentralization process, and improved the transparency and accountability of the public finances (Morgan and Trinh, 2016). Figure 2.10 shows government revenues, expenditures, and public debt, as a percentage of GDP during 1998-2017. The left axis measures the revenues and

[20] According to the Decision No.2730 issued by the SBV in 2015, the VND/USD rate would be daily adjusted based on (i) the previous day's weighted average dong/USD exchange rate; (ii)a weighted average of movements in dong exchange rates vis-à-vis seven other important trading partners' currencies; (iii) domestic macroeconomic conditions; and (iv) monetary and monetary policy targets.

expenditures, while the right axis measures gross debt. All series are expressed as a percentage of GDP. The government budget has long been in deficit despite the steady increase in state revenues. The increasing public expenditure during 1998-2007 is attributed to the increasing investment in public infrastructure during the rapid economic development stage (Greiner and Fincke, 2007). In the second sub-period, expenditure lightly decreases though it remains (IMF report, 2019). At the same time, revenues largely decline due to tariff reductions, decreasing proceeds from the sale of natural resources and land, and corporate 'tax holidays' (IMF report, 2014; WB, 2017). Notably, the large fiscal deficit in 2009 is attributed to the 2009 fiscal stimulus program, which was 8.3 percent of GDP (Abbott and Tarp, 2011; Pham and Riedel, 2013). It contributed to the peak inflation in 2011. Around that time, the fiscal stimulus package came to the end (IMF report, 2012; Bhattacharya, 2014).

Figure 2.10: Government revenue, expenditure, and public debt (in percentage of GDP)



Note: This figure shows the budget balance and public debt as a percentage of GDP during 1998-2017. The left axis measures the revenues and expenditures as percentage of GDP, the right axis measures gross debt as percentage of GDP. Source: IMF

Public debt has continuously increased from 31 percent of GDP in 2000 to 60 percent of GDP in 2016, which is among the "steepest increases in the region" (WB report, 2018). The easy fiscal stance before 2011 together with the negative output gap during 2012-2016 bear the main

responsibility for the rise of public debt (IMF, 2014).This debt level is in excess of the safe level of 40-45 percent of GDP as suggested by the IMF (2014). Since 2017, the authorities have limited government debt (IMF report, 2019).

In summary, during the last two decades, Viet Nam has conducted substantial reforms that resulted in fast income growth and rapid financial deepening. However, moderate cross-country productivity growth together with initial low-income levels only led to a slow income catching-up of Viet Nam toward the higher-income countries. The widespread reforms in the financial sector accommodated economic achievements.

2.3 Vietnamese integration with the rest of the world

2.3.1 Overview of the Balance of Payment (BoP)

Participating in international product and capital markets has pushed Viet Nam through some challenging reforms including the opening up to foreign trade and cross border investments. In 1988, the Foreign Investment Law was enacted to foster cross-border investments. In addition, the authorities removed the state monopoly in trade, allowed the private sector to involve in trade, cut trade taxes, and conducted exchange rate reform. All together, these measures have stimulated the growth in foreign direct investment (FDI) inflows and foreign trade in the subsequent years. Viet Nam has actively started to participate in many international trade communities, such as the Association of Southeast Asian Nations Free Trade Area (AFTA) in 1996, WTO in 2007, and the Eurasian Economic Union in 2016 (VN-EAEU FTA). Viet Nam also concluded many bilateral trade agreements with other economies such as the U.S. in 2001, Japan in 2009, Chile in 2014 (VCFTA), and South Korea in 2015 (VKFTA). At the same time, Viet Nam also sought for financial collaboration with other communities within the framework of the Association of Southeast Asian Nations (ASEAN), ASEAN with Japan, Korea, and China (ASEAN+3), and the Asia-Pacific Economic Cooperation (APEC). Viet Nam has recently agreed to the Trans- Pacific Partnership (TPP) and the European Union (EU)–Viet Nam FTA.

Viet Nam has experienced a positive BoP for the last two decades, mainly driven by foreign direct investments. Table 2.2 shows Viet Nam's BoP as a percentage of GDP over the period 1998-2017. The current account has a small deficit of 1 percent of GDP in the first sub-period and a very small surplus in the second one despite of current account deficit during the years

2007-2010. Exports and imports are important items in the BoP, accounting for 59 and 64 percent of GDP on average in the first period, increase to over 80 percent in the second. This rise reflects the opening up of the Vietnamese economy to international trade. Overall, the trade balance had a deficit of close to 5 percent in the first period but a much smaller deficit in the second. Especially in the first sub-period, the trade deficit is compensated by the remittances from abroad. On the financial side, the financial account experiences a surplus of 5 to 6 percent of GDP in both sub-periods, mainly due to large FDI inflows.[21] Other investment flows like portfolio investments are typically small due to underdeveloped financial markets. Taking account of errors and omissions – which were particularly large in the second period – a positive BoP emerged which added to Viet Nam's international reserves.

Table 2.2: Selected BoP items for Viet Nam 1998-2017, as percentage of GDP

	1998-2007	2008-2017
Current account (excludes reserves and related items)	-1.3	0.2
Exports	58.6	80.9
Imports	63.5	82.0
Balance on goods and services	-4.9	-1.1
Secondary income (including Remittances)	5.6	5.7
Financial account (excludes reserves and related items)	-6.3	-5.2
Net foreign direct investment	4.6	6.3
Net errors and omissions	-1.2	-4.4
Reserves and related items	3.8	1.1

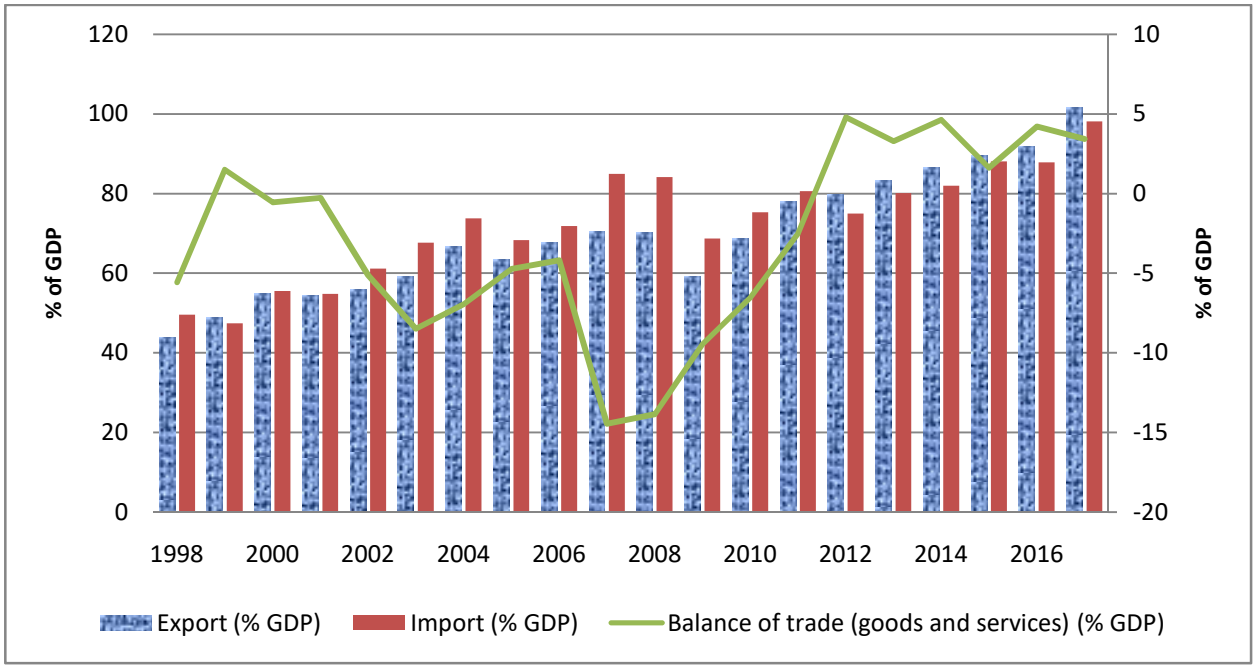
Note: Reserves and related items is the net change in a country's holdings of international reserves, is equal to the difference in the balance on the current and capital account and the balance on the financial accounts plus the net errors and omissions. Source: IMF

Figure 2.11 further illustrates the dynamics of exports, imports, and the balance of trade over time. The left axis measures the export and import values, while the right axis measures the balance of trade. All are expressed as percentage of GDP. The volume of exports and imports as a percentage of GDP doubled from 1998 to 2017, reaching 102 percent and 98 percent, respectively. Imports remain higher than exports, especially in the year 2007-2008, resulting in a widening trade deficit from 6 percent of GDP in 1998 to 14 percent of GDP in 2007-2008. In itself, a trade deficit is not a bad thing for a fast-growing country like Viet Nam as economic growth is associated with an increasing need for inputs and equipment; especially the year 2007-

[21]Note that the negative value of the financial account in table 2.2 and figure 2.12 reflect BoP accounting conventions. A negative FA implies a net inflow of foreign capital, that is, a net sale of domestic assets.

2008 is associated with massive FDI inflows to Viet Nam leading to a large investment expansion. Since 2012, the trade balance has been in surplus.

Figure 2.11: Export, import, and balance of trade (in percentage of GDP)

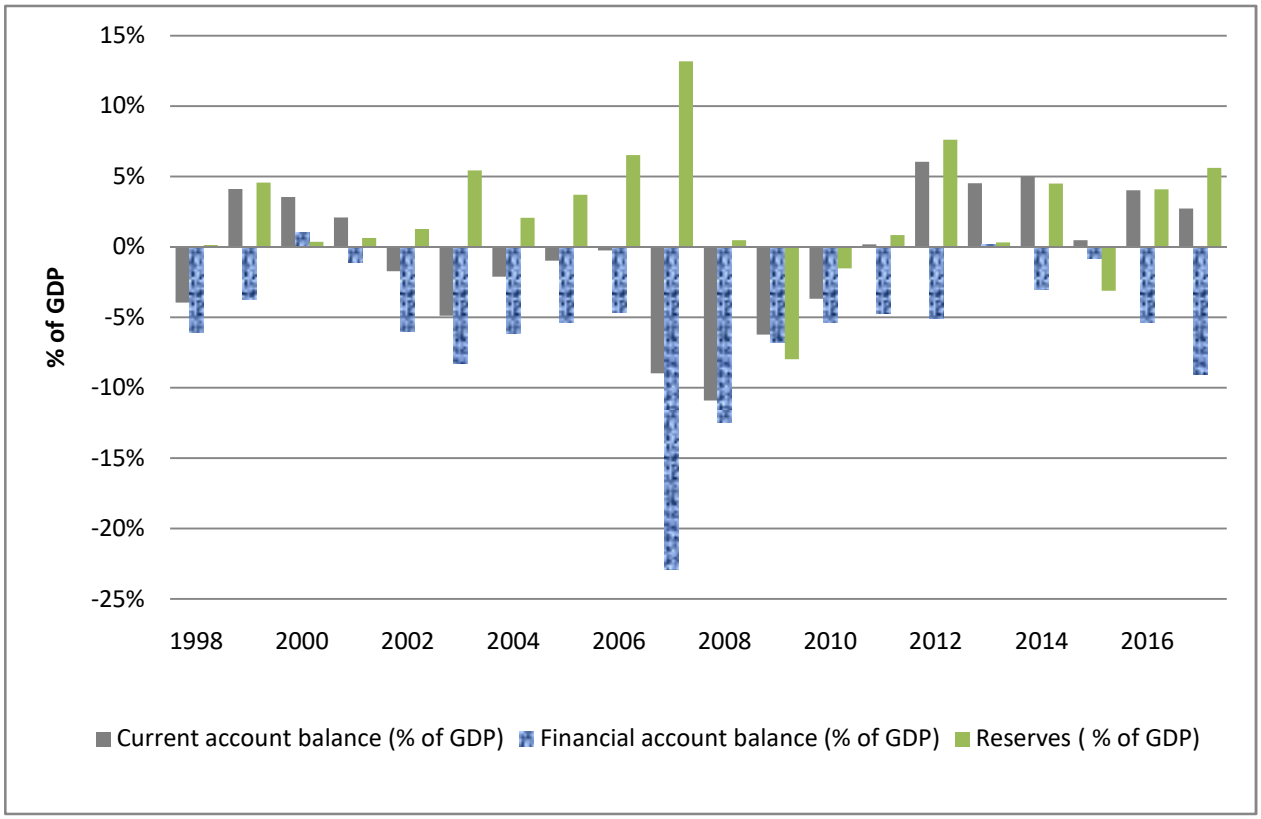


Note: This figure displays the time series of exports, imports, and balance of trade, as percentage of GDP for Viet Nam during 1998-2017. The left axis measures the export and import values, as percentage of GDP, while the right axis measures the balance of trade, as percentage of GDP. All is in real term. Source: World Development Indicator.

Figure 2.12 further displays the dynamics of current account balance, financial account balance, and reserves, as a percentage of GDP for Viet Nam during 1998-2017. The financial account balance has been relatively stable around -5 percent of GDP from 1998 to 2006, with a sudden jump to -23 percent of GDP in 2007 and -12 percent of GDP in 2008. This is mainly attributed to massive capital inflows to Viet Nam in response to the country's membership of the WTO that came into effect in 2007. Large FDI inflows have covered almost the entire current account deficit for Viet Nam during the last two decades. By and large, FDI inflows have been the source of increasing foreign reserves, providing a buffer should the country encounter trouble relating to external finance needs. Foreign exchange reserves have amply accumulated since 2001 and reached a peak of 14 percent of GDP in 2007. The reserves position deteriorated during 2009-2011 in response to the capital flight, associated with a large Viet Nam dong depreciation rate in

the corresponding period (Pham and Riedel, 2012). Since 2012, there is again a steady increase in reserves.

Figure 2.12: Viet Nam current account balance, Financial account balance, and Reserves (in percentage of GDP)



Note: This figure displays the current account balance, financial account balance, and reserves, as percentage of GDP for Viet Nam during 1998-2017. Source: IMF

2.3.2 Trade integration

In this section, we focus on trade integration between Viet Nam and other A10 economies. Over the past decades, international trade was an important driver of rapid industrial growth and the transformation of the predominantly agricultural economies of East and Southeast Asia into modern industrial economies (Mason and Shetty, 2019). This happened in a remarkably short period by historical standards. The central point of the miracle growth is the export-led growth strategy that was adopted first by Japan in the 1960s. The strategy has facilitated a successful

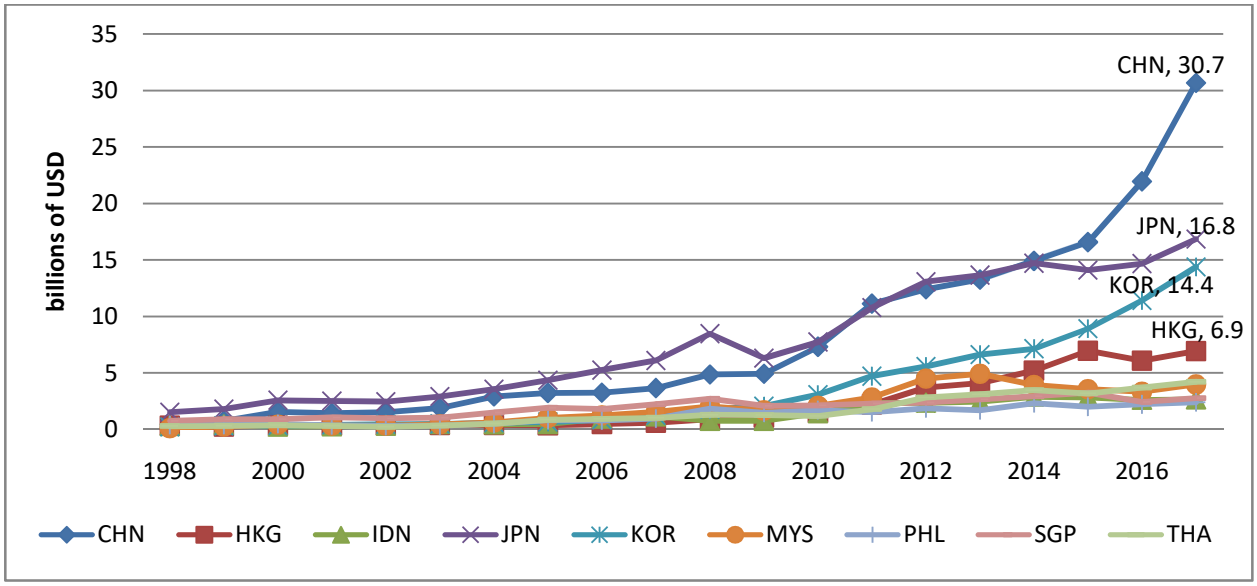
Table 2.3: Summary statistics of trade matrix in A10 economies

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Panel A	total export (% of GDP)	within A10 (million US dollars)	within A10 (% of total export)	Export destination (in percentage of total export)									
				JPN	SGP	HKG	KOR	CHN	MYS	THA	IDN	PHL	VNM
1997-2007													
CHN	24	207,666	49.0	16.0	2.5	20.2	5.0	.	1.4	1.0	1.1	0.8	0.8
HKG	147	129,942	49.0	4.8	1.9	.	1.7	36.9	0.8	0.9	0.4	0.9	0.4
IDN	36	38,722	49.0	19.3	8.6	2.0	6.2	5.3	3.2	2.0	.	1.3	0.7
JPN	13	185,917	32.0	.	3.1	5.3	6.1	9.2	2.2	2.9	1.3	1.6	0.5
KOR	37	94,200	36.0	7.9	2.4	5.3	.	13.4	1.7	1.1	1.5	1.4	1.0
MYS	113	57,246	43.0	9.4	14.2	4.5	2.8	4.7	.	3.7	1.8	1.3	0.7
PHL	35	18,597	58.0	19.2	8.5	8.5	3.9	6.5	5.9	3.6	0.8	.	0.7
SGP	200	97,064	41.0	4.9	.	7.0	2.7	4.9	11.7	3.2	4.8	1.7	1.3
THA	64	40,925	38.0	11.7	6.4	4.5	1.6	5.2	3.8	.	2.1	1.5	1.4
VNM	59	9,782	37.0	12.6	5.1	1.6	2.1	7.4	2.1	1.9	1.9	2.1	.
Average	73	88,006	43.0										
2008-2017													
CHN	24	698,431	34.0	6.7	2.0	13.8	4.3	.	1.7	1.4	1.4	0.9	2.0
HKG	201	288,672	53.0	3.1	1.4	.	1.4	43.0	0.6	1.1	0.5	0.5	1.2
IDN	22	88,919	49.0	13.4	8.0	1.4	5.9	9.8	4.6	2.9	.	2.1	1.3
JPN	16	327,657	39.0	.	2.7	4.5	6.5	15.4	1.8	3.8	1.7	1.2	1.3
KOR	50	253,282	40.0	4.8	2.8	4.6	.	20.1	1.1	1.1	1.5	1.2	3.2
MYS	80	119,386	53.0	9.3	12.8	4.3	3.2	11.4	.	4.9	3.3	1.4	1.8
PHL	26	32,503	51.0	15.6	6.6	8.1	3.9	9.5	2.2	3.2	1.0	.	0.9
SGP	193	222,674	43.0	3.2	.	8.0	2.9	8.1	8.2	2.6	6.5	1.3	2.0
THA	69	97,586	38.0	8.2	3.7	4.5	1.6	9.0	4.2	.	3.3	1.9	2.8
VNM	81	48,719	36.0	9.5	2.2	2.6	4.5	9.8	2.6	1.9	1.6	1.6	.
Average	76	217,783	44.0										

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Panel B	total import (% of GDP)	within A10 (million US dollars)	within A10 (% of total import)	Import source (in percentage of total export)									
				JPN	SGP	HKG	KOR	CHN	MYS	THA	IDN	PHL	VNM
1997-2007													
CHN	20	178,725	50.0	21.2	2.9	3.8	12.7	.	3.3	2.4	1.9	1.5	0.4
HKG	140	179,314	72.0	11.5	5.2	.	4.7	44.1	2.4	1.8	0.7	1.3	0.1
IDN	30	21,322	32.0	8.1	8.1	0.5	3.3	5.1	2.6	2.9	.	0.3	0.8
JPN	11	159,226	31.0	.	1.2	0.3	4.0	15.1	2.7	2.5	3.5	1.4	0.7
KOR	33	84,207	35.0	15.8	1.7	0.8	.	9.7	2.1	0.9	2.6	0.8	0.2
MYS	93	53,401	49.0	15.0	10.8	2.3	4.4	6.9	.	4.0	2.9	2.3	0.5
PHL	43	20,457	51.0	18.0	7.4	4.1	6.8	4.8	3.7	3.3	2.1	.	1.0
SGP	177	82,965	41.0	9.9	.	1.8	3.1	6.4	12.1	3.3	2.9	1.8	0.6
THA	57	43,138	45.0	20.2	4.3	1.2	3.2	6.8	5.1	.	2.1	1.5	0.5
VNM	64	17,824	59.0	11.1	12.7	3.4	9.8	11.1	2.9	5.1	1.9	0.5	.
Average	67	84,058	46.0										
2008-2017													
CHN	21	503,741	29.0	9.5	1.5	0.7	8.9	.	2.9	2.0	1.3	1.1	1.0
HKG	198	351,940	66.0	7.1	5.9	.	3.9	42.6	2.1	1.9	0.5	1.2	0.8
IDN	21	95,635	56.0	9.5	12.5	1.2	5.3	15.2	5.5	5.0	.	0.5	1.3
JPN	17	297,567	34.0	.	0.9	0.2	3.6	18.9	2.8	2.5	3.0	1.0	1.5
KOR	46	185,889	33.0	10.2	1.6	0.3	.	14.6	1.7	0.8	2.1	0.6	1.3
MYS	68	104,308	54.0	9.1	10.9	1.9	4.3	14.8	.	5.5	4.4	1.0	2.1
PHL	33	40,521	50.0	9.3	6.7	2.4	6.1	10.8	3.6	5.3	3.9	.	1.9
SGP	169	153,647	34.0	4.9	.	0.7	4.3	8.5	8.1	2.0	3.7	1.3	0.6
THA	62	109,999	47.0	15.5	3.2	0.8	3.4	14.2	5.0	.	2.8	1.1	1.3
VNM	82	87,339	65.0	9.1	5.1	1.1	13.9	25.0	3.1	5.3	1.9	0.6	.
Average	72	193,059	47.0										

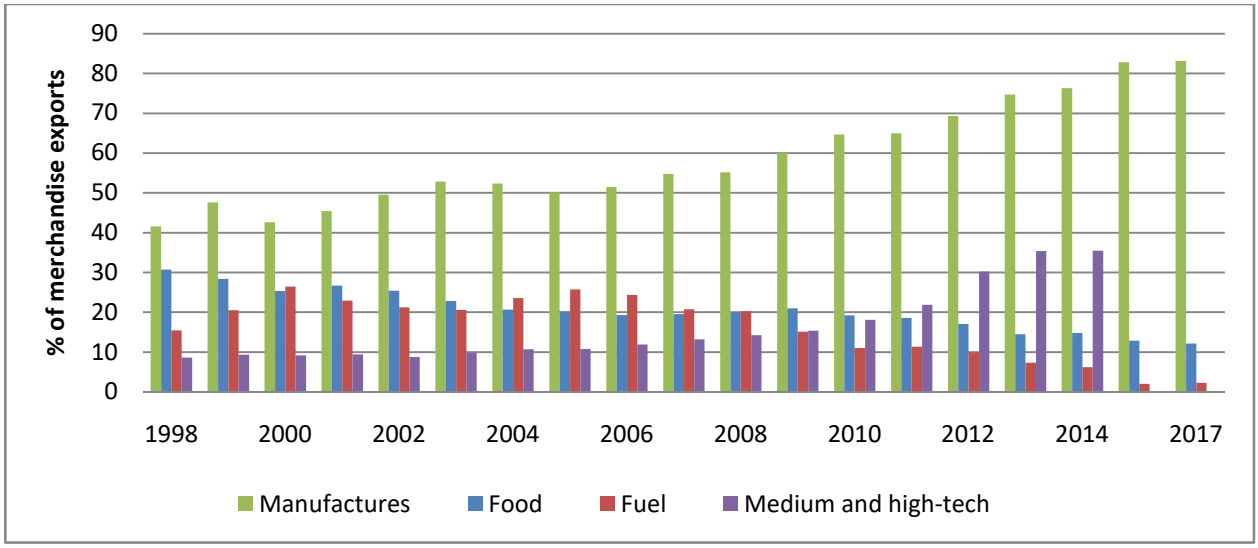
Note: "Within ASEAN+3" or "intra-region" is the value of export (import) to (from) ASEAN+3 economies from (to) ASEAN+3 economies. "ASEAN+3 % of total export (import)" is the share of intra-regional export/import in total export (import) from (to) the region. "Export (import) destination (in percentage of total export (import))" is the share of bilateral export (import) over total export (import). Bilateral export (import) is the export (import) value to (from) the countries in the row from (to) the countries in the first column. Source: DataStream.

Figure 2.13: Export volume from Viet Nam to A10 economies (in current billion USD)



Note: This figure displays the time series of export volume from Viet Nam to individual A10 economies during the period 1998-2017. Export volume is in current billion U.S. Dollar. Source: DataStream

Figure 2.14: Viet Nam export basket, 1998-2017



Note: This figure displays the time series of exporting basket of Viet Nam during 1998-2017. The axis measures the commodities export as percentage of merchandise export. Merchandise export includes food, fuel, manufactures, agricultural raw material export, and unclassified export. Merchandise export shares may not sum to 100 percent because of unclassified trade. Manufactures comprise commodities in SITC sections 5 (chemicals), 6 (basic manufactures), 7 (machinery and transport equipment), and 8 (miscellaneous manufactured goods), excluding division 68 (non-ferrous metals). Food comprises the commodities in SITC sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels). Fuels comprise the commodities in SITC section 3 (mineral fuels, lubricants and related materials). Medium and high-tech export is a sub-category of manufactured exports. Data is missing for 2015.Data on Medium and high-tech export is missing during 2015-2017. Source: World Development Indicator

shift from labor-intensive exports to high-technology exports. Following Japan, the four Asian tigers (includes Hong Kong, Singapore, Taiwan, and South Korea) also adopted the export-oriented manufacturing growth strategy and successfully developed more capital-intensive industries in the 1970s and 1980s. In the beginning of the 1970s, export-oriented policy and import-substituting industrialization were adopted by Malaysia, Thailand, and the Philippines (Ariff and Hill, 1985), followed by Indonesia in around 1980. By the mid-1980s, China started exporting electrical and nonelectrical machinery and other more sophisticated products.

Following the successful policy of neighboring countries, Viet Nam has started adopting the export-led growth strategy since the 8th National Congress of the Communist Party in 1996.Since 1998, exports and imports have taken off with two digit growth rates per year. To date, Viet Nam is the 21st largest in the world regarding total trade.

Table 2.3 presents the export and import matrix of the A10 economies during the period 1998-2017, respectively. Panel A reports the export matrix, while panel B reports the import matrix. The host countries are in the first column, while the trading partner countries are in the rows. The second column shows the average intra-region export (import) value (in millions of US dollars). The third column gives the share of total exports (imports) over GDP. The fourth column gives the share of intra-region exports (imports) over total exports (imports). The remaining columns give the share of bilateral exports (imports) to (from) each of the other A10 economies over total exports (imports).

Some results are worth noting. Overall, intra-region exports have considerably increased, from an average per country of US$88 billion USD in the first period to US$218 billion USD in the second period. On average, 43% of the exports of these economies went to other economies in the group during the first period. This share has slightly increased to 44% in the second period. This mostly reflects the rise in the share of the total exports from China to the other A10 economies, which compensated falls in the share of total exports from the high-income A10 economies. Nevertheless, this intra-region trade is still relatively low compared to Europe where intra-region trade accounts for 83% of total exports.[22]China and Japan were the main exporters to the A10 countries in the first period, followed by Hong Kong, Singapore, and Korea. However, China has become the leading exporter to the A10 countries in the second period in which export volume

[22]Source: Europa.eu

more than doubled that of the second country, Japan. Interestingly, China has decreased the proportion of its exports to the A10 economies to 34% in the second period from 49% in the first period.

On the import side, we see a similar picture. In the first period, China, Japan, and Hong Kong are the main – roughly equal-sized – intra-region importers. However, Chinese imports from the region grow much fast than that of other countries, making it by far the largest intra-region importer in the second sub-period. Simultaneously, China has reduced its share of intra-region imports from 50 percent to 29 percent across these two periods.

The other noticeable fact is the sizable bilateral trade between China and Hong Kong, and between Singapore and Malaysia. Both Hong Kong's exports to China and its imports from China are about 40 percent of its total exports and imports, respectively. It shows the strong dependence of Hong Kong on China. This is not surprising and can be explained by the geographical and historical ties between the two economies. Also, Singapore and Malaysia are mutually dependent as they are the most important buyer and seller of each other's goods and services in the region because of their tight historical and economical links. Note that the percentages – all around 10 percent – are considerably lower than in the Hong Kong – China relation.

We now turn to Viet Nam. Table 2.3 shows that in the period 2008-2017, 36 percent of Vietnamese exports go to the A10 economies and 65 percent of Vietnamese imports come from the A10 economies. These percentages are approximately the same as in the period 1998-2007. China and Japan are the most important trading partners for Viet Nam in the region, followed by Singapore and Korea. Figure 2.13 displays the time series of export volume from Viet Nam to individual A10 economies during the period 1998-2017. It shows that among these economies, China has surpassed Japan in the second period and has become the most important trading partner for Viet Nam. By 2017, the export value between Viet Nam and China had grown to US$30.7billion, accounting for 9.8% of the total export from Viet Nam.

Viet Nam's export basket has shifted from low-skill intensive goods to high-skill intensive goods. Figure 2.14 displays the development of exporting baskets of Viet Nam during 1998-2017. The

axis measures each type of commodity exports as a percentage of merchandise exports.[23] Manufacturing exports have expanded since 2003, accounting for 52.8 percent of total exports in 2003, up to 82.8 percent in 2016, driven by dynamic growth in the export-oriented foreign sector (WB report, 2018). Medium and high-tech goods exports have increased from 10 percent of total merchandise exports in 2003 to 35 percent in 2014. At the same time, the share of primary commodity exports has steadily fallen, with fuel exports down from 20 percent in 2003 to 2 percent in 2017 that reflects the contraction of oil production (World Bank, 2018).

2.3.3 Financial integration

Parallel to the increasing trade integration of East Asia, the A10 economies have also deepened financial integration. Over the past 20 years, there has been a remarkable inflow of FDI to the A10 region. Figure 2.15 displays the global FDI inflows to the region and the distribution of these inflows across countries during 1998-2017. The left axis measures the FDI inflows to the A10 economies, while the right axis measures the share of FDI inflows to the A10 economies over the global FDI inflows. Total FDI has increased more than fivefold, from $87 billion in 1998 to $453 billion in 2017. By the end of 2017, total FDI to the region accounted for about 23% of global FDI inflows, mainly concentrated in China and Singapore.

Most FDI inflows to A10 countries originate from other countries outside the region. Intra-regional FDI has also become more important, although it remains moderate. Figure 2.16 displays the distribution of the intra-regional FDI stocks across recipient countries during the years 2009 - 2017.[24] Intra-regional FDI stocks have almost doubled from $456 billion in 2009 to $974 billion in 2017, accounting for a moderate average of 19%of total FDI to the region over 2009-2017. Most of intra-regional FDI investments go to China and Singapore.[25] Figure 2.17 displays the source of intra-regional FDI investments. Unsurprisingly, the countries with relatively high per

[23]Merchandise export shares may not sum to 100 percent because of unclassified trade. Medium and high-tech export is a sub-category of manufactured exports. Data for the year 2015 is missing.

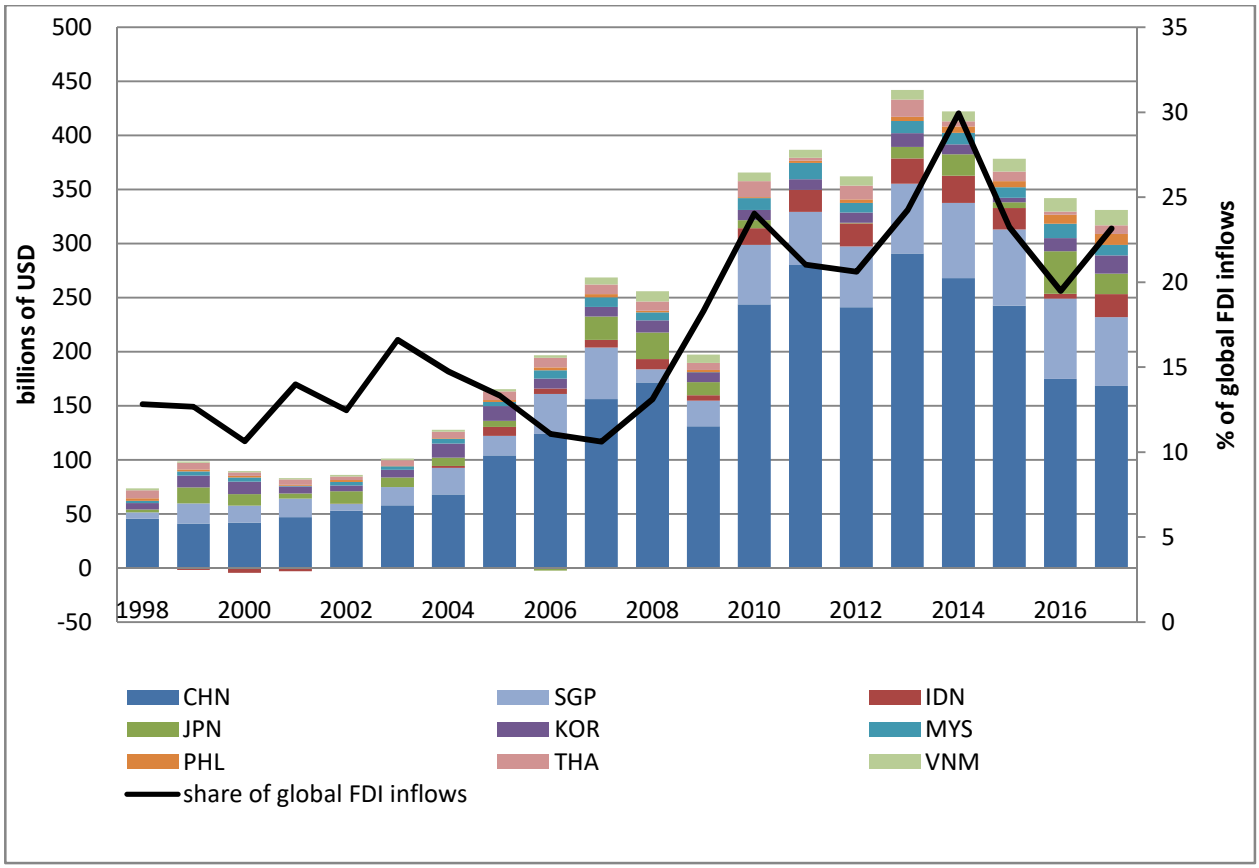
[24]According to the OECD, FDI stocks measure the total level of direct investment at a given point in time, usually the end of a quarter or of a year. The outward FDI stock is the value of the resident investors' equity in and net loans to enterprises in foreign economies. The inward FDI stock is the value of foreign investors' equity in and net loans to enterprises resident in the reporting economy. FDI flows record the value of cross-border transactions related to direct investment during a given period, usually a quarter or a year. Outward flows represent transactions that increase the investment that investors in the reporting economy have in enterprises in a foreign economy. Inward flows represent transactions that increase the investment that foreign investors have in enterprises resident in the reporting economy less transactions that decrease the investment of foreign investors in resident enterprises.

[25]Note that we do not include FDI from Hong Kong and Taiwan, that together account for 48% of regional FDI.

capita income –primarily Japan, but also Singapore, Malaysia, and recently Korea – are the top FDI suppliers within the region.

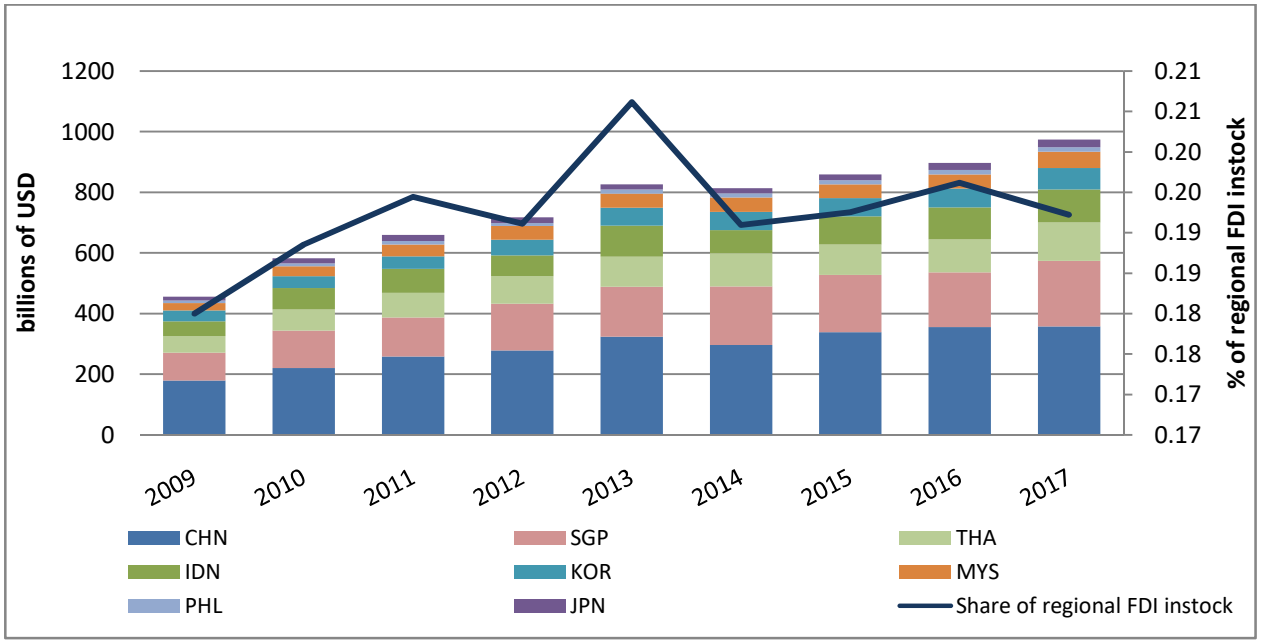
Table 2.4 presents the summary of capital flows to and from the A10 economies during 1998-2017, divided into two panels A and B, corresponds to the two sub-period 1998-2007 and 2008-2017. The reported economies are in the first column. The second column reports the total FDI inflows to the reported economies, in billion USD. The third column reports the share of FDI inflows as a percentage to the reported economies. Columns (4) and (5) report similarly to columns (2) and (3), respectively, for FDI outflows. Columns (6) and (7) also report similarly to columns (2) and (3), respectively, for portfolio investment inflows.

Figure 2.15: FDI inflows to A10 economies (in billion USD)



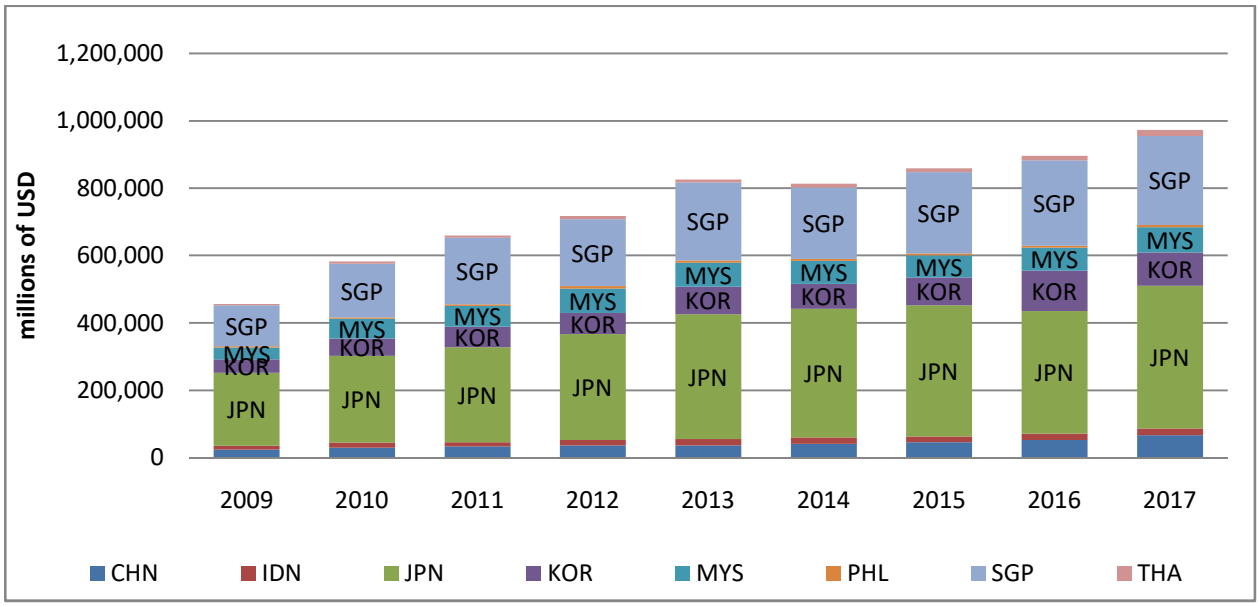
Note: This figure displays the global FDI inflows to the region and the distribution of these inflows across the different countries during 1998-2017. The left axis measures the FDI inflows to the A10 economies, while the right axis measures the share of FDI inflows to the A10 economies over the global FDI inflows. Global FDI inflows is the world FDI inflows. Share of global FDI inflows is the percentage of total FDI inflows to the region over the FDI inflows to the world. The figure does not include FDI inflows to Hong Kong. Source: IMF.

Figure 2.16: Intra-regional FDI instock host economies



Note: This figure displays the recipients of intra-regional FDI stock during 2009 -2017. FDI stocks measure the total level of direct investment at a given point in time, usually the end of a quarter or of a year. The intra-regional FDI instock is the sum of FDI instock from the A10 economies to themselves. The figure does not include Viet Nam due to data limitation. The figure does not include FDI instock from Hong Kong. The data for 1998-2008 is not available. Source: Coordinated Direct Investment Survey (CDIS).

Figure 2.17: Source of Intra-regional FDI instock



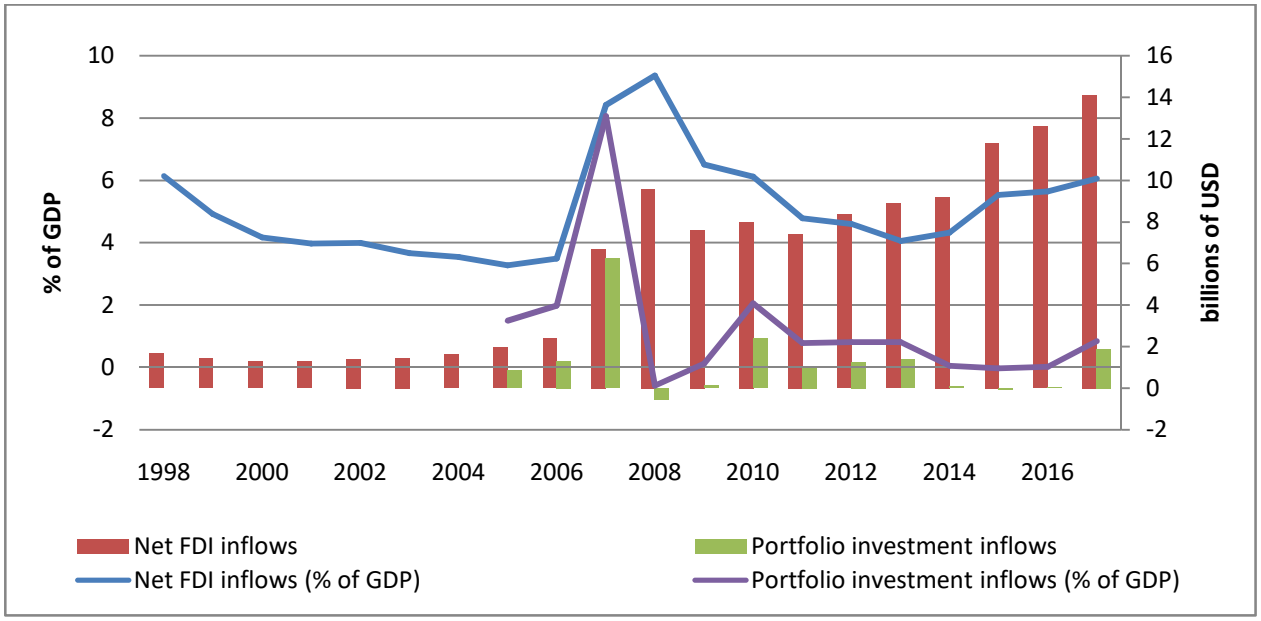
Note: This figure displays the providers of intra-regional FDI instock. The FDI instock is in million U.S. dollar. The figure does not include FDI from Hong Kong and Viet Nam. Source: Coordinated Direct Investment Survey (CDIS).

Table 2.4: Summary of capital flows to and from A10 economies during 1998-2017

	FDI inflows		FDI outflows		Portfolio Investment inflows	
	volume (billion USD)	% of GDP	volume (billion USD)	% of GDP	volume (billion USD)	% of GDP
1998-2007						
CHN	73.9	3.9	10.0	0.5	11.7	0.5
HKG	33.7	18.7	34.4	19.1	20.5	11.1
IDN	1.2	0.0	3.5	1.1	2.3	0.4
JPN	8.5	0.2	41.4	0.9	112.7	2.5
KOR	9.2	1.4	7.5	1.0	13.1	1.8
MYS	4.2	3.4	3.5	2.5	1.7	1.0
PHL	1.7	1.7	0.9	0.7	1.7	1.7
SGP	20.8	17.5	13.2	10.8	4.8	3.5
THA	6.2	3.9	0.5	0.3	2.2	1.0
VNM	2.1	4.6	0.1	0.2	2.8	3.8
Average	16.2	5.5	13.1	4.2	18.5	2.7
2008-2017						
CHN	221.2	2.8	96.1	1.1	46.4	0.5
HKG	101.8	36.8	87.7	32.5	12.5	4.7
IDN	16.5	2.0	5.0	0.6	14.4	1.7
JPN	13.8	0.3	127.6	2.5	103.1	2.0
KOR	10.4	0.8	26.8	2.2	15.1	1.3
MYS	9.7	3.3	12.8	4.5	5.3	1.7
PHL	4.3	1.6	3.5	1.4	1.2	0.6
SGP	53.9	19.0	30.8	11.2	0.9	0.1
THA	8.6	2.3	9.3	2.4	1.6	0.4
VNM	9.8	6.3	1.0	0.6	0.8	0.5
Average	45.0	7.5	40.0	5.9	20.1	1.3

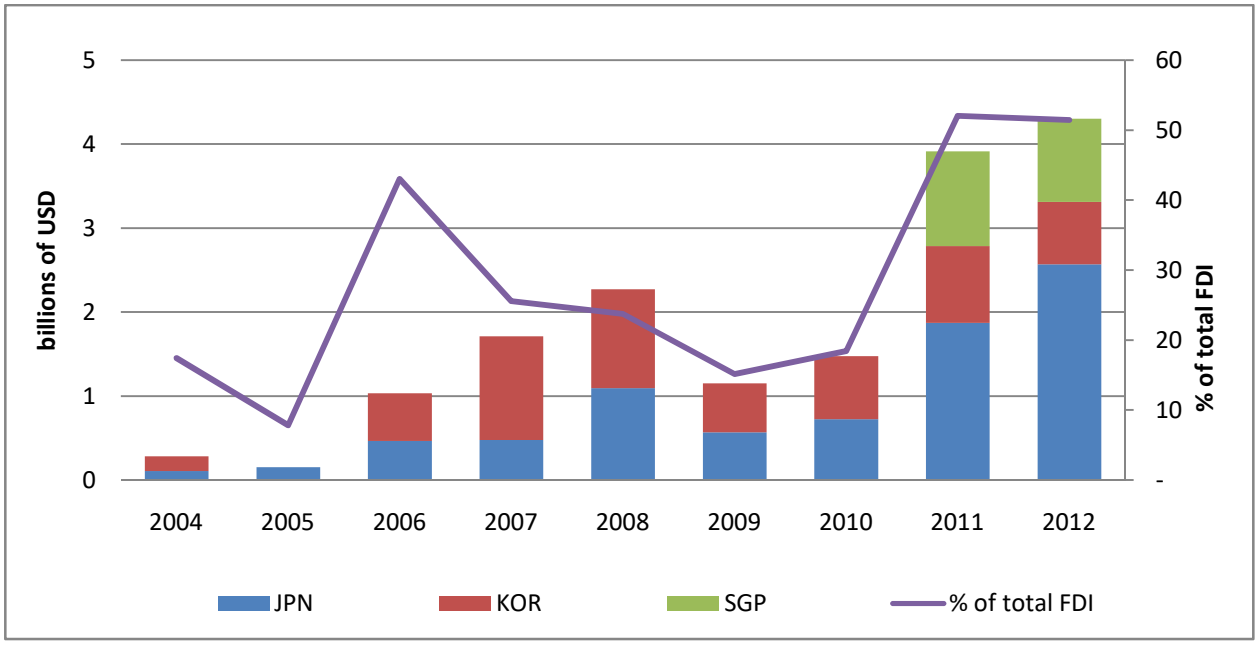
Note: FDI inflows is the total inflows. Share of total FDI inflows to the region is the share of FDI inflows to an economy over the total FDI inflows to the A10 economies. FDI outflows and Portfolio investment inflows follow the same calculation. All inflows are in billion U.S. dollars. Source: Author calculation based on the IMF BoP and Coordinated Direct Investment Survey (CDIS).

Figure 2.18: Capital inflows to Viet Nam 1998-2017



Note: This figure displays the time series of capital inflows to Viet Nam during 1998-2017, including FDI and portfolio inflows. The left axis measures the capital inflows as percentage of GDP. The right axis measures the capital inflows in billion USD. Source: Balance of Payment, IMF.

Figure 2.19: Top FDI investors in Viet Nam, 2004-2012



Note: This figure displays the major sources of FDI inflows to Viet Nam. . The left axis measures the FDI volume by each investor, in billion U.S. dollar. The right axis measures the percentage of FDI volume from Japan, Korea, and Singapore over the total FDI of Viet Nam. Source: UNCTAD

Overall, capital flows to and from the region have considerably expanded over time. The average FDI inflow per economy has surged from 16.2 billion USD in the first sub-period to 45 billion USD in the second sub-period, corresponding to 5.5 percent and 7.5 percent of GDP, respectively. The surge in FDI inflows was led by China, Hong Kong, and Singapore. Although China is the top FDI recipient with FDI inflows increase from 73.9 billion USD in the first period to 221.2 billion USD in the second period, the FDI inflows as a share of GDP decreased to 2.8 percent in the second period from 3.9 percent in the first period.

FDI outflows have also risen dramatically, mainly led by Japan, Hong Kong, and Singapore. Especially, average FDI outflows from China increased almost ten times, from 10 billion USD in the first period to 96 billion USD in the second period, making China the second-largest FDI supplier in the second period among A10 economies.

Average portfolio flows to A10 increased from 18.5 billion USD in the first period to 20.1 billion USD in the second period, mainly led by China and Indonesia. In the other A10 economies, portfolio inflows have shrunk considerably. For example, average portfolio inflows to Singapore decreased from 4.8 billion USD in the first period, corresponding to 3.5 percent of GDP, to 0.9 billion USD in the second period, corresponding to 0.1 percent of GDP.

Regarding Viet Nam, the economy is an attractive destination for foreign investors owing to its abundant, relatively cheap, and skilled labor force, political stability, improved ease of doing business, and its membership in the ASEAN and AFTA. In addition, the geographical proximity to China has encouraged multinational corporations shifting their production lines to Viet Nam amid increasing average wages in China (Mirza and Giroud, 2004). As a result, Viet Nam has attracted a considerable amount of FDI relative to its economic size. Table 2.4 shows that FDI inflows to the country have increased almost five times, from an average of 2.1 billion USD in the first period to 9.8 billion USD in the second period, corresponding to an increase in the share of FDI inflows over GDP from 4.6 percent to 6.3 percent. The portfolio investment inflows are moderate. They are officially recorded only since 2005 and are mostly concentrated in 2007.

Figure 2.18 displays the time series of capital inflows to Viet Nam during 1998-2017, including FDI and portfolio inflows. The left axis measures the capital inflows as a percentage of GDP. The right axis measures the capital inflows in billion USD. Inflows of FDI to the country have started surging since 2007, in response to Viet Nam's membership in the WTO. After a peak in 2008,

FDI inflows fell off in the subsequent years in light of the global credit crunch 2007-2009 but picked up again after 2011. It reached 14.1 billion USD in 2017, corresponding to 6 percent of GDP.

Figure 2.19 displays the major FDI investors in Viet Nam. The left axis measures the FDI volume by each investor, in billions of U.S. dollars. The right axis measures the percentage of FDI volume from Japan, Korea, and Singapore over the total FDI of Viet Nam. During 2004-2012, Korea, Japan, and Singapore are the top FDI investors in Viet Nam. Together they account for over 50% of total FDI inflows in 2012. Data that are more recent are unavailable.

2.4 Conclusion

In this chapter, I provide a comprehensive overview of economic integration between Viet Nam and the other A10 economies during 1998-2017. I document that intra-regional economic integration has substantially evolved during the last two decades. I also show that economic development and integration between Viet Nam and the other A10 economies has been ongoing, though Viet Nam is still lagging in many dimensions of integration.

During 1998-2017, Viet Nam has made significant progress in economic development owing to fast growth in productivity and its labor force, as well as a structural shift toward the high productivity sectors. The country has opened its economy to the world, which has facilitated global economic integration. Financial reforms have further helped foster international trade and investment. Viet Nam has reaped substantial gains through increasing international economic cooperation. International trade has taken off with two digit growth rates per year since 1998. The current account has shifted from deficit to surplus since 2012, mainly supported by a positive trade surplus. Viet Nam's exports have not only grown in volume but also have changed in composition. The export basket has somewhat shifted from low-skill intensive goods to high-skill intensive goods. The other A10 economies are the most important trading partners of Viet Nam, especially Japan and China. On the financial side, FDI inflows play a dominant role. Especially since 2007, when Viet Nam joined the WTO, FDI inflows started to accelerate. Japan, Korea, and Singapore are the top investors of Viet Nam.

Chapter 3
Financial integration in Asia

3.1 Introduction

The 1997 Asian financial crisis, triggered by the collapse of the Thai Baht, led to a strong impetus for regional cooperation in Asia in order to create institutions to prevent and manage future financial crises and to develop sound financial systems to enhance economic efficiency. Related proposals, among others, include the 2000 Chiang Mai initiative (CMI), the 2003 Asian Bond Market Initiative (ABMI), the 2004 ASEAN Capital Market Forum, and the ASEAN Comprehensive Investment Agreement (ACIA), effective March 2012.[26] Despite these efforts, empirical evidence shows that the degree of financial integration in Asia remains a subject of debate.

Some studies suggest that the region has weak financial market integration (Kim, 2005; Kim et al., 2008; Park and Lee, 2011; Claus and Lucey, 2012) or that financial integration lags real economic integration (Jang, 2011; Lee and Park, 2013). Others have confirmed the process of

[26]The Chiang Mai Initiative, launched in 2000, aims to create a network of bilateral swap arrangements among the ASEAN economies, China (including Hong Kong), Japan, and the Republic of Korea, collectively known as ASEAN+3, to address short-term liquidity problems in the region and to complement existing international financial arrangements. The ACMF, established in 2004, is a forum comprising capital market regulators from the 10 ASEAN economies (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam). Initially focused on projects to harmonize standards in capital market regulations, the ACMF has since shifted to consider more strategic issues to achieve greater regional capital-market integration. The ABMI was launched in 2002 to develop local currency bond markets as an alternative source of funding to foreign-currency-denominated bank loans in order to minimize the currency and maturity mismatches that had made the region vulnerable to sudden reversals of capital inflows. Policymakers in the ASEAN+3 region have also aimed to promote regional financial cooperation and integration under ABMI.

financial integration is ongoing (Yang et al., 2003; Boubakri and Guilaumin, 2015). Most existing literature has focused on global integration (for example, Beirne et al., 2010; Chevallier et al., 2018), but not on regional financial integration. Among the few examples of the latter are Guillaumin (2009), Yu et al. (2010), and Hinojales and Park (2011), who show that financial integration has recently intensified. Previous literature has still not fully examined the impact of the 2008 global financial crisis (GFC) on the development of financial integration in Asia. Comprehensively reviewing financial integration within the region, especially after the GFC, will prove informative for both policymakers and private or institutional investors, whether domestic or regional.

This study aims to assess the degree to which selected Asian economies are becoming more financially integrated within the region. We also investigate whether the financial integration process is accelerating, decelerating, or remaining the same over time. To do so, we use daily data from 11 Asian equity markets from 31 May 2002 to 1 June 2018, which covers the period before, during, and after the GFC. We apply four different, commonly used methodologies: beta-convergence, sigma-convergence, the Markov regime-switching model, and the Dynamic Conditional Correlation (DCC) model. While beta- and sigma-convergence examine price convergence to gauge the degree and speed of financial integration, the latter two methods examine the extent of asset return co-movement to capture the short-run dynamics of financial integration.

This study makes three contributions to the literature on Asian financial integration. First, we study the degree and evolution of financial integration over a long period that includes the 2008 crisis. Existing studies lack consensus regarding the evolution of financial integration in Asia after the crisis, a gap that our analysis fills. Second, we separate the crisis period from before and after the crisis to correctly assess the evolution of integration without distortion from the period of turmoil. Third, we use several methodologies to examine different dimensions of integration, thus providing a more balanced picture compared to a single methodology.

Our empirical evidence can be summarized as follows. First, the degree of financial integration roughly mirrors the level of economic development in our sample. High-income economies are relatively more integrated than upper-middle-income economies, which are in turn, are more integrated than lower-middle-income economies. Second, unlike previous studies, we show that

integration for most economies has followed a steady path, notwithstanding the short-term discontinuity represented by the 2008 crisis. Third, the Vietnamese equity market displays increasing regional co-movement but lacks evidence of integration.

The remainder of this paper is structured as follows. Section 3.2 reviews the relevant literature; Section 3.3 presents the data and its properties. Section 3.4 concerns the research design. Section 3.5 describes the empirical results and robustness checks and discusses these. Section 3.6 summarizes and discusses the main empirical results. Section 3.7 concludes.

3.2 Literature review

This section is divided into two parts to explain the background for this work. Section 3.2.1 concerns the commonly used empirical methodologies to measure financial integration. Section 3.2.2 briefly reviews the relevant empirical literature, focusing on financial integration in the Asian region, and highlights key elements of the integration process, such as the extent to which Asian financial markets are integrated within the region and with the rest of the world.

3.2.1 Measurement of financial integration

Financial integration is the process by which an economy's financial markets become more closely linked with those in other economies. The choice of methodology presents a key challenge in assessing financial integration, as the literature offers no standard approach. Baele et al. (2004) review existing methodologies, grouping them into three categories: (i) price-based measures; (ii) news-based measures; and (iii) quantity-based measures.[27]The price-based approach, which is most commonly used in the literature, measures discrepancies in prices or returns on assets across different markets (Baele et at., 2004). News-based measures capture the percentage of asset price changes explained by common factors, whereas quantity-based indicators are based on volumes of capital flows and the stocks of external assets and liabilities.

We adopt four price-based measures applied to Asian stock markets. Price-based indicators have the advantages of: (i) data availability; (ii) data reliability; (iii) economic meaning; and (iv) ease of building and updating (see Adam et al., 2002; and Billio et al., 2017).

[27]For a review, see Adam et al., 2002; Baele et al., 2004; Kose et al., 2006; and Lane and Milesi-Ferretti, 2007.

The first group of integration measures is based on the price convergence concept, namely. This includes both beta- and sigma-convergence (Adam et al., 2002), which originate from the literature on economic growth and may be readily adapted to financial markets. Beta-convergence measures the speed of adjustment when countries deviate from a long-run benchmark value. Sigma-convergence measures the return dispersion over a specific period, indicating how far away one market is from full convergence to a benchmark. A handful of studies have employed beta- and sigma-convergence to study integration of European economies (Adam et al., 2002; Baele et al., 2004; Babetskii et al., 2007; Dvoroková, 2014; Sehgal et al., 2017). Rizavi et al. (2011) examine both beta- and sigma-convergence for a group of ten Asian countries (India, Hong Kong, Indonesia, Malaysia, South Korea, Pakistan, the Philippines, Singapore, China, and Thailand) for the period from 1999 to 2009, finding evidence of initially increasing convergence in all countries yet divergence since 2004.

Another popular price-based indicator involves a multivariate cointegration framework developed by Johansen (1988). This method detects the number of common stochastic price trends in a group of equity markets and provides insights into the long-run relationships among the markets. The technique is expanded into a vector error-correction model to allow for short-term adjustments toward the equilibrium. Several papers have attempted to assess financial integration using this cointegration technique. Early papers, including Chan et al. (1992) and Huang (1995), found no evidence of cointegration between Asian and U.S. markets or among the Asian markets themselves. DeFusco et al. (1996) found no cointegrating vectors among the equity markets of Korea, the Philippines, Taiwan, Malaysia, and Thailand from 1989 to 1993. By contrast, Chung and Liu (1994) identified two cointegration relationships among stock prices of the U.S. and five East Asian countries: Japan, Taiwan, Hong Kong, Singapore, and South Korea. Masih and Masih (1999) found a single cointegrating vector among Southeast Asian equity markets from 1992 to 1997. These early papers all treat convergence as a static phenomenon, not a time-varying process, which may provide misleading implications for policymakers and practitioners. Many subsequent papers have attempted to allow time-variant integration by using rolling or recursive cointegration approaches (for Europe, see Serletis and King, 1997; Rangvid, 2001; Pascual, 2003; Gilmore et al., 2008; Mylonidis and Kollias, 2010; for Asia, see Awokuse et al., 2009; Yu et al., 2010; Assidenou, 2011; and Chien et al., 2015).

A third approach to investigate financial integration is to measure the degree of market co-movement. Financial markets are then said to be integrated if prices or returns in these markets move proportionally or follow similar patterns. Previous studies typically use the Autoregressive conditional heteroskedasticity (ARCH) or Generalized Autoregressive conditional heteroskedasticity (GARCH) frameworks developed by Engle (1982) and Bollerslev (1986), respectively. Over time, a wide range of ARCH/GARCH models has been developed. The multivariate GARCH model is designed to make GARCH models more parsimonious. The CCC–GARCH model (Bollerslev, 1990) uses constant conditional correlations, while the DCC–GARCH model (Engle, 2002) allows time-varying serial and cross-market conditional correlations.[28] Using a DCC–GARCH model, Syllignakis and Kouretas (2011) studied contagion effects among the U.S. and German stock markets and seven emerging Central and Eastern Europe markets. Boubakri and Guillaumin (2015), examining East Asian financial integration between 1990 and 2012 using the multivariate DCC–GARCH framework, found that emerging equity markets were partially segmented before 2008 and that regional integration followed an upward trend after 2008. Beirne et al. (2010) and Chevallier et al. (2018) argued that Asian markets are mainly affected by global rather than regional shocks.

Fourth and finally, we consider the Markov regime-switching autoregressive time-series model, which has emerged as a leading approach to detecting and dating the turning points of equity markets (Hamilton, 1989). Unlike other integration measures, this model takes into account possible breaks caused by high- and low-volatility regimes. Failure to consider these breaks may lead to incomplete or incorrect statistical inferences. Bekaert and Harvey (1995) used such a model, in combination with multivariate ARCH models, to account for the time-varying nature of integration in emerging markets. Subsequent studies include Linne (2002), Bialkowski (2004), Moore and Wang (2007), and Sehgal et al. (2018), which applied the model to detect volatility co-movement, mainly focusing on European stock markets. Only limited empirical literature has applied Markov-switching models to Asian stock markets. Li and Lin (2003) examined the Taiwanese stock market from 1981 to 1998, reporting that the number of regimes is sensitive to

[28] Literature using the DCC-GARCH model includes, for Asia, Chiang et al. (2007), Gupta and Guidi (2012), Lean and Teng (2013), Narayan et al. (2014), Boubakri and Guilaumin (2015); Baumohl (2013) for the CEE-4 (Czech Republic, Poland, Hungary, and Slovakia) and G7 (the United States, Japan, Germany, the UK, France, Italy, and Canada) markets; for Europe, Kim et al. (2005), Syllignakis and Kouretas (2011), Ahmad et al. (2013), Sehgal et al. (2017); and Alotaibi and Mishra (2017) for GCC markets (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates).

the sample period. Wang and Theobald (2008) investigated regime-switching behaviour for six East Asian stock markets from 1970 to 2004, detecting more than one regime for each stock market. Nevertheless, none of these studies has investigated regime synchronization among Asian stock markets.

3.2.2 Financial integration in Asia

Since the first steps towards financial liberalization in Asia, researchers have been interested in the financial integration of Asian markets, particularly equity markets. There is little consensus so far on the degree of integration. Some studies have argued that Asian financial markets are globally integrated (commonly represented by the United States), [29]while Chiang et al. (2007) and Singh et al. (2010), among others, have argued that Asian financial integration is more regionalized (commonly represented by Japan) than globalized. Chi et al. (2006) used an Intertemporal Capital Asset Pricing Model (ICAPM) approach to show that integration among Asian national markets and with the region (Japan) is higher than their integration with the world (the United States). On the other hand, Kim (2005) and Park and Lee (2011) offered evidence to suggest that the region's equity markets are integrated more globally than regionally. Similarly, Ng (2000) examined the role of Japanese and U.S. markets in explaining the volatility of returns in six Pacific-Basin equity markets from 1975 to 1996, reporting that the influence of the world market tends to exceed that of the regional market, though together they still account for a small part of the variation in return.

In general, existing studies have shown that overall financial integration remained weak before the 1997 Asian financial crisis (AFC) but has accelerated afterwards (Kim, 2005; Park and Lee, 2011; Kim and Lee, 2012). This has been partly attributed to the increase in cooperation initiatives at the regional level, including the 2010 Chiang Mai Initiative (CMI), the 2003 Asian Bond Markets Initiative, and the 2004 ASEAN Capital Market Forum (Didier et al., 2017). Moreover, globalization has facilitated cross-border trading, and increased cross-border financial activity also contributes to financial integration (Carrieri et al., 2007; Yu et al., 2010).

While the existing literature has mostly focused on the financial integration of Asian economies with developed economies, little is known about intra-regional integration. Few studies have

[29]For example, Arshanapalli et al. (1995), Janakiramanan and Lamba (1998), Ghosh et al.(1999), Zhou et al. (2012), and Diebold and Yilmaz (2012).

assessed the degree of financial integration among Asian economies (Boubakri and Guilaumin, 2005; Glick and Hutchison, 2013; Huyghebaert and Wang, 2010; Yu et al., 2010). Yu et al. (2010) used several methodologies to assess the degree of integration in 10 Asia economies, finding a stronger degree of integration within the high-income group of Hong Kong, Taiwan, South Korea, and Singapore compared to other, lower-income economies in the region. Huyghebaert and Wang (2010) found that shocks in Hong Kong and Singapore largely affected other East Asian equity markets after 1997 but had no effect on Mainland China. Glick and Hutchison (2013) evaluated the financial linkages between China and its neighbouring economies from 2005 to 2012, reporting weak cross-country correlations in long-term interest rates but stronger correlations in the equity market. They attribute these equity market linkages to increasing investor attentiveness to China as a source and destination of equity finance during the crisis rather than to any financial deepening or liberalization. Chien et al. (2015) applied the recursive cointegration technique to confirm increasing, albeit limited integration from 1992 to 2013 between China and the region. Boubakri and Guilaumin (2005),using the DCC–GARCH approach, argued that the years 2009 to 2012 were characterized by an upward trend in the regional integration of East Asian stock markets. By contrast, Rizavi et al. (2011) examined integration in the Asian region using beta- and sigma- convergence and found limited evidence of convergence from 2004 to 2009.

To summarize, the literature offers no consensus regarding the degree of intra-regional financial integration in Asia, nor is there a clear preference for one methodology to measure financial integration. Furthermore, there is little evidence of how the degree of financial integration has changed after the recent global financial crisis. This paper contributes to the literature by explicitly addressing these issues, examining the degree of financial integration among 11 Asian economies by employing beta-convergence, sigma-convergence, the Markov regime switching model, and GARCH–DCC. The study covers the period from 2007 to 2018, capturing potential changes in the degree of integration before, during, and after the GFC. The next section discusses the data and methodology in detail.

3.3 Data and times series properties

3.3.1 Data

In studying financial integration in the Asian region, we include Japan, Singapore, Hong Kong, South Korea, Taiwan, China, Thailand, Malaysia, the Philippines, Indonesia, and Viet Nam. For each economy, we employ the MSCI daily equity index extracted from the Thomson Financial DataStream from May 31, 2002 to June 1, 2018 (4,176 observations).[30] Using the MSCI index for all countries provides cross-country consistency (Arouri and Jawadi, 2010). All indices are expressed in U.S. dollars. For the regional benchmark, we use the MSCI ACFM Asia index, which covers 15 countries, including all economies covered in this study. The data are limited to 2002–2018 because the MSCI regional equity index is not available before May 2002.[31] Returns are calculated as the first difference of logarithmic prices multiplied by 100 (daily percentage return).

As different stages of the crisis may have differently influenced financial integration, we divide the sample period into three sub-periods: *before crisis* (31 May 2002 to 31 July 2007), *during crisis* (1 August 2007 to 31 March 2009), and *after crisis* (1 April 2009 to 1 June 2018). The starting date and length of the GFC are defined following existing literature. The literature broadly agrees the GFC started in August 2007, when BNP Paribas halted redemptions on three investment funds (Bekaert et al., 2014; Fratzcher, 2012; Kenourgios and Dimitrou, 2015; Sehgal et al. 2017; Song et al., 2018) and ended in March 2009 (Bekaert et al., 2014; Fratzcher, 2012; Kenourgios and Dimitrou, 2015).[32]

We divide the 11 economies into three groups based on income level, using the World Bank classification. The first group includes the high-income economies of Japan, Korea, Singapore, Taiwan, and Hong Kong. The second group includes the upper-middle-income economies of China, Malaysia, and Thailand. The third group includes the lower-middle-income economies of Indonesia, the Philippines, and Viet Nam.

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[30]For Viet Nam, the MSCI index is not available before 30 November 2006.

[31]The MSCI ACFM Asia index consists of Bangladesh, China, Hong Kong, Indonesia, India, Japan, Korea, Sri Lanka, Malaysia, the Philippines, Pakistan, Singapore, Thailand, Taiwan, and Viet Nam.

[32]Dooley and Hutchison (2009) identified February 2009 as the end of the GFC, while Cheung et al. (2010) use April 2009 as the ending date. Mobarek et al. (2016) suggested placing the end of the GFC in the last quarter of 2009. Glick and Hutchison (2013) identified May 2010 as the end of the GFC.

3.3.2 Time series properties

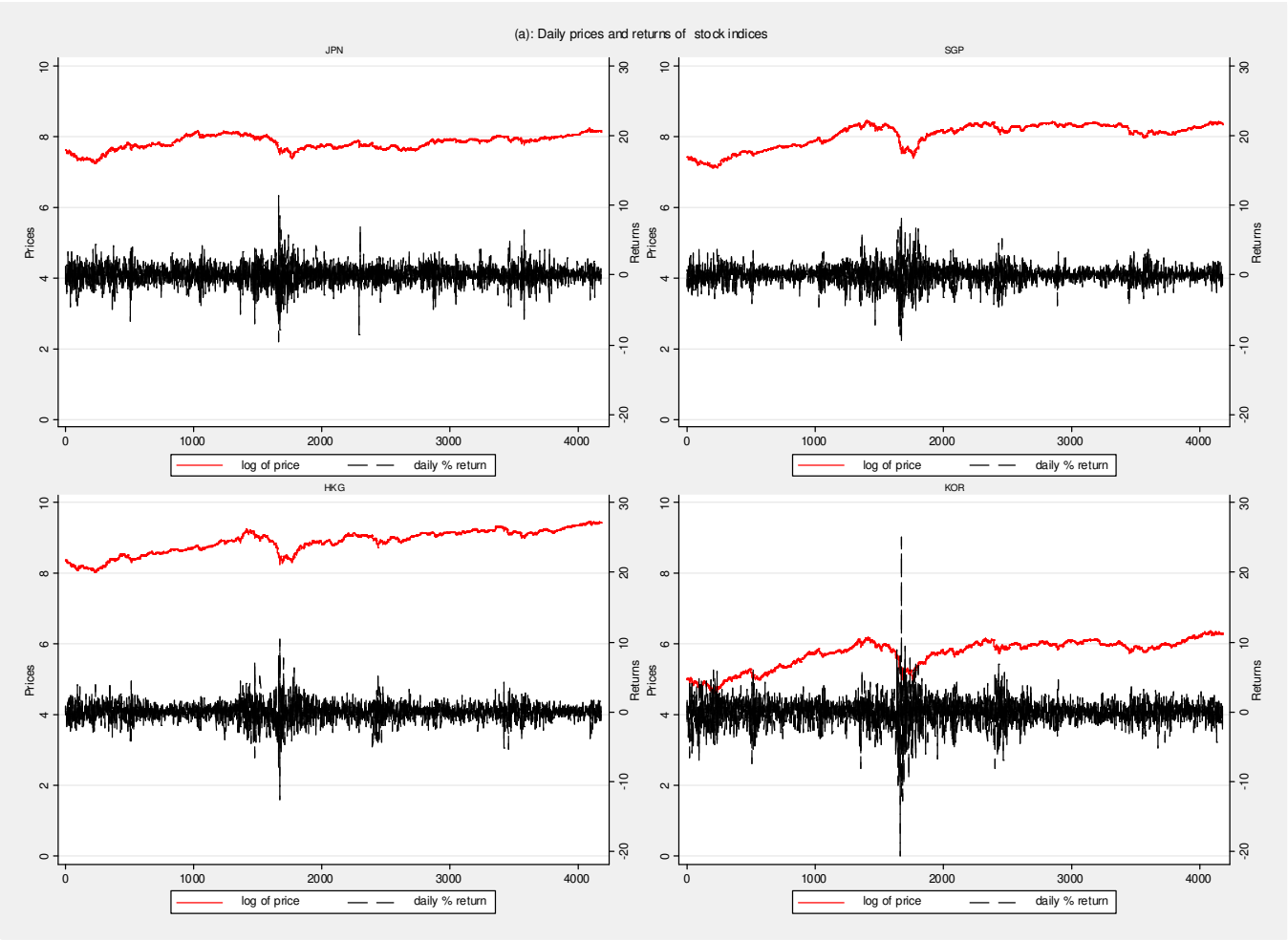
To begin, we plot the logarithm of the price level (red solid line) and the percentage stock returns (black dashed line) respectively using daily data over the sample period for individual countries and benchmark index in Figure 3.1. We observe that all markets display upward trends from the beginning of the period until approximately late 2007. After a common, severe downturn during the GFC, 2007 to 2009, the upward trend resumes. Except for Viet Nam, the plots show a clustering of larger return volatility around the GFC period, thus reflecting the impact of the crisis.

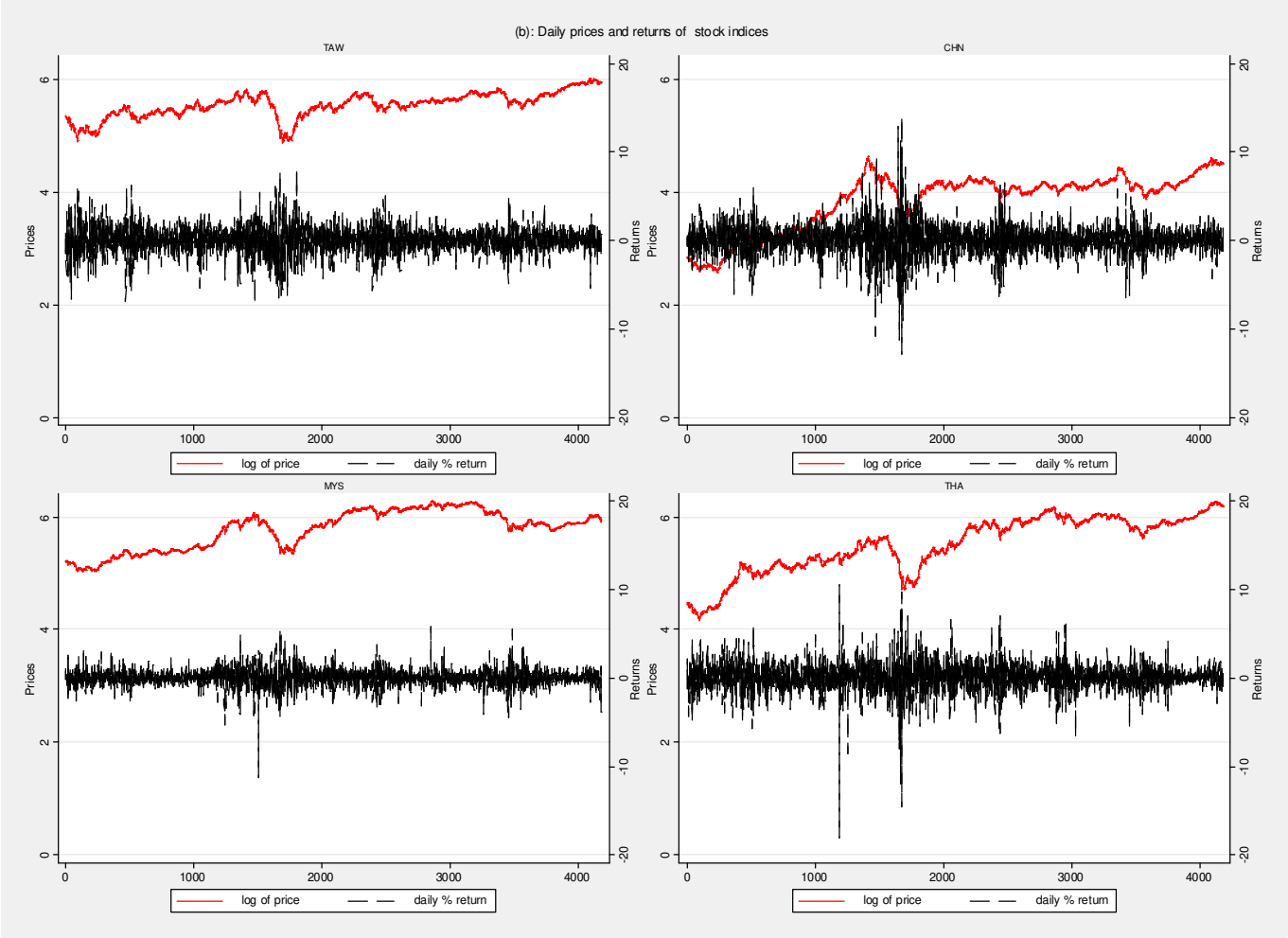
Next, the descriptive summary statistics of the return series are presented in Table 3.1 both for individual countries and for the three groups of countries. Mean returns and volatility are quite diverse among economies and across periods. The average return is rather low in Japan, Taiwan, Thailand, and Viet Nam, even turning negative for Viet Nam. Indonesia, Malaysia, and China experienced the highest average returns. With respect to volatility, captured by the standard deviation of daily returns, Thailand is the least volatile market, while Korea, China, and Indonesia are the most volatile markets. Furthermore, all the equity returns have negative skewness and positive excess kurtosis, suggesting that the returns are left-tailed with higher peaks and have thicker tails than a normal distribution.

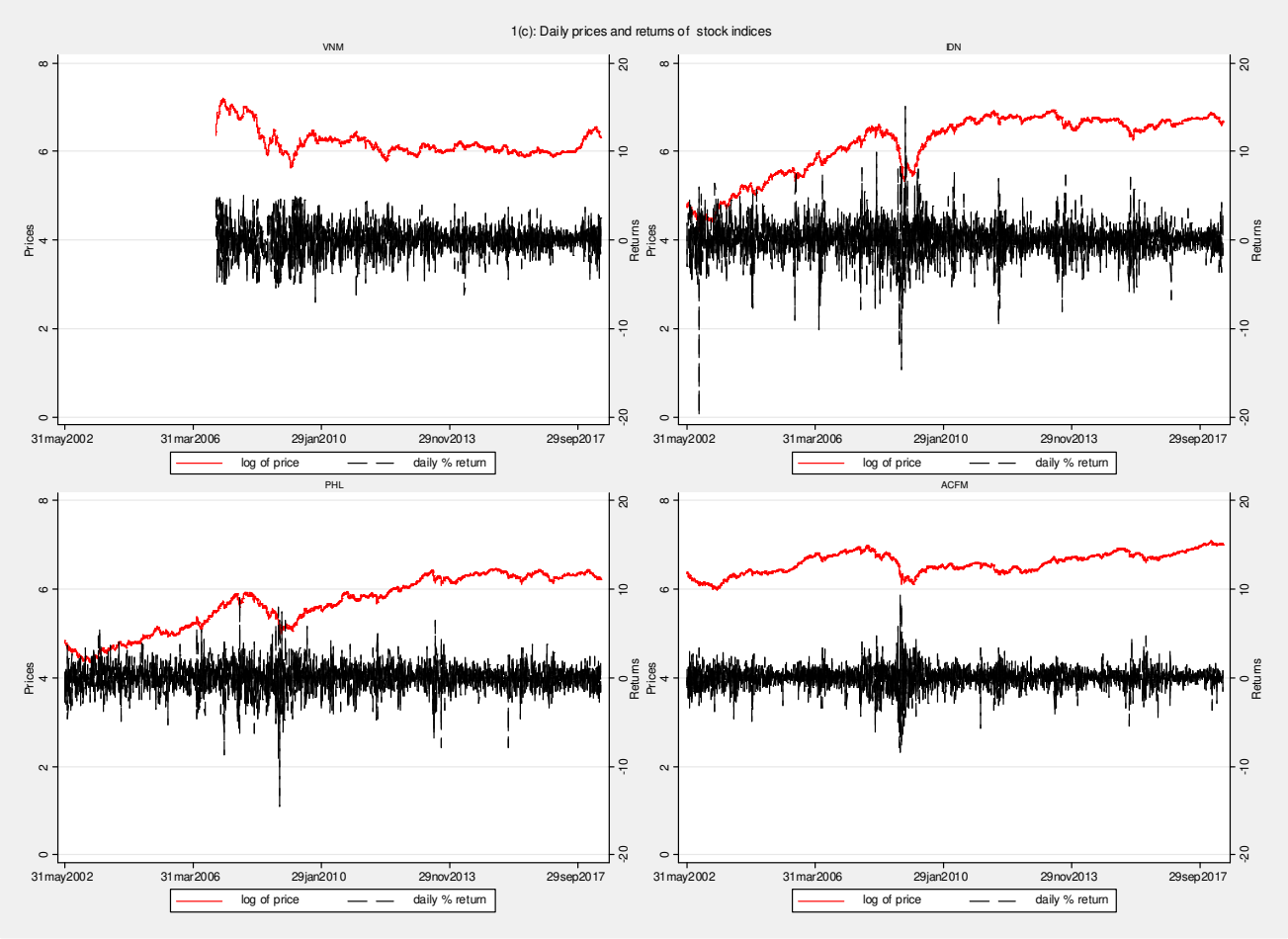
Table 3.1 also presents differences among country groups. For the whole period, the highest average returns and lowest volatility are observed for the lower-middle income group, while the high-income group has the lowest average returns and the highest volatility. Wald tests show that the differences in average returns among groups are insignificant, suggesting that the region has become increasingly financially integrated, which may reduce the differences in average returns across different groups of countries.

Examining the average returns of the three sub-periods, stock returns are generally higher *before crisis* compared to *after crisis* or *during crisis*. The dispersion of returns across countries appears to have declined after the crisis. We further test for differences in average returns between pairs of sub-periods: *during crisis* and *before crisis*, *during crisis* and *after crisis*, and *before crisis* and *after crisis*. Wald tests suggest that there are significant differences in the average returns between the crisis period and the other periods, while there is no significant difference between

Figure 3.1: Daily prices and returns of stock indices




(b): Daily prices and returns of stock indices
TAW
CHN
MYS
THA
Prices
Returns
log of price
daily % return



Note: These figures plot the time-series pattern of the daily % prices (measured as logarithm of daily price) and percentage daily returns of the stock indices per country. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM); ACFM (MSCI All Countries Frontier Markets equity index);

Table 3.1: Descriptive statistics of the return series

	N	mean	max	min	sd	skewness	kurtosis	Before GFC	During GFC	After GFC	*t-value*		
								(1)	(2)	(3)	(1)=(2)	(2)=(3)	(1)=(3)
(a) High income economies	*4175*	*0.021*	*11.72*	*-8.85*	*1.13*	*-0.3*	*10.5*	*0.049*	*-0.150*	*0.036*	*2.69****	*-3.02****	*0.40*
JPN	4175	0.012	11.47	-9.51	1.35	-0.2	7.9	0.034	-0.141	0.028	2.07**	-2.33**	0.15
SGP	4175	0.022	8.56	-9.81	1.24	-0.2	8.9	0.064	-0.166	0.032	2.89***	-2.87***	0.9
HKG	4175	0.025	10.45	-12.57	1.24	-0.2	11.1	0.045	-0.121	0.041	2.08**	-2.33**	0.12
KOR	4175	0.031	24.99	-20.67	1.78	-0.2	21.0	0.078	-0.186	0.044	2.22**	-2.38**	0.68
TAW	4175	0.014	8.23	-7.17	1.39	-0.2	6.2	0.025	-0.137	0.036	1.78*	-2.43**	-0.26
(b)Upper middle income economies	*4175*	*0.033*	*8.82*	*-9.14*	*1.13*	*-0.3*	*9.6*	*0.077*	*-0.127*	*0.037*	*2.84****	*-2.62****	*1.2*
CHN	4175	0.041	14.04	-12.84	1.66	-0.1	10.3	0.101	-0.109	0.033	1.90*	-1.54	1.47
THA	4175	0.018	5.78	-11.28	0.94	-0.4	11.3	0.051	-0.111	0.022	2.89***	-2.54**	1.01
MYS	4175	0.041	10.52	-18.08	1.53	-0.6	13.6	0.079	-0.16	0.056	2.44**	-2.73***	0.47
(c)Lower middle income economies	*4175*	*0.034*	*6.93*	*-11.29*	*1.20*	*-0.7*	*9.4*	*0.093*	*-0.167*	*0.037*	*3.29****	*-3.38****	*1.52*
IDN	4175	0.045	15.04	-19.95	1.81	-0.6	12.5	0.108	-0.135	0.042	2.06**	-1.87*	1.18
PHL	4175	0.034	9.33	-14.49	1.43	-0.5	9.1	0.072	-0.143	0.045	2.35**	-2.48**	0.62
VNM	3001	-0.0001	5.22	-6.99	1.63	-0.1	4.4	0.229	-0.224	0.024	2.17**	-3.06***	1.75*
(d) ACFM	*4175*	*0.015*	*9.40*	*-8.43*	*1.13*	*-0.5*	*10.1*	*0.039*	*-0.155*	*0.033*	*2.61****	*-3.06****	*0.17*
t-test for the mean differences													
t-value (a)=(b)		-1.11											
t-value (b)=(c)		-0.04											
t-value (a)=(c)		-0.79											

Note: This table reports the descriptive statistics of the daily percentage return series for all economies and the regional equity index. sd is standard deviation. The t-test is the two-sample t-test on the equality of the means. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM); ACFM (MSCI All Countries Frontier Markets equity index); *, **, *** indicate significance levels of 10%, 5%, and 1% respectively.

Table 3.2: Time series properties

	DF stat			Normality	Autocorrelation				ARCH(2)
	lags	ln(price)	ln(return)	chi2(2)	Q(2)	Q(12)	Q2(2)	Q2(12)	
JPN	3	-1.65	-34.2***	491***	55.14***	64.37***	704.86***	2,257***	590***
SGP	1	-1.68	-44.0***	561***	5.11*	38.23***	940.101***	4,160***	820***
HKG	1	-1.19	-44.3***	676***	3.34	14.11	1049.17***	3,412***	766***
KOR	1	-1.69	-45.0***	1,020***	2.83	29.52***	102.48***	1,907***	96***
TAW	1	-1.82	-44.1***	342***	8.57**	29.30***	182.58***	1,091***	171***
CHN	1	-1.65	-45.1***	608***	6.40**	35.20***	757.57***	3,435***	614***
THA	1	-1.69	-43.4***	765 ***	51.05***	64.21***	172.22***	459***	158***
MYS	2	-1.62	-35.1***	1,001***	9.15**	30.54***	410.41***	808***	339***
IDN	4	-1.97	-29.4***	908***	46.10***	59.84***	183.77***	544***	161***
PHL	1	-1.17	-43.6***	689***	45.59***	64.25***	242.31***	970***	225***
VNM	7	-2.41	-17.1***	96***	151.28***	198.00***	744.14***	2,639***	543***
ACFM	2	-1.23	-37.9***	771***	10.01**	23.98**	1013.04***	4,636***	886***

Notes: This table reports the properties of the daily percentage return series for all economies and the MSCI ACFM index. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM); ACFM (MSCI All Countries Frontier Markets equity index). The sample period is from May 31, 2002 to June 1, 2018. DF stat is the Dickey–Fuller test statistic. Q(x) and Q2(x) are the Ljung-Box statistics for serial correlation in returns and squared returns for order x. ARCH is the Lagrange multiplier test for autoregressive conditional heteroskedasticity. *, **, *** :The rejection of the null hypotheses of no autocorrelation, normality and homoscedasticity at the 10%, 5%, 1% levels of significance respectively for statistical tests, respectively.

the *before* and *after crisis* periods. Only in Viet Nam are the differences in average returns weakly significant between the *before* and *after crisis* periods. Note that the period *before crisis* in Viet Nam is shorter than for the other economies due to data unavailability.

Last, we examine the time series properties of the variables by testing the unit root, normality, and the ARCH effect, with the results presented in Table 3.2. Generally, the literature reports stationary equity returns but not logarithmic price levels. We first perform the Augmented Dickey–Fuller (ADF) unit root test for each economy, testing the logarithmic price levels and the returns. The lag length is selected by Schwarz information criterion (SIC). The ADF test statistics clearly indicate that all logarithmic price series are non-stationary and that all return series are stationary at the 1% level. We further test for normal distribution of the return using the joint test of skewness and kurtosis. The null hypothesis that the return distribution has a skewness of zero and kurtosis of three is rejected at the 1% level for all economies, thus indicating that the returns are not normally distributed. We also test for the presence of autocorrelation, heteroscedasticity, and ARCH effects tests, which are necessary to support the methodologies to detect co-movement among stock return series. Except for Hong Kong and Singapore, the Ljung–Box test (Q(2)) confirms the presence of autocorrelation on the daily equity return series.[33] Both the Ljung–Box statistics for the squared returns and the ARCH LM test are highly significant, which indicates the presence of ARCH effects in all series.

3.4 Research design

In this section, we outline the methodologies we use to assess the degree of financial integration across Asian equity markets. We first describe how to implement beta- and sigma-convergence on equity series. We then introduce the Markov Regime switching model of Hamilton (1989), which allows for shifts with unknown timing governed by the Markov process. Lastly, we discuss the DCC–GARCH model, which accounts for dynamics in the degree of financial integration.

[33]The null hypothesis of no serial correlation is rejected at the lags of 6 for Singapore and 13 for Hong Kong.

3.4.1 Beta-convergence

The concept of beta-convergence, originating from the growth literature, describes the catch-up effect: an economy with lower GDP per capita tends to grow faster than one with higher GDP per capita. Adam et al. (2002) proposed a "beta-convergence" measure of financial integration to capture the speed of convergence on government bond yields. In this paper, we use beta-convergence to evaluate the degree to which equity prices in one country have converged with equity prices in a benchmark country. The absolute value of the beta indicates the speed at which the equity market in economy *i* converges toward that of the benchmark equity market, calculated as follows:

$$(r_{i,t} - r_{B,t}) = \alpha_i + \beta_i\left(lnp_{i,t-1} - \varphi lnp_{B,t-1}\right) + \sum_{l=1}^{L} \gamma_l (r_{i,t-l} - r_{B,t-l}) + \varepsilon_{i,t} \qquad (3.1)$$

Where$r_{i,t}$, $r_{B,t}$are respectively the equity returns of economy *i* and the benchmark's equity index at time *t*; $lnp_{i,t}$, $lnp_{B,t}$are respectively the logarithm of economy *i*'s equity price index and the logarithm of the benchmark's equity price index at time *t*;β_i β_i is the convergence coefficient; φ measures the scale between the logarithm of economy *i*'s equity index and that of the benchmark's equity index; L is the number of lags; and $\varepsilon_{i,t}$ is the error term.

Should the logarithmic prices of different equity markets converge (apart from a constant), the estimate for β_i should be significantly negative, with the size of $\beta_i$measuring the speed of convergence. Specifically, the half-life of a shock to the price differential is computed as:

$$half - life = \frac{\ln(0.5)}{\beta_i} \qquad (3.2)$$

Equation 3.1 is estimated using Nonlinear Least Squares, in which the lag length is determined by the Schwarz Bayesian Information Criteria (SBIC) and standard errors are corrected for heteroscedasticity and serial correlation. In this analysis, we also estimate equation 3.1 for different sub-periods and test for the equality of the beta coefficients across pairs of sub-periods.

3.4.2 Sigma-convergence

Standard economic theories suggest that financial integration corresponds to decreasing cross-sectional dispersion in the returns of specific assets. Adam et al. (2002) suggest using sigma-convergence to measure the cross-sectional standard deviation of a variable. We apply this concept to test whether the cross-country standard deviation of stock returns has a declining

trend. Lower (higher) dispersion indicates greater (less) financial integration. Dispersion of an equity return *i* relative to the benchmark return (*B*) is measured as follows:

$$\sigma_i^S = \sqrt{T^{-1}\sum_{t=1}^{T}\left(r_{i,s-t} - r_{B,s-t}\right)^2} \qquad (3.3)$$

where$r_{i,t}, r_{B,t}$ are respectively returns of economy *i*'s equity index and the benchmark's equity index at time *t*; and $\sigma_i^S$is the return dispersion between economy *i* and the benchmark market *B* over the window [s-T, s]. By definition,$\sigma_i^S$is always positive. Lower values ofσ_i^Sindicate higher levels of convergence. Sigma convergence to zero indicates full integration. Sigma-convergence is estimated for each economy over the whole examined period, as well as over the sub-periods.

3.4.3 Markov Regime Switching

The Markov Regime Switching method, developed by Hamilton (1989), identifies turning points in stock markets and has been widely used to measure financial integration. Two stock markets are considered to be integrated if they experience the same regime. We employ a two-stage approach in this paper. First, using the Markov Regime Switching model (MRS), we estimate the probability that an equity market will experience a specific regime. Then, in the second stage, we empirically assess the unconditional correlation between the logits of the regime probabilities of two markets.

Stock return regimes are usually characterized as either low-volatility or high-volatility (Ang and Bekaert, 2002; Ang and Bekaert, 2004; Maheu and McCurdy, 2000). Assume that $r_{i,t}$ is the return of economy *i*'s equity index, with regime-dependent means μ_{i,s_t} and variances σ_{is_t}.

$$r_{i,t} = \mu_{i,s_t} + \varepsilon_{i,t} \qquad (3.4)$$

$$\varepsilon_{i,t} \sim N(0, {\sigma_{is_t}}^2)$$

The variance ${\sigma_{is_t}}^2$ of the error term depends on the regime at time *t*, represented by the variable s_t, which is considered the process's 'state' or 'regime' in week *t*. The regime is non-observable and takes a value of 1or 2.[34] We assume that state transition probabilities are constant and

[34] Following existing literature, we restrict the number of regimes to two because including more regimes would pose computational challenges. Nevertheless, we provide the three-regime MSR model to examine whether two regimes are preferable to three.

characterized by a matrix $\Pi_i$comprising the transition probabilities of being in generic state *m* at time *t* given existence in state *n* at time *t-1*:

$$\Pi_i = \begin{bmatrix} p_{11} & p_{21} \\ p_{12} & p_{22} \end{bmatrix}, p_{mn} = \Pr\{s_t = m | s_{t-1} = n\}, m, n = 1,2 \qquad (3.5)$$

The sum of the probabilities must satisfy $\sum_{n=1}^{2} p_{mn} = 1$ and $0 \leq p_{mn} \leq 1$ for $m, n = 1,2$. Note that we use the information set from the overall sample period to estimate the probability of staying in a regime at time *t*, $Pr(s_t | r_{i,T}, r_{i,T-1}, \ldots)$;in other words, we use the smoothed probability.

Conditional on being in state *m*, the expected duration D_m of the state *m* is:

$$E[D_m] = \frac{1}{1 - p_{mm}} \qquad (3.6)$$

The closer p_{mm} is to 1, the higher is the expected duration of state m or, in other words, the more persistent the regime.

After estimating the coefficients of the model and the transition matrix, we apply the following logit transformation to remove the 0–1 range restriction from the probability values:

$$logit(P_{mm}) = \ln\left(\frac{P_{mm}}{1 - P_{mm}}\right) \qquad (3.7)$$

The degree of integration between equity market *i* and the benchmark equity market is determined by the Pearson pairwise correlation between logits of the regime probabilities of the two markets.

Note that we use weekly data instead of daily data, as higher frequencies have more noise, which makes it difficult to isolate a regime.[35] Hamilton and Susmel (1994) indicate that Markov-switching heteroscedasticity is more appropriate for low-frequency data over a long period of time.

[35] We aggregate daily measures into a weekly frequency by computing the corresponding time-series average over a five-day week, excluding holidays (Girardin & Liu, 2007; Vagias, 2013). The weekly percentage stock return is defined as the first difference of the natural logarithm of each weekly stock-price index multiplied by 100. Our sample contains 835 weekly observations. The descriptive statistics for weekly return series are in table A 3.1 in the Appendix 3.

3.4.4 Dynamic conditional correlation -GARCH

Correlations among equity stock indexes provide important information about the degree of equity market integration. Markets become more integrated with increasing correlations over time (Yu et al., 2010). We employ the dynamic, conditional correlation, generalized, autoregressive, conditionally heteroscedastic (DCC–GARCH) model developed by Engle (2002). It presents the trend in correlations among equity markets in a time-varying manner, which is superior to other methods (Arouri and Nguyen, 2009; Engle, 2002). The method involves two steps. First, a univariate GARCH model is estimated for each country's equity return. Second, the parameters obtained in the first step are used to estimate the dynamic, conditional correlation (DCC) parameters. In particular, let $r_{i,t}$, the daily percentage return series of economy *i,* be modelled as follows:

$$r_{i,t} = \mu_i + \sum_{k=1}^{n} \beta_k r_{i,t-k} + \beta_{US} r_{t-1}^{U.S.} + \varepsilon_{i,t} where \varepsilon_{i,t} | \Omega_{t-1} \sim N(0, \sigma_{i,t}^2), \text{and } t = 1, \dots, T. \quad (3.8)$$

$$\sigma_{i,t}^2 = \alpha_i + \phi_i \varepsilon_{i,t-1}^2 + \delta_i \sigma_{i,t-1}^2 \quad (3.9)$$

Where n is the lag length order determined by the SBIC;$r_{t-1}^{U.S.}$is the lagged U.S. stock return, whichis often used as a proxy for global factor (Chiang et al., 2007; Dungey et al., 2003; Hemche et al., 2016; Sehgal et al., 2017); $\varepsilon_{i,t}$is the innovation on the information set Ω_{t-1}; α_i is a constant; ϕ_i and δ_i are ARCH and GARCH effects, respectively; and $\phi_i + \delta_i$ <1. We estimate s (6) and (7) both for each country's equity return and for the benchmark return.

Let $z_{i,t}$ and $z_{B,t}$ be the standardized residuals of the equity market returns of economy *i* and the benchmark equity market *B*, respectively, resulting from estimating equations 3.8 and 3.9. $z_{i,t}$and $z_{B,t}$ follow the GARCH process as follows:

$$q_{iB,t} = \bar{\rho}_{iB} + \lambda_1 (z_{i,t-1} z_{B,t-1} - \bar{\rho}_{iB}) + \lambda_2 (q_{iB,t-1} - \bar{\rho}_{iB}) \quad (3.10)$$

and

$$\rho_{iB,t} = \frac{q_{iB,t}}{\sqrt{q_{ii,t}}\sqrt{q_{BB,t}}} \quad (3.11)$$

where $q_{iB,t}$is the off-diagonal element of the variance–covariance matrix;$\bar{\rho}_{iB}$is the unconditional expectation of the cross-product $z_{i,t}$,$z_{B,t} * z_{B,t}$; and $\rho_{iB,t}$ is the conditional correlation between the equity market returns of economy i and the benchmark equity market B at time t.The non-

negative scalar parameters λ_1, λ_2 capture the effects of previous shocks and of the previous dynamic conditional correlation on the current dynamic conditional correlation; And $\lambda_1 + \lambda_2\lambda_2 < 1$.

Finally, we estimate the average pairwise, conditional correlation coefficients between the equity returns of each economy and the regional benchmark equity return to estimate the degree of integration between these markets and the regional benchmark.

3.5 Empirical results

Regarding the empirical results, Sections 3.5.1 and 3.5.2 present estimates of the degree of financial integration using beta- and sigma-convergence, respectively. The estimates using the Markov Regime Switching Auto Regressive model are presented in Section 3.5.3, while Section 3.5.4 discusses the results from using the Dynamic Conditional Correlation GARCH model. Section 3.5.5 describes additional robustness checks.

3.5.1 Beta-convergence

Table 3.3 presents the results for beta-convergence based on estimation of equation 3.1. We estimate equity price convergence for each economy relative to the regional MSCI ACFM index for the whole period, as well as for the three sub-periods. Due to space constraints, we only report our main focus, the beta-coefficients; the standard errors of the beta estimates are in parentheses. The last three rows of Table 3.3 report the Wald test of the null hypothesis that there is no difference in beta estimates between pairs of sub-periods.

Focusing first on the overall period, the beta coefficients vary across economies, suggesting that countries converge to the regional benchmark at different rates. The beta coefficients for Japan are the highest and significant at the 1% level, suggesting that, over the whole period, the Japanese stock market converged fastest to the regional benchmark among economies in the sample. The magnitude of beta, -0.598, indicates that 0.598% of the logarithmic price discrepancy between the Japanese stock market and the regional market was corrected each trading day on average, corresponding to a half-life adjustment period of 116 trading days. Economically, this means that price differentials between the Japanese and regional stock markets would reduce by half in 5.8 months. The rapid pace of convergence for Japan is in line

Table 3.3: Beta convergence

	JPN	SGP	HKG	KOR	TAW	CHN	MYS	THA	IDN	PHL	VNM
(1) Whole period	-0.598***	-0.113*	-0.125*	-0.156*	-0.490***	-0.109**	-0.069	-0.117*	-0.088*	-0.072	-0.158
	(0.202)	(0.066)	(0.074)	(0.084)	(0.152)	(0.053)	(0.054)	(0.061)	(0.046)	(0.050)	(0.120)
(2)Before crisis	-0.634*	-0.604**	-0.828**	-1.406***	-1.066***	-0.454	-0.394	-0.551**	-0.559**	-0.800**	-3.737***
	(0.348)	(0.304)	(0.343)	(0.471)	(0.406)	(0.289)	(0.293)	(0.236)	(0.273)	(0.339)	(1.279)
(3) During crisis	-2.885*	-3.313**	-3.577***	-7.845***	-1.723*	-2.442**	-1.995*	-2.315**	-2.689***	-1.912*	-0.955*
	(1.743)	(1.469)	(1.183)	(2.249)	(1.004)	(1.137)	(1.145)	(1.082)	(0.895)	(0.996)	(0.568)
(4) After crisis	-1.763***	-0.575***	-0.869***	-0.504***	-0.782***	-0.444**	-0.215**	-0.400***	-0.672***	-0.194*	-0.206
	(0.506)	(0.145)	(0.220)	(0.159)	(0.227)	(0.185)	(0.100)	(0.122)	(0.151)	(0.115)	(0.205)
Wald test (2)=(3)	1.25	3.46*	6.48**	3.91**	0.38	2.32	1.97	2.94*	4.51**	1.29	3.84*
Wald test (3)= (4)	0.30	3.59*	6.50**	5.17**	0.87	2.40	2.56	3.57*	4.19**	3.37*	2.07
Wald test (2)=(4)	3.38*	0.01	0.01	3.33*	0.29	0.00	0.37	0.34	0.10	3.16*	6.80**

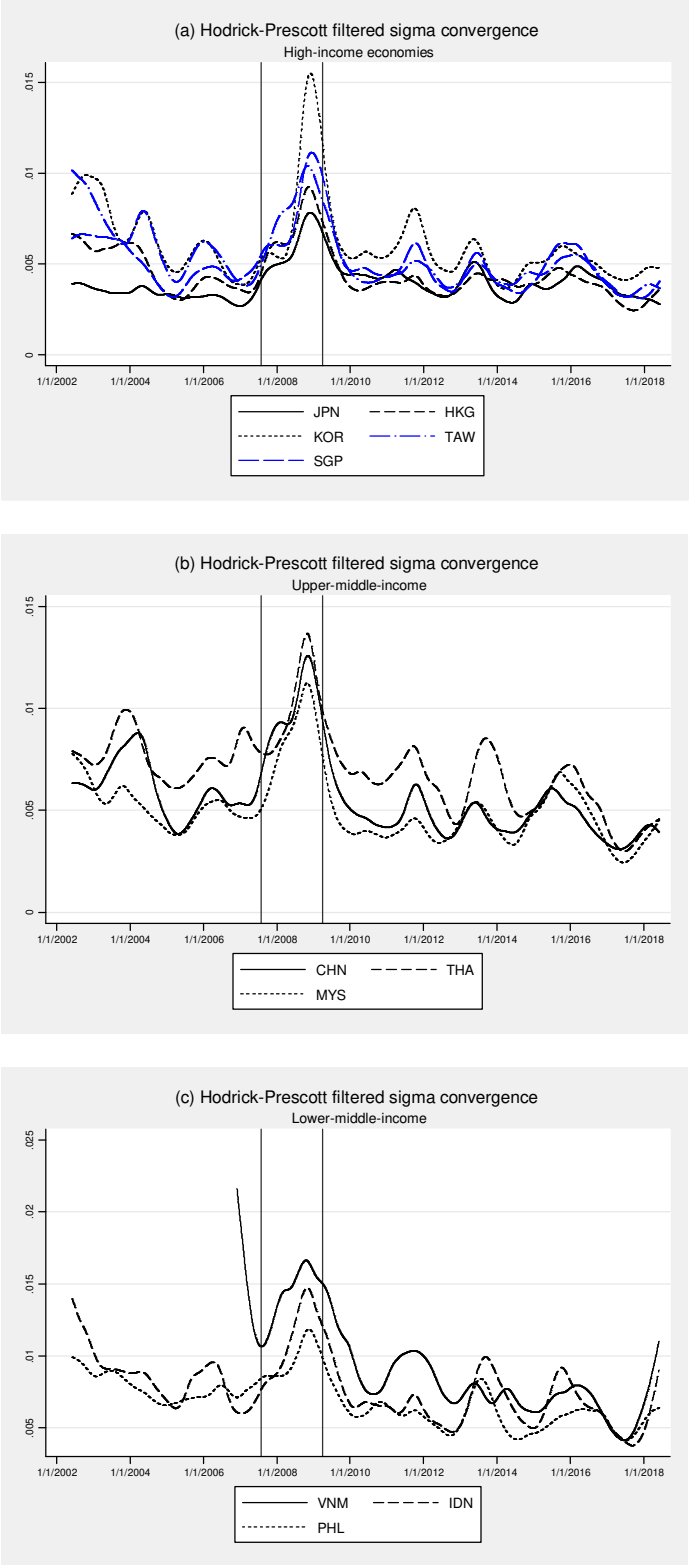
Note: This table reports the beta estimates from the estimation of equation 3.1 and the Wald test statistics for the equality of the beta coefficients. Standard errors are in parentheses. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM); *, **, *** indicate significance levels of 10%, 5%, and 1% respectively.

Table 3.4: Sigma convergence

	JPN	SGP	HKG	KOR	TAW	CHN	MYS	THA	IDN	PHL	VNM
(1) Whole period	0.40***	0.51***	0.45***	0.61***	0.54***	0.57***	0.51***	0.70***	0.77***	0.69***	0.92***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
(2)Before crisis	0.33***	0.49***	0.46***	0.63***	0.61***	0.60***	0.52***	0.77***	0.84***	0.78***	1.43***
	(0.33)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.09)
(3) During crisis	0.62***	0.81***	0.72***	0.94***	0.82***	1.03***	0.87***	1.03***	1.14***	1.00***	1.44***
	(0.03)	(0.04)	(0.03)	(0.06)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.06)
(4) After crisis	0.39***	0.46***	0.39***	0.53***	0.45***	0.47***	0.43***	0.61***	0.67***	0.58***	0.79***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)

Note: This table reports the sigma estimates from the estimation of equation 3.3 and the two sample t-test on the equality of the means of sigma across sub-periods. The values of standard error are in parentheses. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM); *, **, *** indicate significance levels of 10%, 5%, and 1% respectively.

Figure 3.2: HP sigma convergence



with our expectations given Japan's leading financial role in the region. Taiwan is the second-fastest-converged economy. Its beta coefficient of -0.49 indicates that the Taiwanese stock market needs 141 days to reduce its distance by half from the regional stock market. Although they are in the same income group as Japan and Taiwan, Singapore, Hong Kong, and Korea have much lower beta coefficients, significant at the 10% level and indicating a slower speed of convergence. For example, the beta for Hong Kong is -0.125, corresponding to 577 days of half-life convergence.

In the upper-middle-income group, only China and Thailand display evidence of beta convergence. The speed is roughly similar to that of Singapore and Hong Kong. The slowest price convergence is observed for Indonesia, with corresponding half-life convergence of 787 days (39.3 months). For Viet Nam, Malaysia, and the Philippines, the beta coefficients are insignificant, offering no evidence of price convergence.

Next, we look at the beta coefficients across sub-periods. The speed of convergence displays considerable time-bound variation. Most economies experience faster convergence *during crisis*, except for Viet Nam, where the speed of convergence decreases. The Wald test results for the differences in the beta coefficients for the paired periods *before* and *during crisis* confirm faster adjustment to the equilibrium for Singapore, Hong Kong, Korea, Thailand, and Indonesia and slower adjustment for Viet Nam.

For the period *after crisis,* most economies display statistically significant beta coefficients at the minimum level of 10%. For Japan, the speed of convergence *after crisis* is statistically significantly larger than that *before crisis*, implying increasing integration in recent years. By contrast, Korea and the Philippines display statistically significantly smaller beta coefficients *after crisis* compared with *before crisis,* suggesting slower convergence after the crisis. Viet Nam is the only economy that shows no evidence of convergence *after crisis.* The Wald tests fail to reject the null hypotheses of equal beta coefficients for the sub-periods *before* and *after crisis* in most countries(except for Japan, Korea, the Philippines, and Viet Nam.

Overall, these results suggest that convergence occurred in most economies across periods, albeit at different speeds. Convergence speed roughly mirrors the level of economic development, with faster convergence for higher-income economies and slower convergence for lower-income economies. Convergence sped up during the crisis. After the crisis, it returned to the level before

the crisis, except that Japan increased convergence and Korea and the Philippines decreased convergence. Little evidence for Vietnamese convergence is found.

3.5.2 Sigma-convergence

Table 3.4 reports daily mean return dispersion (in percentage terms) per country and per period as measured by sigma in equation 3.3.[36] Among all economies, Japan displays the lowest dispersion in returns, while Viet Nam displays the highest, suggesting that Japan is the most converged economy with the region and Viet Nam is the least. Moreover, the group of high-income economies have lower return dispersion, while the group of lower-middle-income economies have higher return dispersion, implying that the high-income economies are more integrated than the middle-income ones.

Considering the sigma across sub-periods, dispersion of returns during the GFC is much larger than that in the periods *before* and *after* crisis, indicating high return volatility during the crisis period. However, return dispersions declined from the period *before* to the period *after crisis*. This decline is smaller for the high-income economies and larger for the middle-income economies, suggesting increasing integration in the region, especially among middle-income economies. For Viet Nam, the return dispersion decreased considerably after the crisis, bringing it close to that of the other lower-middle-income economies.

Figure 3.2 depicts the time-dependent patterns of the dispersion index sigma. To enhance readability, we have applied a Hodrick–Prescott filter to smooth the underlying series with a smoothing parameter equal to $\lambda=1600 \times (20 \times 12)^2=5{,}760{,}000$. Figures 3.2 (a)–(c) show sigma-convergence for the five high-income economies, three upper-middle-income economies, and three lower-middle-income economies, respectively. Overall, we observe some cyclicality in the return dispersion series. Also, return dispersion trended upwards during the GFC but trended downwards after the crisis, returning roughly to the *before crisis* level for all income groups. In the high-income group (Figure 3.2a), the *before crisis* period is characterized by strong sigma-convergence for Hong Kong, Singapore, Korea, and Taiwan to the low and relatively stable Japanese level. During the crisis, the differences in dispersion levels increase again, though all countries follow roughly the same, cyclical pattern. After 2009, dispersion levels gradually

[36]The reported mean dispersion for each country and period is the average across all daily estimates of dispersion. Standard errors are in parentheses.

converge again. In the upper-middle-income group (Figure 3.2b), China and Malaysia show very similar patterns of dispersion, while Thailand converged to the other two after 2015. In the lower-middle-income group, Indonesia and the Philippines display similar patterns in dispersion throughout the whole period. Viet Nam starts at much higher dispersion *before crisis*, converging gradually toward Indonesia and the Philippines (the other two countries in the group)after 2013.

In summary, Japan has the lowest return dispersion, whereas Viet Nam has the highest, although its return dispersion has considerably decreased in recent years. The high-income economies are the most converged, while the lower-middle-income economies are the least. The increased return dispersion during the crisis reflects high volatility; dispersion fell after the crisis, suggesting an increasing degree of integration for middle-income economies. Viet Nam has considerably lower return dispersion in the years after the GFC, bringing it closer to the level of integration of the lower-middle-income group.

3.5.3 Markov Regime Switching

We first examine whether there is evidence for two distinct regimes in equity returns. We start by estimating equation 3.4, which has both a switching mean return and variance. This is the full model (MSM). Subsequently, we test restricted models: a one-regime model (MSM1), a model with only a regime-dependent mean return (MSM2), and a model with only a regime-dependent variance (MSV2). We employ the logarithmic likelihood ratio (LR) and the Akaike information criterion (AIC) to test the restricted models.[37]Table 3.5 reports the logarithmic likelihoods, AICs, and the LR test statistics. Both the LR and AIC indicate that the full model (MSM) is preferred for all countries, except for Viet Nam, for which the MSV2 model is preferred.

Continuing with the first step, we estimate the MSV2 model for Viet Nam and the MSM model for all other economies in the sample, with the results presented in Table 3.6. First, the estimated volatility and mean returns clearly differentiate each regime. Regime 1 is characterized by high mean return and low volatility, while regime 2 has low mean return and high volatility. For all countries, the estimated mean return in regime 1 is positive and significant at least at the 5% level, while that in regime 2 is negative, although this finding is insignificant in most cases. Wald

[37] See Hansen (1992) and Psaradakis and Spagnolo (2003) for an in-depth discussion of goodness-of-fit tests.

Table 3.5: Log likelihood, AIC, and LR test

	MSM		MSM1				MSM2				MSV2			
	Log likelihood	AIC	Log likelihood	AIC	LR test	p-value	Log likelihood	AIC	LR test	p-value	Log likelihood	AIC	LR test	p-value
JPN	-1760.1	4.2	-1816.8	4.3	113.4	0.0	-1787.4	4.3	54.6	0.0	-1767.9	4.2	15.6	0.00
SGP	-1807.7	4.3	-1916.6	4.5	217.9	0.0	-1885.3	4.5	155.3	0.0	-1818.7	4.4	21.0	0.00
HKG	-1804.1	4.3	-1891.0	4.5	173.9	0.0	-1857.1	4.5	106.1	0.0	-1810.7	4.3	13.2	0.00
KOR	-2043.6	4.9	-2157.2	5.1	227.2	0.0	-2109.8	5.1	132.3	0.0	-2054.9	4.9	22.6	0.00
TAW	-1928.9	4.6	-2009.1	4.7	160.4	0.0	-1974.0	4.7	90.3	0.0	-1937.7	4.7	17.7	0.00
CHN	-2033.5	4.9	-2124.8	5.0	182.7	0.0	-2087.6	5.0	108.3	0.0	-2040.7	4.9	14.5	0.00
MYS	-1673.9	4.0	-1748.9	4.1	149.9	0.0	-1708.8	4.1	69.8	0.0	-1680.5	4.0	13.2	0.00
THA	-2022.0	4.9	-2098.2	5.0	152.4	0.0	-2072.8	5.0	101.6	0.0	-2031.5	4.9	19.0	0.00
IDN	-2144.2	5.2	-2259.6	5.3	230.8	0.0	-2204.4	5.3	120.5	0.0	-2152.8	5.2	17.2	0.00
PHL	-1985.7	4.8	-2042.8	4.8	114.3	0.0	-2015.2	4.8	59.0	0.0	-1994.7	4.8	18.0	0.00
VNM	-1562.3	5.2	-1663.9	5.4	203.3	0.0	-1628.6	5.4	132.6	0.0	-1562.5	5.2	0.50	0.79
ACFM	2128.6	-5.1	2039.3	-5.0	178.6	0.0	2085.3	-5.0	86.6	0.0	2100.4	-5.0	56.5	0.00

Note: This table reports the results of the logarithmic likelihoods, AICs, and the LR test statistics between the full model (MSM) and each restricted model. MSM1 is a one-regime model, MSM2 is model with only a regime-dependent mean return, and MSV2 is a model with only a regime-dependent variance. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM).

Table 3.6: Estimated coefficients for the Markov regime switching model

	JPN	SGP	HKG	KOR	TAW	CHN	MYS	THA	IDN	PHL	VNM	ACFM
Regime 1												
Mean 1	0.36***	0.34***	0.26***	0.43***	0.36***	0.38***	0.27***	0.44***	0.47***	0.50***	-0.06	0.01***
	(0.12)	(0.07)	(0.08)	(0.09)	(0.09)	(0.10)	(0.07)	(0.11)	(0.11)	(0.11)	(0.12)	(0.00)
Sigma 1	1.40	1.45	1.75	2.20	1.86	2.14	1.20	2.08	2.10	1.72	2.26	0.01
Regime 2												
Mean 2	-0.36*	-0.33	-0.42	-0.82	-0.62**	-0.26	-0.16	-0.39	-0.22	-0.18		-0.00*
	(0.19)	(0.23)	(0.32)	(0.43)	(0.27)	(0.35)	(0.17)	(0.33)	(0.34)	(0.21)		(0.00)
Sigma 2	2.80	3.56	3.90	5.31	3.90	4.76	2.66	4.48	5.31	3.56	6.43	0.03
Transition probabilities												
p11	0.95	0.94	0.96	0.95	0.96	0.96	0.94	0.94	0.94	0.95	0.96	0.92
p21	0.06	0.33	0.00	0.01	0.02	0.02	0.05	0.03	0.04	0.05	0.09	0.08
Wald test sigma												
Chi2	84.54	220.49	136.52	187.58	159.46	175.25	166.93	159.7	230.36	118.06	166.78	185.57
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wald test mean												
Chi2	10.36	7.14	3.92	7.81	10.68	2.82	4.3	5.46	3.34	6.91		28.15
p-value	0.00	0.01	0.05	0.01	0.00	0.09	0.04	0.02	0.07	0.01		0.00
Expected duration of the regime (weeks)												
Regime 1	22.19	30.51	114.15	76.55	54.85	64.62	20.94	39.52	26.39	21.41	28.34	12.96
Regime 2	15.79	15.96	26.84	21.97	23.93	23.23	15.51	15.85	15.47	20.86	11.36	11.85
RCM	39.67	26.03	12.55	14.16	19.96	20	35.92	27.93	29.04	35.69	23.67	38.43
Log likelihood	-1,760	-1,808	-1,804	-2,044	-1,929	-2,033	-1,674	-2,022	-2,144	-1,986	-1,563	2,129
SBIC	4.26	4.38	4.37	4.94	4.67	4.92	4.06	4.89	5.18	4.8	5.25	-5.05

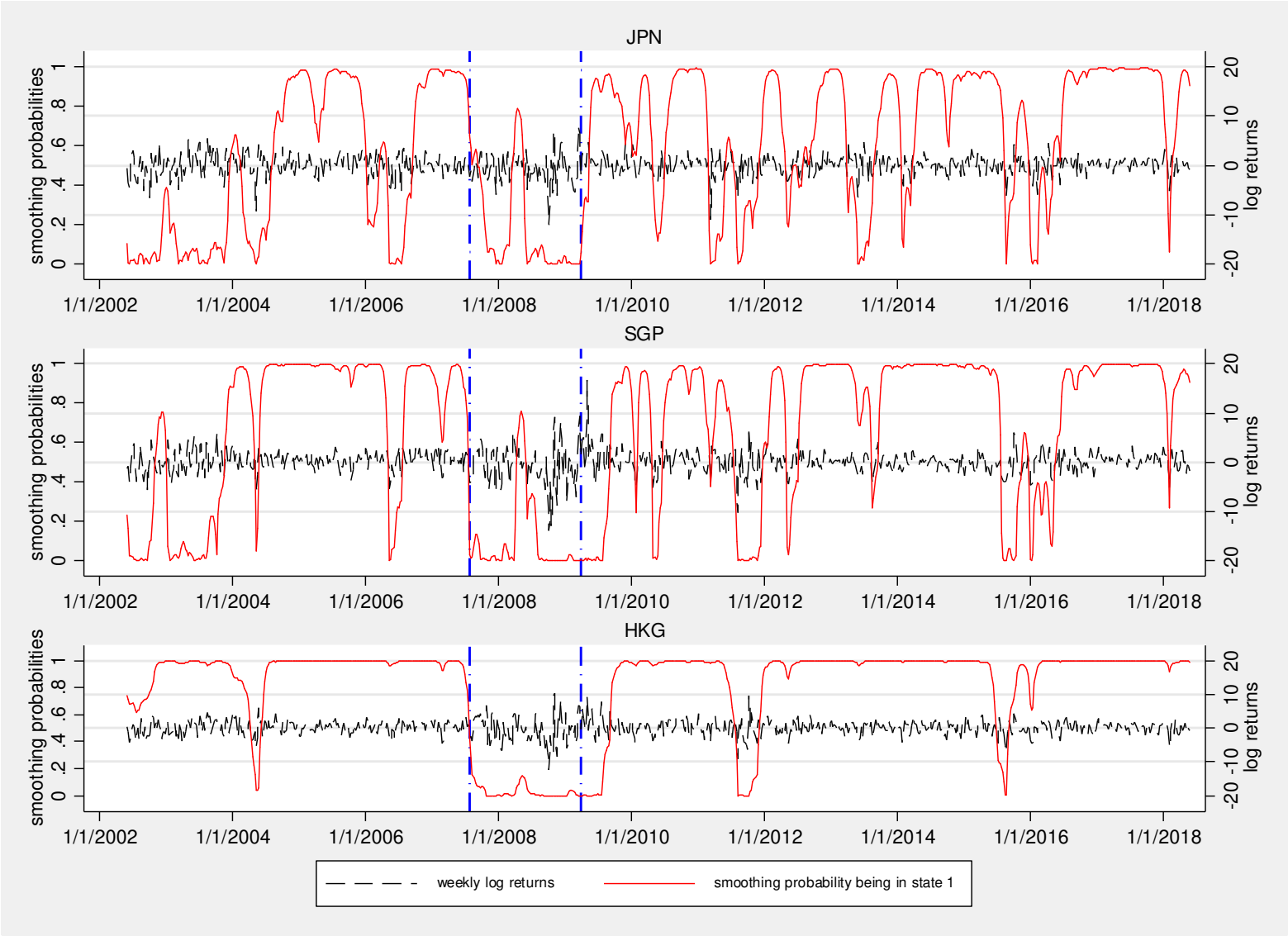
Note: This table reports the results of the Markov switching estimation. Duration is in weeks. Returns are the logarithmic differences of weekly equity index. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM);sigma1, sigma2 are natural logarithm of the estimated standard deviations, mean1, mean2 are the estimated mean of return, respectively; p11 is the probability of staying in the regime 1, p21 is that of transforming from regime 2 to regime 1. Standard errors are in parentheses. *, **, *** are significance at 10% , 5%, 1% levels, respectively.

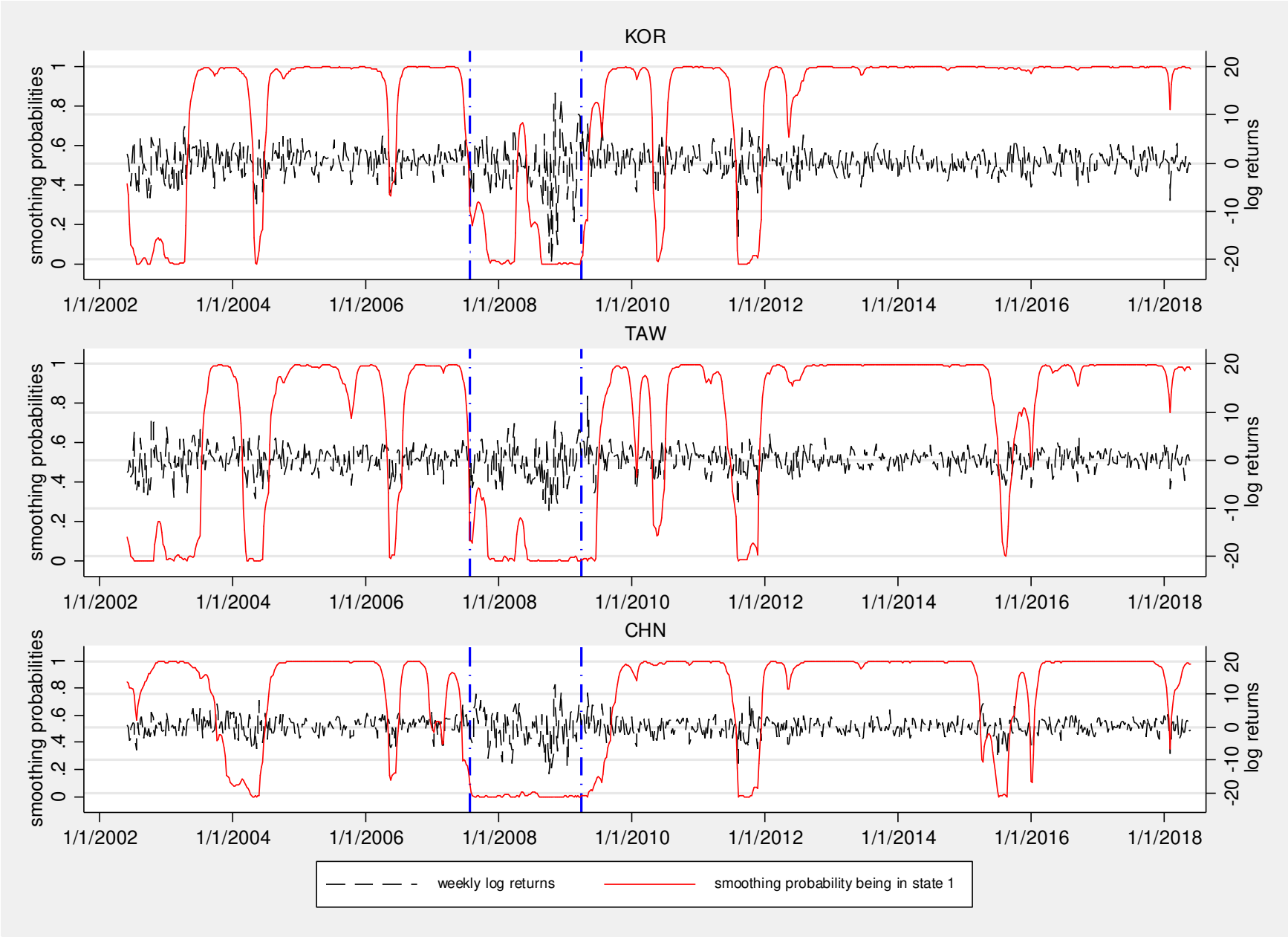
Table 3.7: Regime correlation between each economy and the regional benchmark index

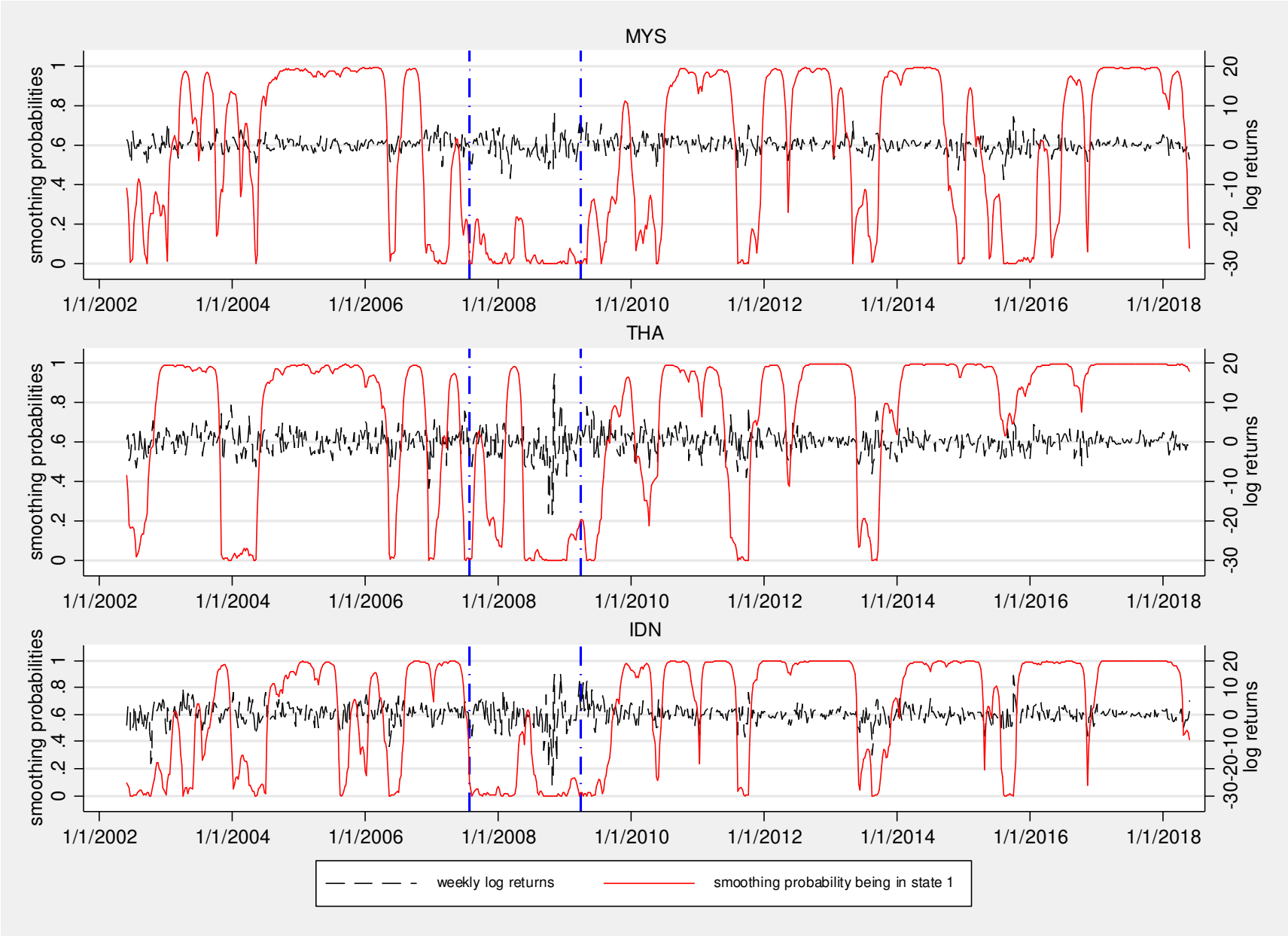
	JPN	SGP	HKG	KOR	TAW	CHN	MYS	THA	IDN	PHL	VNM
Whole period	0.81***	0.77***	0.70***	0.71***	0.70***	0.63***	0.61***	0.52***	0.61***	0.60***	0.30***
Before crisis	0.87***	0.73***	0.55***	0.605***	0.61***	0.34***	0.36***	0.27***	0.59***	0.54***	-0.37**
During crisis	0.48***	0.58***	0.68***	0.43***	0.52***	0.38***	0.62***	0.23**	0.51***	0.52***	0.11
After crisis	0.80***	0.73***	0.65***	0.65***	0.65***	0.62***	0.60***	0.56***	0.46***	0.45***	0.25***

Note: This table reports the Pearson pair wise correlations in the logit probability of regime 1 between each economy's equity index and the regional benchmark index. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM); *, **, *** indicate significance levels of 10%, 5%, and 1% respectively.

Figure 3.3: Smoothed probabilities of being in state 1 (dot line) and equity return (solid line).




KOR
TAW
CHN
smoothing probabilities
log returns
0
.2
.4
.6
.8
1
-20
-10
0
10
20
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
weekly log returns
smoothing probability being in state 1


MYS
THA
IDN
smoothing probabilities
log returns
0
.2
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.6
.8
1
-30
-20
-10
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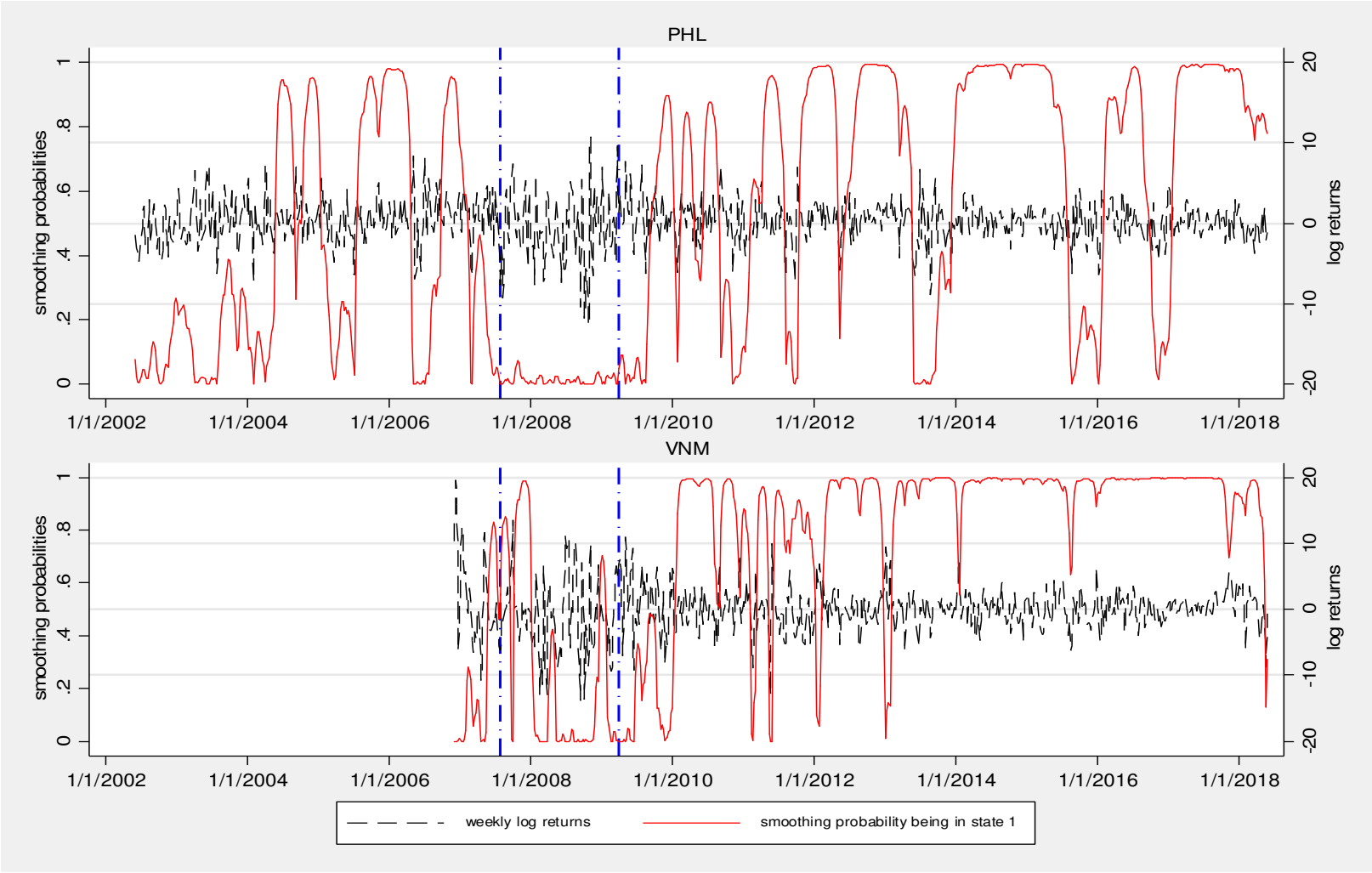
10
20
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
weekly log returns
smoothing probability being in state 1


PHL
smoothing probabilities
log returns
0
.2
.4
.6
.8
1
-20
-10
0
10
20
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
VNM
weekly log returns
smoothing probability being in state 1

tests confirm that the standard deviation and the mean equity return differ significantly across regimes in all countries. Second, both regimes are very persistent, but regime 1 is always more persistent than regime 2. Figure 3.3 illustrates regime persistence for each country.

In the second step, we use the Markov regime estimates to assess the degree of co-movement in equity markets across countries. To that end, we compute the bilateral correlation between the logits of the regime 1 probabilities of each economy's equity index and the regional benchmark index, with the results as shown in Table 3.7. Over the whole period, most countries exhibit considerable correlation—above 0.5—with the benchmark equity market; the exception, Viet Nam, has a correlation of 0.3. *Before crisis*, correlations are highest for the high-income countries, followed by those of two lower-middle-income countries, Indonesia and the Philippines, and only then the three upper-middle-income countries. Viet Nam, the remaining lower-middle-income country, even has a negative correlation, although this is based on a small number of observations. *After crisis*, the correlations closely follow the level of development of each economy: highest for the high-income countries, followed by the three upper-middle-income countries and then the lower-middle-income countries, and lowest for Viet Nam. For the high-income countries, the correlations are roughly similar between the *before* and *after crisis* periods. The three upper-middle-income countries had a substantial rise in correlation *after crisis*, while the lower-middle-income countries of Indonesia and the Philippines had a small decline. For Viet Nam, the correlation became significantly positive, though still small, *after crisis*. *During crisis*, evidence is mixed. Correlations declined substantially for Japan, Korea, and Taiwan and increased for China and, to a lesser extent, Singapore. For Viet Nam, the correlation rose to about zero.

In summary, the findings show that the MSM well identifies the high- and low-volatility regimes for all economies. Both regimes persist strongly, though the low-volatility regime is more persistent. Financial integration between each market and the benchmark equity market decreased during the crisis but bounced back after the crisis. Typically, the pattern of regime correlations corresponds to the country's level of development (income), especially *after crisis*. The upper-middle-income countries—China, Malaysia, and Thailand—became more integrated with the benchmark index over time, catching up to a large extent with the high-income countries. Integration in Viet Nam, while increasing, still significantly lags.

3.5.4 DCC–GARCH

Table 3.8 reports the results of the estimation of equations 3.8 to 3.11, where the number of AR-terms in the mean equation is determined by SBIC criteria. Panel A reports the results of the GARCH specification for each Asian economy, while panel B reports the results for the simultaneously estimated regional equity index. Panel C reports the result of the conditional correlation equation 3.11. The last row of Table 3.8 presents the Wald statistics for the specification conditions of the model.

Regarding the GARCH estimation results, two interesting findings standout. First, the U.S. market returns are always significantly positive and consistently large in magnitude in the mean equation, ranging from 0.247 (for Viet Nam) to 0.63 (for Korea). This evidence supports the results from existing literature that the United States plays an influential role in Southeast Asia. Second, for the variance equation, the GARCH and ARCH coefficients are always positive and significant at the 1% level, and the Wald test for the null hypothesis that $(b_i + c_i)$<1 cannot be rejected at the 1% level. This confirms the time-variant nature of the volatility, supporting the choice of a GARCH specification. Furthermore, the GARCH coefficients are large (ranging between 0.85 and 0.94) and always exceed the ARCH coefficients (ranging between 0.05 and 0.13), thus indicating the strong persistence of equity volatility.

Regarding the dynamic conditional correlations, λ_1 and $\lambda_2$are always statistically significant at the minimum level of 1% (except for Viet Nam, where λ_1 is not statistically significant).This suggests that the conditional correlation is time-variant. The Wald test for the null hypothesis that $\lambda_1 + \lambda_2 < 1$ cannot be rejected at the 1% level. In all specifications, λ_2 always greatly exceeds λ_1, confirming the strong persistence in conditional correlations.

In Table 3.9, we compute the average pairwise, conditional correlation coefficients between the equity returns of each economy and the regional benchmark equity return. Overall, all equity markets display high correlation with the regional benchmark, except for Viet Nam. Japan correlates most strongly with the benchmark equity market, followed by the other high-income economies (Singapore, Hong Kong, Taiwan, and Korea). The lowest correlation is detected for

Table 3.8: Estimation results from the GARCH DCC models

		JPN	SGP	HKG	KOR	TAW	CHN	THA	MYS	IDN	PHL	VNM
Panel A	AR(1)	-0.09***							0.07***	0.03*	0.06***	0.16***
		(0.01)							(0.01)	(0.02)	(0.01)	(0.02)
	AR(2)	-0.02*										
Mean		(0.01)										
equation	L.rUSA	0.52***	0.36***	0.43***	0.63***	0.51***	0.54***	0.35***	0.30***	0.52***	0.51***	0.25***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
	Constant	0.00*	0.00**	0.000**	0.00**	0.00*	0.00***	0.00***	0.00**	0.00***	0.00**	0
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	ARCH	0.07***	0.07***	0.06***	0.07***	0.05**	0.06***	0.12***	0.07***	0.13***	0.09***	0.12***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Variance	GARCH	0.90***	0.92***	0.92***	0.92***	0.94***	0.93***	0.88***	0.92***	0.85***	0.88***	0.85***
equation		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
	Constant	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Panel B	AR(1)	-0.08***										-0.04*
		(0.01)										(0.02)
Mean	L.rUSA	0.52***	0.51***	0.51***	0.50***	0.51***	0.50***	0.51***	0.51***	0.52***	0.52***	0.56***
equation		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
	Constant	0.00**	0.00*	0.00**	0.00*	0.00**	0.00**	0.00***	0.00*	0.00**	0.00**	0
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	ARCH	0.09***	0.10***	0.09***	0.10***	0.10***	0.09***	0.11***	0.11***	0.11***	0.11***	0.14***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Variance	GARCH	0.89***	0.89***	0.90***	0.89***	0.88***	0.90***	0.88***	0.87***	0.88***	0.88***	0.85***
equation		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
	Constant	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Panel C	Correlation	0.76***	0.54***	0.64***	0.67***	0.57***	0.67***	0.37***	0.40***	0.39***	0.32***	0.15
		(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.12)
	lambda1	0.03***	0.02***	0.03***	0.03***	0.03***	0.03***	0.03***	0.04***	0.04***	0.01**	0
Adjustment		(0.01)	0.00	(0.01)	(0.01)	(0.01)	0.00	(0.01)	(0.01)	(0.01)	0.00	0.00
	lambda2	0.95***	0.9705***	0.94***	0.96***	0.94***	0.96***	0.94***	0.93***	0.92***	0.98***	0.99***
		(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	0.00
	Wald test	(null: (ARCH+GARCH)-1<0)										
	Chi square	29.33	9.79	16.35	15.25	13.92	15.27	2.01	8.64	10.34	11.87	9.01
	p value	1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00	1.00	1.00	1.00
	Wald test	(null: (lambda1+lambda2)-1<0)										
	Chi square	7.14	10.82	7.78	5.52	11.52	11.76	9.49	14.35	11.64	4.06	1.30
	p value	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	0.98	0.87

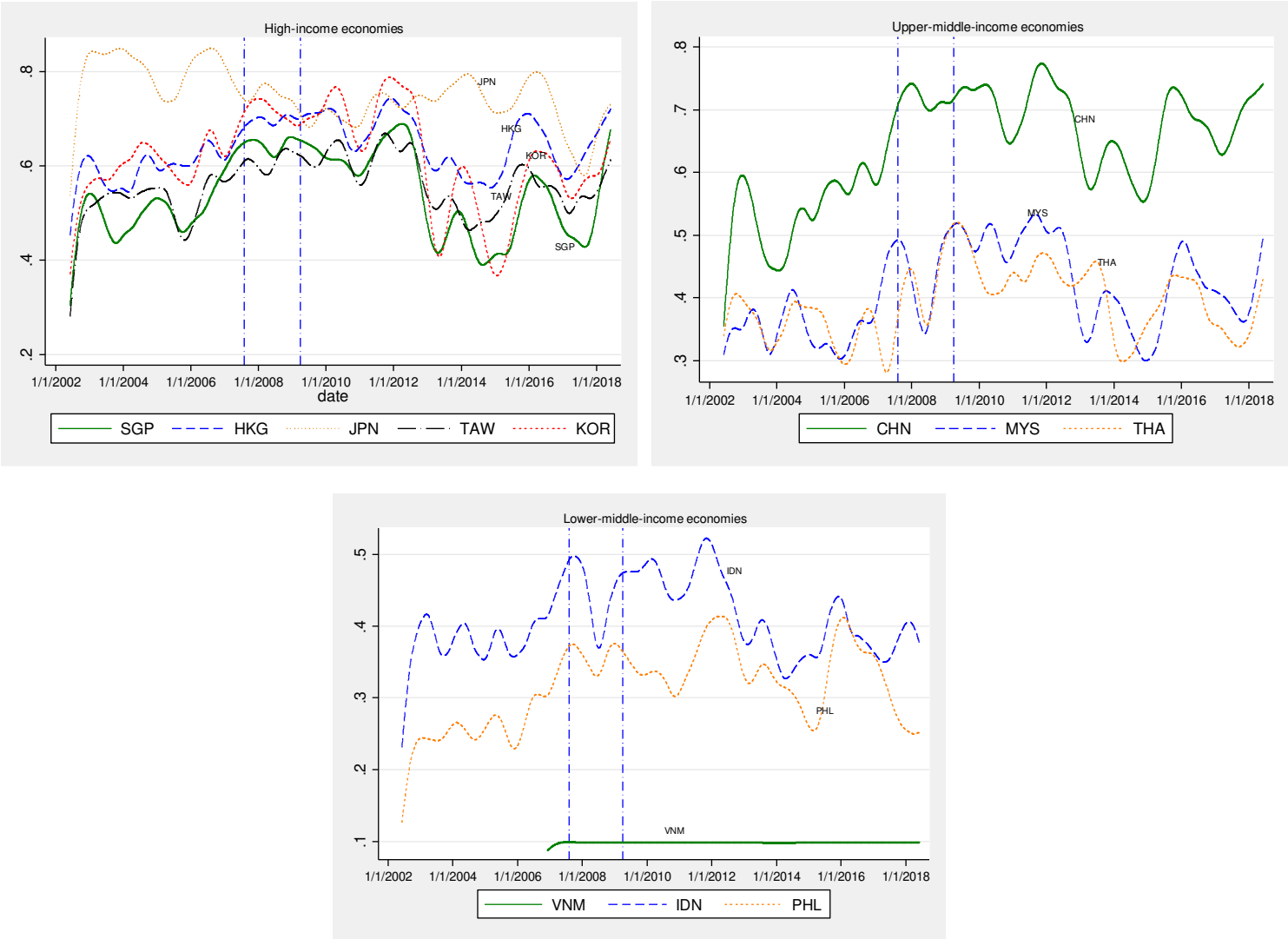
Note: This table reports the estimation of equation 3.8 to 3.11. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM); L.rUSA is the lag of return of U.S equity index; *, **, *** indicate significance levels of 10%, 5%, and 1% respectively.

Table 3.9: Average conditional correlation between each equity market i and the regional benchmark equity market

	JPN	SGP	HKG	KOR	TAW	CHN	THA	MYS	IDN	PHL	VNM
Whole period	0.75	0.54	0.64	0.62	0.56	0.64	0.39	0.41	0.41	0.31	0.09
Before crisis	0.80	0.51	0.60	0.60	0.52	0.55	0.35	0.44	0.45	0.36	0.02
During crisis	0.75	0.65	0.70	0.72	0.61	0.72	0.43	0.43	0.42	0.34	0.06
After crisis	0.72	0.54	0.65	0.61	0.57	0.68	0.41	0.43	0.42	0.34	0.10

Note: This table reports the average conditional correlations of returns between each economy's equity index and the regional benchmark index. The abbreviations for each economy's equity index are defined as follows: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM).

Figure 3.4:The trend of dynamic conditional correlation between each equity market and the regional benchmark equity market.



Note: Trends are obtained via a standard Hodrick-Prescott filter (with λ=5760000).

the lower-middle-income countries, such as Indonesia and the Philippines. Viet Nam has significant but very small correlation with the region, indicating only modest regional integration. In general, the conditional correlations are quite stable across sub-periods. By way of graphical illustration, Figure 3.4 displays smoothed time-paths of financial integration as measured by the dynamic correlation between the regional index and the 11 economies,[38]confirming the findings in Table 3.9. In addition, short-run—that is, cyclical—fluctuations in conditional correlations display similar visual patterns, suggesting economies' responses to shocks are somewhat synchronized.

3.5.5 Robustness checks

The choice of the GFC period may affect the main results regarding the development of financial integration over time. In this section, we check the robustness of our main results using other dates for the GFC period, following Glick and Hutchison (2013). In this alternative definition, the crisis started on 10 July 2008 and ended on 20 June 2010. The period before 10 July 2008 then becomes the *before crisis* period and the period after 20 June 2010 becomes the *after crisis* period. Since a different date definition for the GFC can only affect results across sub-periods, we omit as irrelevant those results concerning the whole period.

For beta-convergence, the beta coefficients *during crisis* are insignificant, and the Wald tests show that the betas do not differ significantly between sub-periods for most economies. This may be because the shorter crisis period using this alternate definition makes estimates for the period *during crisis* less reliable. The results for other measures remain largely unchanged. While not reported here, all of these results are available upon request.

3.6 Discussion

Given the diversity of measures used, Table 3.10 summarizes the main empirical results. Note that each indicator has a different focus. For example, beta-convergence measures the speed at which prices in individual equity markets adjust toward the equilibrium benchmark equity market. Sigma-convergence measures the distance by which the return of an equity market diverges from that of the benchmark market. The Markov Regime Switching model estimates the

[38] As before, we smooth correlations using a standard Hodrick–Prescott filter (with λ=5,760,000) to visualize the underlying patterns more clearly.

degree of regime alignment between two equity markets. The GARCH–DCC model captures the degree of co-movement in returns. Given these indicators' different focuses, their combined evidence should be interpreted with caution.

On the question of the degree of integration, we mainly rely on beta-convergence, which informs us whether a convergence process is ongoing and at which rate. On the question of the evolution of financial integration—whether it is progressing, at a standstill, or regressing—we rely on all indicators as complementary sources of information. We mainly compare the periods before and after the crisis; notably, cross-market correlations in equities may have been temporarily distorted during the turmoil and are subject to volatility bias. In this context, stable speeds of adjustment to equilibrium before and after the crisis are important indications that stock-market integration is proceeding at a steady rate.

Overall, the degree of integration seems to mirror the level of economic development: a higher degree of financial integration is observed in the high-income group, followed by the upper-middle-income group, and then, finally, the lower-middle-income group. For example, the results from beta-convergence indicate that the high-income economies are converging faster than the middle-income economies (including both upper- and lower-middle-income economies). Meanwhile, the high-income group also has the lowest return dispersion in the sample. The pairwise regime alignment and the co-movement in returns between the economies in the high-income group and the benchmark equity market are also relatively high. Regarding individual countries, our analysis suggests that Japan has the most-integrated economy, followed by Taiwan, and then by the other economies in the high-income group (Singapore, Hong Kong, and Korea). In the upper-middle-income group, China and Thailand have a similar degree of convergence as Singapore, Hong Kong, and Korea. In the lower-middle-income group, only Indonesia displays evidence of financial integration, albeit at a relatively low level. Malaysia and the Philippines had close to zero integration, though integration has recently picked up again. Viet Nam mostly lacks evidence of integration.

While earlier studies have claimed that the degree of regional financial integration in Asian countries significantly increased after the 2008 GFC (Boubakri and Guillaumin, 2015; Yu et al., 2010), our results suggest instead that integration has remained largely unchanged, when excluding the period during the crisis. That is, isolating the crisis period, when prices and returns

are highly volatile, integration has proceeded steadily in Singapore, Hong Kong, Taiwan, China, Thailand, and Indonesia. For these economies, prices converged after the crisis at a speed that remains largely unaltered from that before the crisis. The estimates from GARCH–DCC further support this conclusion; sigma-convergence and the Markov Regime Switching model offer partial support (see Table 10). Note that neither Yu et al. (2010) nor Boubakri and Guillaumin (2015) separated the period of turmoil from the non-crisis period. Thus, their conclusions regarding the degree of regional integration after the GFC may be distorted.

In this respect, we find mixed results for the various indicators during the crisis period. For example, all the economies exhibit signs of divergence, according to sigma-convergence, apparently caused by high volatility during the crisis (Bekaert et al., 2011). Meanwhile, Singapore, Hong Kong, Korea, Thailand, and Indonesia converged faster, while Viet Nam slowed its convergence rate, according to the beta-convergence coefficients. The estimates from the Markov Regime Switching model, meanwhile, suggest that the degree of regime alignment decreased for Japan, Korea, and Taiwan, increased for China, came close to zero for Viet Nam, and remained stable for the rest of the sample. By contrast, the GARCH–DCC estimates suggest that the degree of integration is stable. Since the crisis period was characterized by high volatility, volatility- and heteroscedasticity-adjusted indicators are preferred to better capture this period of high uncertainty (Billio et al., 2017). However, the Markov Regime Switching model may not well capture all movements in the variance (Cai, 1994). Especially since the crisis period is short, the regimes may become unstable, making less reliable the correlations of regime probability. Therefore, we mainly rely on the GARCH–DCC results to draw our conclusions: the degree of integration is quite stable during the crisis period.

Another disparity among the indicators concerns the evolution of integration *before* and *after crisis*. The beta-convergence estimates indicate that convergence rate accelerated for Japan and decelerated for Korea and the Philippines in the period after the crisis. For other economies, the results from beta-convergence instead suggest that convergence rate remains unchanged, suggesting that the financial integration process has been stable.

While many economies displayed a steady degree of integration, Viet Nam has experienced increasing integration with the region. Viet Nam has narrowed the return dispersion gap, improved return correlation, and increased the degree of regime alignment across periods, thus

approaching a level of correlation close to that of the other lower-middle-income economies in the region. Nevertheless, notwithstanding some evidence of increasing return correlations for Viet Nam, its economy still is apparently lacking substantial convergence, as our beta-convergence results suggest.

3.7 Conclusion

In this paper, we have assessed the level of financial integration for a group of 10 Asian equity markets. We also ask whether the degree of integration among these markets changed after the 2008 Global Financial Crisis. To this end, we employ four measures to account for various dimensions of financial integration. We use daily price data from the stock markets from 31 May 2002 to 1 June 2018, dividing the sample period into periods before, during, and after the crisis to assess the crisis's impact on Asian equity market integration.

We further divided the 10 markets into high-, upper-middle-, and lower-middle-income economies. To some degree, the level of financial integration of these three groups mirrors their differences in economic development. Furthermore, comparing before and after the crisis shows that integration has followed a steady path for most of the 10 economies. Not surprisingly, Japan is the most-integrated economy in the region, and the speed of its integration has accelerated in the period after the crisis. Viet Nam apparently lacks convergence, even as its equity market has gained more alignment with the region. Investors in Asia who want to diversify their equity portfolios to cushion against shocks might therefore find relative opportunities in Viet Nam.

Empirical evidence suggests a relationship between financial integration and economic development. Therefore, further investigation is warranted to determine the nature of any barriers affecting the process of financial integration.

Table 3.10: Summary of integration status for 11 Asian equity markets

Methods	Evidence: post vs. pre	Evidence for crisis period	Evidence income group/ economies
Beta	For JPN speed of convergence increases after crisis; for KOR and PHL it decreases, for the rest there is no change.	For Singapore, Hong Kong, Korea, Thailand, and Indonesia the speed of convergence increase during crisis; for VNM it decreases, for the rest there is no change.	- The speed of convergence for JPN, TAW is the highest. - The speed of convergence is relatively equal for SGP,HKG,KOR,CHN,THA. - The speed of convergence for IDN is the smallest. - For PHL and MYS, there is no clear evidence of convergence until the later periods. For VNM, there is no evidence of convergence for the whole period.
Sigma	- Return dispersion remains roughly stable after crisis for HC; and declines for the rest. - Viet Nam has considerably narrowed the dispersion after crisis, brought to the level close to other LC.	Return dispersion is wider during crisis but remains the same for Viet Nam indicating return divergence	Return dispersion roughly mirrors the level of economic development: HC has the lowest dispersion, followed by UC, then by LC.
MRS	- For HC the correlation before-after crisis is relatively equal. - For UC, the correlation substantial rises after crisis. - For LC, the correlation lightly declines after crisis - For VNM, the correlation improves a lot compare to the before crisis period though it is still small.	Evidence is mixed: For JPN, KOR, and TAW, the correlation during crisis declines; for CHN it increases, for VNM it is close to zero, for the rest, it is roughly unchanged.	- Level of correlation mirrors the level of economic development for the whole period. - Viet Nam has the lowest correlation but it has improved the most across sub periods.
DCC	Conditional correlations are quite stable across sub periods; for VNM, it improves a lot compare to the before crisis period though it is still small.	-The correlation is relatively stable across sub periods -For VNM, the correlation is close to zero	- The correlation mirrors the level of economic development for whole period. - For Viet Nam, the correlation with the region is small but it improves a lot across sub periods though it is still small.

Note: Japan (JPN), Singapore (SGP), Hong Kong (HKG), South Korea (KOR), Taiwan (TAW), China (CHN), Malaysia (MYS), Thailand (THA), Indonesia (IDN), the Philippines (PHL), Viet Nam (VNM); HC: high-income economies; UC: Upper middle-income economies; LC: Lower middle-income economies.

Appendix 3

Table A3.1: Descriptive statistics of the weekly return series

	n	mean	max	min	sd	skewness	kurtosis	Before GFC	During GFC	After GFC	*t-value*		
								(1)	(2)	(3)	(1)=(2)	(2)=(3)	(1)=(3)
(a) High income economies		0.11						0.27	-0.78	0.17	3.26***	-3.55***	0.65
JPN	835	0.06	8.05	-11.95	2.13	-0.69	5.66	0.18	-0.67	0.13	2.79***	-3.31***	0.36
SGP	835	0.11	16.78	-13.98	2.40	-0.18	8.81	0.34	-0.87	0.16	3.69***	-3.47***	1.16
HKG	835	0.13	10.23	-12.19	2.33	-0.25	5.57	0.24	-0.61	0.20	2.66***	-2.78***	0.25
KOR	835	0.16	14.65	-20.97	3.21	-0.83	8.71	0.42	-0.97	0.21	2.86***	-3.07***	1.03
TAW	835	0.07	13.52	-10.37	2.69	-0.32	4.70	0.15	-0.76	0.17	2.29**	-3.05***	-0.10
(b)Upper middle income economies		0.17						0.41	-0.67	0.18	3.28***	-3.03***	1.49
CHN	835	0.20	13.10	-14.26	3.08	-0.44	5.25	0.52	-0.57	0.16	2.43**	-1.94*	1.82*
THA	835	0.09	8.20	-8.64	1.97	-0.35	4.99	0.27	-0.59	0.11	3.31***	-2.90***	1.22
MYS	835	0.21	17.56	-18.29	2.99	-0.43	7.80	0.42	-0.84	0.28	2.90***	-3.21***	0.71
(c)Lower middle income economies		0.17						0.49	-0.92	0.18	3.39***	-3.58***	1.72*
IDN	835	0.22	15.43	-26.03	3.62	-0.89	9.79	0.56	-0.74	0.21	2.36**	-2.25**	1.51
PHL	835	0.17	10.73	-12.75	2.80	-0.30	4.69	0.39	-0.81	0.22	2.94***	-3.19***	0.89
VNM	600	-0.01	19.56	-13.86	3.88	0.22	5.97	1.26	-1.19	0.12	1.92*	-3.13***	1.92*
Regional index	835	0.00	0.10	-0.14	0.02	-0.84	7.03	0.00	-0.01	0.00	3.32***	-3.71***	0.39
t-test for the mean differences													
t-value (a)=(b)		-1.48											
t-value (b)=(c)		-0.02											
t-value (a)=(c)		-0.89											

Chapter 4
Borrowing constraints and export decision: the case of Vietnamese exporters[39]

4.1 Introduction

The recent literature on international trade increasingly features firm heterogeneity and emphasizes the decisions of individual firms in understanding the causes and consequences of aggregate trade. A handful of empirical studies uncovered that a very small percentage of firms are engaged in exporting and that exporters are more productive, larger, and more capital intensive (Aw and Hwang,1994; Bernard, Jensen, 1999). This work triggered a theoretical revolution to account for such firm heterogeneity in international trade modeling (Melitz, 2003). One key implication of the Melitz model is the so-called self-selection effect. That is, due to the presence of high fixed (and variable) costs, only the most productive firms are able to export, while medium productivity firms serve domestically, and low productivity firms exit. Building on this framework, Chaney (2005) and Manova (2013) introduced financial constraints as another dimension of firm heterogeneity in trade theory. Empirical papers accounting for financial constraints in trade such as Greenaway et al. (2007), Berman and Hericourt (2010), Muuls (2015) have provided evidence on the role of financial constraints on firms participating into export

[39] A revised version of this chapter, co-authored with Clemens Kool and Lu Zhang is under review at a journal.

market. Despite this body of literature, the issue is not fully settled yet. First, how financial constraints shape exports remains unclear and not fully understood. Second, it is still ambiguous how the impact of financial constraints on the export decision varies among firm types and exporter types. Last, the role of financial constraints in shaping the export decision for firms at various level of productivity has been largely disregarded so far and remains to be determined.

This paper attempts to fill the void in the literature by providing empirical evidence for the relationship between financial constraints, productivity, and exports at the firm level. It explores several closely related questions. How do financial constraints affect the export decision? How do these effects vary with different types of firm ownership or types of exporter? And how do financial constraints determine export decision for firms at different productivity levels? Our analysis differs from the existing literature in three respects. First, we hypothesize a non-monotonic relationship between leverage and export decision. While increasing debt can benefit firms in participating into international trade, the benefit can become a drag if the debt ratio exceeds a threshold. Second, we distinguish between new exporters and continuous exporters. This allows us to explore the role of borrowing constraints not only in the entry decision but also in remaining export status. Last, rather than focusing on the separate role of financial constraints and productivity on export, we demonstrate their joint role in shaping the export decision.

We address these questions by using a rich firm level data set for Viet Nam during 2009-2014. Viet Nam has emerged as the 24th largest exporter of the world currently from the lowest position on the international trade map only a few decades ago, providing a considerable interest of study. The sample consists of firms with different ownership types. The large majority of firms are private-owned (POE). In addition, there are state-owned (SOE) and foreign-owned (FOE) firms. We find strong results for privately owned firms. Higher leverage and tangible asset ratios are found to lead to higher export probability, but too much leverage has an adverse effect on that probability for private manufacturers. More precisely, we document that leverage increasingly becomes a constraint beyond a threshold of approximately 47%. Furthermore, we differentiate between new exporters and continuous exporters and show that borrowing constraints matter more for maintaining exporting than for starting to export. In addition, we find strong persistence in being either an exporting or non-exporting firm. Last, we allow the interaction between productivity and financial constraints to examine the impact of borrowing constraints on the

decision to export of firms at different levels of productivity. We find that medium and high productive firms are more sensitive to borrowing constraints than the low productive ones.

The remainder of this paper is organized as follows. Section 4.2 reviews and discusses the relevant literature. Section 4.3 presents the data. Section 4.4 provides descriptive statistics. Section 4.5 presents the estimation strategy and methodology. Section 4.6 presents the estimation results. Section 4.7 concludes.

4.2 Literature review

The topic of international trade has received extensive attention in the literature. Early studies established the role of comparative advantage in explaining patterns of inter-industry trade. Initiated by Ricardo (1817) and developed by Heckscher-Ohlin (1933), classic trade theories explain differences in the opportunity costs of production based not on differences in technology but on variations in the factor endowments of each country and in the factor intensity of each industry. Observable intra-industry trade triggered a new trade theory (Krugman, 1980; Helpman, 1981), in which economies of scale and consumer preferences are the key drivers.

Not until the 1990s did the availability of firm-level data allow researchers to explore the role of firm heterogeneity in trade. Empirical papers like Clerides et al. (1998), Bernard and Jensen (1999), Kraay (1999) have suggested the self-selection of firms into international trade because only the most productive firms can cover the trade cost to enter export markets. This work triggered a theoretical revolution to account for such firm heterogeneity in international trade modeling.[40] The seminal paper by Melitz (2003) developed a framework in which firm are heterogeneous regarding their productivity level to explain the self-selection effect. A key insight in the Melitz model is that trade liberalization in the form of falling trade costs drives the low productivity firms out of the market where only the most productive firms can survive. As a result, that reallocation toward high productivity firms raises aggregate productivity.

[40] Before the heterogeneous firm revolution in international economics, theoretical models introduced a representative firm such that, at equilibrium, either all firms export or no firms export. In the monopolistic competition framework of Dixit-Stiglitz, the identical cost-structure assumption and constant mark-ups create invariant export performance within industries

Other theoretical models extend the Melitz model, such as Helpman et al. (2004) who explain the choice between export and foreign direct investment. Following Melitz, a substantial number of firm level studies on firm heterogeneity in trade have been conducted for a selection of countries, including Blalock and Gertler (2004) for Indonesia, Arnold and Hussinger (2005) for Germany, Alvarez and Lopez (2005) for Chile, Damijan et al. (2007) for Slovekia, and Haidar (2012) for India. The focus in this literature has mainly been on establishing the positive role of productivity in explaining firm self-selection into export markets and on explaining individual country characteristics. In the Melitz model and its empirical applications, the extensive side of trade – the number of firms that decide to export - is entirely determined by firm productivity differences. Exporting is costly because of higher sunk costs and higher variable trade costs. The financing side of these costs is typically ignored in these papers.

Only a few theoretical papers introduce financial constraints as another dimension of firm heterogeneity in trade. Chaney (2005) allows the interaction between liquidity constraints and productivity in a Melitz setting to explain the disconnection between firm productivity and export participation in the presence of financial frictions. In Chaney's model, the correlation between productivity and export participation is not perfect but depends on financial constraints. In detail, the most productive firms always export because they can cover the upfront fixed trade costs using the profits from high revenues in the domestic market; no firms at the bottom of the productivity distribution can profitably export due to liquidity shocks, but mid-productivity firms can export conditional on their ability to overcome financial constraints. Manova (2013) also analyzes the impact of financial constraints on the selection into exporting. Firms need external funds to finance foreign expansions, and they differ with regard to the level of collateral they can pledge. The model implies that productivity cut-off levels for the selection into exporting differ across firms. Highly productive firms can offer higher returns to creditors and are less credit-constrained than less productive firms. In this sense, credit constraints reinforce the negative impact that low productivity has on the entry into foreign markets. Our paper builds on both Chaney (2005) and Manova (2013) that firm depends on external finance for oversea trading.

Empirical work accounting for financial constraints in relation to firm heterogeneity in trade is rare. Berman and Hericourt (2010) test Chaney’s model using a cross-country firm-level database and confirm the role of financial constraints as barriers that reduce the impact of productivity on export participation. In contrast to Chaney’s prediction, their results suggest that even low-

productivity firms export and that some high-productivity firms do not. Campa and Shaver (2002) use a panel of Spanish firms to test whether there is any link between liquidity constraints and firms' export. They do find that liquidity constraints are less binding for exporters than for non-exporters. They also find that cash flow is more stable for exporters than for non-exporters. They argue that it is the stability provided by foreign sales that relaxes the constraints of exporters' liquidity, and not the reverse. Exporters earning profits in different markets with imperfectly correlated business cycles can pledge more stable future earnings, which alleviates agency problems in their relationship with financial intermediaries, and relaxes their liquidity constraints. Both Feenstra et al. (2014) and Amiti and Weinstein (2011) argue that exporters face tighter credit constraints due to the nature of international trade: the time between realized revenue and goods is longer and the default risk is higher than for domestic sales. Djankov et al. (2010) indeed show that cross-border shipping and delivery usually take 30–90 days longer to complete than domestic orders.

So far, empirical evidence shows that credit constraints restrict firms from participating into export markets. Only Greenaway et al. (2007) find evidence that exporters display higher financial constraints than non-exporters. However, the positive relationship between financial constraints and export probability in Greenaway et al. (2007) is for new exporters but not for continuous exporters. Their explanation is that new exporters have to pay sunk cost while continuous exporters do not. Therefore, a classification of exporter type is important to understand the nature of the relationship between credit constraints and export participation. This paper extends the empirical literature on the role of credit constraints by analyzing the joint role of credit constraints and productivity on export behaviour while distinguishing between new and continuous exporters.

4.3 Data and variable measurements

In this section, we provide details on the data on which the analysis of the paper is based, and then justify the selection of variables and measurement. Finally, we provide details on the cleaning of the data.

4.3.1 Data

We use an extensive dataset that covers the majority of the Vietnamese manufacturers during the period 2009-2014.This is a firm-level survey dataset provided by the Government Statistical Office (GSO), which is the most reliable source of government statistics in Viet Nam. Manufacturers are categorized as SOEs if the state ownership is greater than 50 percent, POEs if private ownership is greater than 50 percent, and FOEs if the firm is either 100 percent foreign owned or is a joint venture with domestic firms (either with state-owned firms or private owned firms). The survey covers all SOEs and FOEs. In the survey, the POEs are randomly selected to reflect the size structure, the sector, and the geography distribution. Table A4.1 in the Appendix 4 presents the selection of POEs into the survey over the years. Category 1 to 4 reflects the geographic distribution of POEs, in which firms from rural provinces (category 3) are all selected into the survey while only a percentage of firms from big cities (category 1 and 2) were chosen. The survey gives information on balance sheet and income statement items, export status, export value, taxes, and investments.

4.3.2 Variable definitions and measurements

4.3.2.1 Export status

In our analysis, the focus is on the firm's decision to export or not. Therefore, the dependent variable is the firm's export status (ESS) which equals 1 if the firm exports in a given year and 0 when it does not. In a substantial number of cases, information on the export status is missing. This is especially an issue in 2012.To overcome this problem to some extent, we code the export status in year t as 0 if firm exports in year t-1 and year t+1 are both zero. The underlying assumption is that firms with no export activity in both year t-1 and year t+1 are very unlikely to have export activity in year t.[41] By doing so, we fill in 26,179 additional firm-year observations for export status (see Table A4.2 in Appendix 4 for more details). In the empirical analysis, we test for the robustness of our results with respect to this procedure.

4.3.2.2 Financial constraints

Financially constrained firms in both Chaney(2005) and Manova (2013) are firms that are both not productive enough and lack sufficient collateral. A firm that is insufficiently productive

[41]Extending the interpolation for missing observations to firms with positive export status in year t-1 and year t+1yields 829 additional firm-year observations. Unreported results show that the results remain qualitatively unchanged.

cannot generate sufficient liquidity from domestic sales. That is, cash flows do not contribute enough to the overall liquidity needs for export activities. Simultaneously, the firm then is not attractive enough to investors because of low expected returns, which makes it difficult to raise external finance. Alternatively, a firm could obtain external finance pledging collateral. But a firm that lacks sufficient collateralizable assets is unable to borrow to finance the additional liquidity demand related to export activities. As a result, we may claim that a firm that is unable to raise sufficient internal and external finance when needed is a financially constrained firm.

Chaney does not provide an empirical test for his model. Manova (2013) does so by using two proxies to define financially constrained firms, the share of capital expenditure not financed with cash flow from operations and the ratio of tangible assets over total assets. While the first criterion displays the extent to which a firm is able to mobilize external finance, the second criterion displays a firm's ability to back up a loan, which directly affects firm's ability to borrow.

In this paper, we use two proxies for borrowing constraints, the leverage and the tangible asset ratio.[42] The tangible asset ratio is not only used in Manova (2013) but also in Berman and Hericourt (2010), Feenstra et al. (2014), and Manova and Yu (2016) as a measure of how much firms are financially constrained by the size of their collateral. It is measured as the share of net property, plant, and equipment in the total book value of assets. The literature has shown that real assets, which are a means of security, are preferred in external borrowing in poorly developed capital markets (Braun, 2003) where the agency issue and information asymmetry is more pronounced (Booth et al., 2001; Chen, 2004; Nguyen and Ramachandran, 2006).

The leverage is defined as the ratio between debt and total assets. It is used in Greenaway et al. (2007), Tang and Zhang (2012), Minetti and Zhu (2010) and Berman and Hericourt (2010) to proxy for the financial constraints of exporters. To pay the large up-front cost associated with export activities, firms have to borrow from banks to finance the purchase of assets, or leverage their assets. A low existing leverage may indicate firms have more room to borrow, therefore are less financially constrained and more likely to export. A high leverage, vice versa, is a red flag that firms are too much in debt, therefore less appealing for banker because that firm may

[42]Note that both the tangible asset ratio and leverage are crucial criteria in the credit evaluation process practiced by Vietnamese bankers (Leung, 2009; Nguyen and Ramachandran, 2006; Simavi et al., 2007).

encounter trouble with paying principal and interest. Such firms are limited in raising additional funds, therefore are financially constrained and less likely to export.

However, it is unclear whether the relation between leverage and credit constraints is linear or even monotonous. First, we do not know what level of leverage is low or high. Second, a leverage that is very low or even equals zero does not unambiguously signal a lack of financial constraints with considerable room for additional borrowing. It may also indicate lack of access to bank credit because of too small size or creditworthiness. In that sense, a moderate amount of bank debt may indicate the existence of established bank-client relationships and access to further borrowing. More generally, both the corporate finance literature and the macroeconomic finance-growth literature suggest the existence of non-monotonicity in the net benefit of debt. The trade-off theory in corporate finance literature states that the net benefit of debt is decreasing when leverage becomes high (Kraus and Litzenberger,1973; see Frank and Goyal (2009) for a review of the literature). The finance and growth literature has recently provided suggestive evidence of a non-monotonic relationship between credit to the private sector over GDP and economic growth (Arcand et al. 2015).To account for such non-linearities in the way leverage proxies for credit constraints, we use both the leverage and its squared value in our specification.

4.3.2.3 Productivity

Productivity is an important explanatory variable in the literature on firm export status. In Melitz (2003) firms vary by productivity and only the more productive firms are able to export profitably. Following Melitz (2003), we hypothesize that all firms above a productivity cut-off level can export profitably in the absence of financial constraints. Financial constraints raise the cut-off level for exporting profitably. As a result, the impact of productivity on export activities is hindered by the present of financial constraints.

In this paper, we include productivity in our empirical model as a direct factor for the export decision, similar to Melitz. In addition, we allow for its interaction with borrowing constraints to provide insight in the issue that the impact of productivity on export activities is distorted by the presence of borrowing constraints. We measure (labour) productivity as the ratio between net sales and total labour (Wagner, 2002; Kim, 2016; Chen and Guariglia, 2013). We test for the robustness of our results by using real value added per worker as an alternative measurement of productivity (Minetti and Zhu, 2011; Bricongne et al, 2012, Berman and Hericourt, 2010).

4.3.2.4 Other control variables

We include a number of firm-specific control variables, namely capital intensity, age, and size. The literature suggests that a larger capital stock increases the probability of being an exporter (Roberts and Tybout, 1997; Minetti and Zhu, 2011). Firm size and age have often been found to be related to export activity (Tang and Zhang, 2012; Greenaway et al., 2007; Muuls, 2015; Berman and Hericourt, 2010). For firm size, we use both the size of total assets and the size of the firm's labour force. Industry dummies are always included to capture industry-specific effects, as different industries require different levels of capital intensity and have different financial situations (Manova, 2008; Bellone et al., 2010; Jarreau and Poncet, 2014). We also control for business cycle effects by including year dummies in all specifications (Manova, 2008;Bellone et al., 2010). See table A4.3 in the Appendix 4 for details about the variable definitions and units of measurement.

4.3.3 Data cleaning

In constructing our sample, we apply several additional exclusion restrictions. First, we exclude firm-year observations with missing financial information. Second, following the procedure as designed by Feenstra et al. (2014), we exclude the following firm-year observations : (a) observations for which information on total assets, fixed assets, or net sales is missing; (b) observations that report strongly implausible numbers, such as (i) total assets that are smaller than current assets, (ii) total assets that are smaller than net fixed assets, (iii) total assets that are smaller than the cost of fixed assets, and (iv) negative financial costs. Second, we exclude firm-years if any of the following ratios are smaller than zero or larger than 100: (a) debt/total assets, (b) tangible assets/total assets. Third, we exclude firm-years if any of the following variables are negative: (a) net sales, (b) total assets/labour, (c) net sales/labour, (d) net sales/total assets. Fourth, following Greenaway et al. (2007), we eliminate outliers by dropping the first and last percentile of all explanatory variables listed in Table 4.1. After the cleaning, our final sample consists of 103,425 firms with 400,726 firm-year observations covering the years 2009-2014.

4.4 Descriptive statistics

This section provides a preliminary glance at the firm's export activities and financial characteristics in our sample. Table 4.1 presents the distribution of exporters and non-exporters

for each year through the period of study. The proportion of exporters has decreased from 23% in 2010 to about 17% in the following years. The considerable number of firms with missing export status in the survey of 2010 may explain the different characteristics in 2010. For our baseline analysis, we split firms into different groups based on ownership type. Roughly 92% of the firms in the sample are POEs, 1% are SOEs, and 7% are FOEs. The rise in the number of exporters after 2010 comes from all types of manufacturing firms, but mostly from POEs. Most of FOEs are exporters (80%), which makes sense given the involvement of foreign investors. In addition, a large part of SOEs is exporter (43%), while only a small portion of POEs becomes exporters (11%).The high percentage of SOEs exporters may be due to the export state-monopoly before 1990.These percentages are quite stable in the period 2011-2014.

Table 4.1: Number of firms on export status

	All	2010	2011	2012	2013	2014
Total firms	400,726	59,176	67,465	70,436	73,753	77,284
Total firms (non-missing export status)	299,362	26,064	66,096	56,605	73,347	77,250
- Exporter (ESS_t=1)	52,234	6,051	11,086	9,672	12,706	12,719
% of total firms(non-missing export status)	17%	23%	17%	17%	17%	16%
POEs (% of all POEs)	11%	5%	11%	8%	11%	10%
SOEs(% of all SOEs)	43%	27%	46%	42%	46%	45%
FOEs(% of all FOEs)	80%	67%	79%	82%	81%	82%

Note: ESS is export status, take value of 1 if export in year t, 0 otherwise; POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers

Table 4.2 shows the transitions in and out of exporting for firms in the sample with non-missing export status for any two consecutive years. We classify firms according to their export status for a cohort of two years. When a firm did not export in the preceding year, it either starts exporting in the current year and is labeled a “new-exporter”, or remains a “non-exporter”. When a firm exported in the preceding year, it either keeps exporting and is labeled a “continuous-exporter” or stops exporting and is labeled an “exiting-exporter”. Each column describes the transition proportion of export status from one year the next year. For instance, the first column for 2010-2011 indicates that 83.9% of firms that did not export in the year 2010 also do not export in the year 2011, while 16.1% of those begin exporting in the year 2011. Although there are firms that

switch on and off export status, there is a substantial degree of export persistence over time. There is 85.2% of firms that exported in the year 2010 that keep doing so in the year 2011, while 14.8% of those stops exporting in the year 2011. On average 83% of exporters keep exporting in the following years. This suggests that it is more likely to export next year for the current exporters than for the non-exporters.

Table 4.2: Export status transition rate

		2010-2011	2011-2012	2012-2013	2013-2014	Avg.
Non-exporter in year t-1	-Non-exporter in year t	83.90%	96.50%	96.50%	95.80%	93.10%
	-New exporter in year t	16.10%	3.50%	3.50%	4.20%	6.90%
Exporter in year t-1	-Continuous exporter in year t	85.20%	84.40%	84.80%	77.50%	83.00%
	-Exiting exporter in year t	14.80%	15.60%	15.20%	22.50%	17.00%

Table 4.3 contains descriptive statistics for various ownership type in panel A and exporting type in panel B, regarding leverage, tangible asset ratio, productivity, capital intensity, assets, age, and value added per labour. It also reports t-test statistics and p-values (in parentheses) for differences in the means of the variables of interest between exporters and non-exporters. The null hypothesis that there is no difference on average between exporters and non-exporters is always rejected at the 1 percent level. In line with the stylized facts in literature on heterogeneity firms in international trade, exporters in our sample are considerably more productive, larger, more capital intensive, and older than non-exporters. [43] In particular, the productivity of exporters is almost double, and size is seven times larger than non-exporters. We highlight the new stylized facts on the differences across ownership groups. From Table 4.3, we see that the differences between exporters and non-exporters are greater for POEs than for SOEs and FOEs. For example, on average, for POE exporters the debt ratio is 9.7% higher than for non-exporters, while the difference in debt ratio between SOEs exporters and non-exporters is smaller (5.7%), and that for FOEs is the smallest (4.5%). A similar pattern is found in assets size: POE exporters are almost

[43]Bernard and Jensen, 1999, Greenaway and Yu, 2004, and a considerable literature on firm heterogeneity in trade have argued that exporters are more productive, larger, older, and more capital intensive than non-exporters.

Table 4.3: Descriptive statistics

Panel A: All manufacturers and by ownership	All			POEs			SOEs			FOEs		
	ESS=0	ESS=1	t-test	ESS=0	ESS=1	t-test	ESS=0	ESS=1	t-test	ESS=0	ESS=1	t-test
Leverage ratio	49.54	55.25	-45.85	49.70	59.40	-62.56	51.40	57.10	-6.61	43.50	48.80	-12.21
	(24.41)	(23.91)	(0.00)	(24.34)	(22.23)	(0.00)	(25.19)	(22.52)	(0.00)	(26.85)	(25.05)	(0.00)
Tangible asset ratio	19.56	25.97	-71.47	19.20	21.20	-18.04	28.50	25.90	3.90	30.20	32.40	-6.37
	(16.75)	(18.68)	(0.00)	(16.51)	(16.66)	(0.00)	(19.98)	(18.55)	(0.00)	(20.99)	(19.35)	(0.00)
Productivity	489.5	964.2	-96.9	484.4	959.3	-78.8	648.7	1,333.7	-15.9	656.3	944.8	-14.0
	(899)	(1328)	(0.00)	(894)	(1316)	(0.00)	(929)	(1562)	(0.00)	(1069)	(1322)	(0.00)
Capital intensity	154.2	227.2	-55.4	151.0	190.0	-25.6	252.0	307.0	-3.9	270.0	281.0	-1.6
	(210)	(314)	(0.00)	(203)	(268)	(0.00)	(343)	(379)	(0.00)	(372)	(363)	(0)
Assets	12,505	84,733	-238	11,230	66,223	-184	105,324	216,771	-18	46,972	107,084	-29
	(36,313)	(120,962)	(0.00)	(32,114)	(107,353)	(0.00)	(127,733)	(173,921)	(0.00)	(83,150)	(129,383)	(0.00)
Age	5.54	7.87	-110.04	5.50	7.90	-92.86	10.70	12.20	-5.17	6.70	7.60	-11.70
	(4.07)	(4.92)	(0.00)	(4.01)	(4.92)	(0.00)	(6.67)	(7.34)	(0.00)	(4.54)	(4.68)	(0.00)
Value added/labour	0.44	0.81	-14.15	0.44	0.65	-7.88	0.58	0.98	-3.69	0.41	1.06	-3.21
	(5.01)	(2.20)	(0.00)	(3.98)	(1.55)	(0.00)	(2.74)	(1.74)	(0.00)	(23.39)	(2.95)	(0.00)
Panel B: By type of exporter		Newexp			Nonexp			Conexp			Exiexp	
Leverage ratio		56.30			51.40			55.30			55.90	
		(23.50)			(22.96)			(23.90)			(23.26)	
Tangible asset ratio		24.00			18.70			26.90			22.30	
		(18.51)			(15.76)			(18.46)			(18.19)	
Productivity		926.3			512.6			1,036.0			811.9	
		(1279)			(908)			(1366)			(1210)	
Capital intensity		219.0			160.0			247.0			199.0	
		(301)			(205)			(331)			(289)	
Assets		60,540			12,104			104,614			48,903	
		(97,212)			(32,655)			(131,722)			(86,705)	
Age		7.30			5.90			8.60			7.80	
		(4.72)			(4.05)			(4.96)			(4.75)	
Value added/labour		0.67			0.46			0.91			0.56	
		(3.12)			(5.59)			(1.82)			(2.55)	

Note: ESS is export status, take value of 1 if export in year t, 0 otherwise; POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers. Newexp are new exportes; Nonexp are non-exporters; Conexp are continuous exporters; Exiexp are exiting exporters. Mean values of firm characteristics are reported by export status and the t-statistics of the mean equality test. Standard deviations in parentheses under mean values, p-value in parentheses under t-value. Leverage is Total debt/Total assets, in percentage. Tangible asset ratio is Net tangible assets/Total assets, in percentage. Productivity is Net sales/labour, in million dongs per labour. Capital intensity is Net fixed assets/labour, in millions dong per labour. Assets are Total assets, in million dongs. Age is number of operating years since establishment. Value added/labour is value added /labour.

six times larger than POEs non-exporters, whereas SOE and FOE exporters are only two times larger than their non-exporting counterparts. Nonetheless, SOEs and FOEs firms have more favourable characteristics of being exporters than POEs. They are more productive, more capital intensive, and bigger than their POE counterparts. Contrary to the traditional views that SOEs are less efficient than POEs, the SOEs in our samples are more productive than their POE counterparts, possibly owing to the privatization process starting from the early 1990s which may have filtered out the less efficient SOEs. Note that the distributions of most of our main variables are highly skewed to the right. Possible reasons for such right-skewed distributions include the fact that the majority of Vietnamese manufacturers in the sample are privately owned, small and young and have low capital intensity and productivity.

Regarding the type of exporters, there is not much difference with respect to the financial constraints indicators. New-exporters have the debt to total assets ratio of 1% higher and tangible asset ratio of 2.9% lower than that of continuous exporters. In addition, they are less productive, less capital intensive, smaller, and younger than continuous exporters.

In summary, these preliminary descriptive statistics provide a general picture of Vietnamese exporters vs. non-exporters. First, most of FOEs and SOEs are exporters, while only a small portion of POEs becomes exporters. Second, there is persistence in exporting. That is, the current exporters are more likely to export next year in comparison to the non-exporters. Similarly, there is strong persistence in non-exporting. Third, we observe the differences between exporters and non-exporters not only on productivity but also on borrowing constraints and other firm's characteristics. Last, these differences between exporters and non-exporters are more pronounced in POEs than in other types of ownership. To formalize these findings and control for industry and year fixed effects, we empirically model export activities and present the results in the next sections.

4.5 Empirical approach and estimation methodology

In this section, we present the regression framework that we will use to empirically analyze the extensive margin of exports, that is, the probability of a firm deciding to export, conditional on a number of firm characteristics. In addition, we briefly discuss the estimation methodology.

As is shown at first in the descriptive statistics presented in Table 4.3, exporters are different from non-exporters not only in terms of productivity but also with respect to borrowing constraints and other firm characteristics including ownership and type of exporters. In our analysis, we use three different specifications. We begin with the base-line specification with borrowing constraints and productivity, classifying firms into three groups based on ownership types. In the second specification, we account for the observed pattern in the descriptive statistics that current exporters are more likely to export next year more than non-exporters. For this reason, we further classify firms into two groups of new exporters and continuous exporters respectively and investigate how borrowing constraints differently affect the two groups. Last, since the positive impact of productivity may be altered by the presence of borrowing constraints, we allow the interaction between these two factors in the third specification.

4.5.1 Empirical approach

We start from the standard specification, similar to Minetti and Zhu (2011). Let us denote π_{it} as the difference in expected operating profits between exporting and not exporting for firm i at time t, whereπ_{it} depends on the firm's financial constraints FC_{it-1}, productivity $Prod_{it-1}$, and other firm's characteristics X_{it-1}. $\lambda_{si}$and $\lambda_t$are industry and year fixed effects, respectively.According to the models developed by Chaney (2005) and Manova (2013), financial constraints come into play in the firm export decision due to the existence of sunk cost.

$$\pi_{it} = FC_{it-1}\beta + \theta Prod_{it-1} + X_{it-1}\gamma + \lambda_{si} + \lambda_t + \varepsilon_{it} \qquad (4.1)$$

We assume that the firm decides to export when it expects its operating profits to be higher when it exports than when it does not. Therefore, we specify the model that explains the export decision of the firm *i* at time t as follows:

$$y_{it} = \begin{cases} 1, & \pi_{it} > 0 \\ 0, & \pi_{it} \leq 0 \end{cases} \qquad (4.2)$$

Where $y_{it}$is the export status of firm i in period t, which takes the value of 1 if firm *i* exports in period t and 0 otherwise. Our target is to identify and quantify the role of financial constraints on the export entry decision. We estimate these effects using a binary choice approach

$$y_{it} = \begin{cases} 1 & if FC_{it-1}\beta + \theta Prod_{it-1} + X_{it-1}\gamma + \lambda_{si} + \lambda_t + \varepsilon_{it} > 0 \\ 0 & otherwise \end{cases} \qquad (4.3)$$

In our specification, FC_{it-1}representseither leverage (and its squared term) or the tangible asset ratio. The firm characteristics such as age, size, and capital intensity are included in vector of control variablesX_{it-1}. Other unobserved firm attributes are captured byε_{it},ε_{it}~N(0,1).

Next, we focus on the difference between new exporters and existing exporters. The literature argues that the role of financial constraints on the export decision is based on the existence of sunk cost. It virtually ignores the role of financial constraints on maintained export activities. Once a firm has started exporting, that is, once the sunk cost has been paid, financial constraints may play an even more important role in financing working capital and trade-related costs. In other words, financial constraints may matter in maintaining the export status as well. Bearing this in mind, we hypothesize that financial constraints may have a different impact on the probability of being a new or a continuous exporter. To verify this argument, we estimate 4. 3 for the two sub-samples. The first sub-sample includes new exporters and non-exporters. The second sub-sample includes the continuous exporters and stopped exporters. The result from the former sub-sample reveals the effects of financial constraints on the probability of being a new exporter, while those from the later sub-sample reveal the impact of financial constraints on the probability of being a continuous exporter. Because we have a dataset with an average of 4 years of observations per firm, we define new exporters as those who did not export in year t-1 and export in year t; continuous exporters are those who exported in year t-1 and continue doing so in year t. This is similar to the approach taken by Berman and Hericourt (2010) who have a dataset with an average of 3 years of observations per firm.[44]

Finally, we look into the interaction between borrowing constraints and productivity. According to the prediction in Chaney's model, the role of financial constraints on the export entry decision is different at the different level of productivity. The highest and lowest productive firms do not depend on borrowing constraints. The former group is productive enough to generate sufficient liquidity from domestic sales, while the later one has too low productivity to export, regardless of borrowing constraints. Only the mid-level productivity firms are productive enough to export profitably but may not generate enough internal liquidity to finance the sunk cost. This group

[44]The definition of new, continuous, and stopped exporters differs in the literature, mostly for reasons of data availability. Greenaway et al. (2007) for example use a UK manufacturing dataset with an average of 7 observations per firm. They look at three continuous years and define new exporters as those who did not export in year t-2, either exported or not in year t-1, and always export in year t; continuous exporters are those who always export in three years.

may need external finance and may be sensitive to financial constraints. Therefore, it is necessary to examine how the presence of borrowing constraints has a different impact on firms at various productivity levels. To do so, we allow for interaction between borrowing constraints and productivity.

$$y_{it} = \begin{cases} 1 & if FC_{it-1}\beta + (FC_{it-1} \times Prod_{it-1})\varphi + \theta Prod_{it-1} + X_{it-1}\gamma + \lambda_{si} + \lambda_t + \varepsilon_{it} > 0 \\ 0 & otherwise \end{cases} \quad (4.4)$$

4.5.2 Methodology

Since our dependent variable is a binary variable that takes the value one for an exporter and zero for a non-exporter, a probit model is a suitable choice for estimating the probability of exporting. Therefore we estimate equations 4.3 and 4.4 by a probit model. Industry and year dummies are included in all estimations to capture systematic differences across industries as well as systematic changes in the business environment faced by all firms. Industry dummies are at the 2-digit level as defined under Viet Nam Standard Industrial Classification (VSIC) version 2007. This broad set of fixed effects allows us to reduce the possibility of omitted variable bias. To minimize endogeneity problems, we lag all firm characteristics by one year. The logarithm transformation of non-financial variables helps to mitigate the potential multicollinearity. All standard error are White-adjusted for possible heteroskedasticity.

Different from its OLS counterpart, the estimated coefficients obtained through a probit estimation are not directly interpretable as the predicted change in the dependent variable as a result of one unit change in the independent variable. The estimated probit coefficients display the change in the z-score of the dependent variable upon a unit change in the independent variable.

To assess the size and significance of the impact of an independent variable on the dependent one in a probit model, the literature typically uses marginal effects calculated at the means of all covariates or calculated as the average marginal effects across all observed values (AME). The latter has the advantage of taking the observed distribution into account. Nevertheless, the AME only gives a point estimate of the average elasticity, while we are particularly interested in the question to what extent the impact of for instance leverage on the export decision varies across a plausible range of values. For this reason, we calculate the marginal effect across a range of representative values (MER) of the variable of interest and present these graphically. Our choice

for the range of representative values of one variable is within the observed range of values of that variable in our sample.

4.6 Estimation results

In this section, we present the estimation results using the approach presented in Section 4.5. Our analysis is threefold. First, we analyze the impact of borrowing constraints and productivity on the export decision and present the results in Section 4.6.1. Second, to gain greater insight into the relationship between borrowing constraints, productivity, and export decision, we graphically analyze the results from Section 4.6.1 in Section 4.6.2. Next, we examine the role of borrowing constraints in maintaining export status and starting to export. The results are presented in Section 4.6.3. In addition, we investigate how the export decision of firms at various level of productivity depends on the borrowing constraints and present the results in Section 4.6.4. Last, in Section 4.6.5 we test the robustness of our results by excluding the firm-year observations with interpolated export status and by using the value added per labour as an alternative measure of productivity, respectively.

4.6.1 To export or not to export

Table 4.4 reports the baseline estimation results of equation 4.3 on the impact of borrowing constraints on a firm's export decision. Columns (1) and (2) present the estimates of equation 4.3 for leverage and tangible asset ratio for all manufacturers in the sample. In columns (3) through (8), we estimate the same models as in columns (1) and (2) for the different groups of POEs, SOEs, and FOEs, respectively. In the discussion, we mostly focus on the results for the POEs. Note that the group of POEs has by far the largest number of year-observations. Therefore, the results for POEs dominate the results for all firms. In addition, we consider the POEs to be the most interesting group in our sample to investigate the role of borrowing constraints in the export decision, as both FOEs and SOEs may face "softer" borrowing constraints.[45] The baseline predicted probability shows that POEs have a much smaller likelihood of exporting than SOEs and FOEs.

[45]Moreover, for SOEs it is unclear to what extent the decision to export is primarily driven by economic arguments such as expected profitability. National strategic motives may play a role too.

A number of findings stand out. First, we find that leverage and its quadratic term both are highly significant for POEs with a positive coefficient for the level and a negative one for the quadratic term. It suggests a concave a concave relationship between leverage and export probability for POEs. Both the F-test and the Sasabuchi-Lind-Mehlum (SML) test statistics in the lower section of Table 4.4 provide support for the inverse U-shape of the leverage effect for POEs.[46] Economically, it implies that a small amount of debt – possibly indicating access to external funding and room for higher borrowing – increases the likelihood of exporting, while a high debt level indicates less borrowing room, making it harder to raise additional funds to finance the export-related costs. The estimated coefficients suggest that the threshold where leverage starts yielding a negative marginal effect on the likelihood of being an exporter equals about 0.47 (=0.853/2*0.904).

For SOEs and FOEs little evidence on leverage is found. One possible explanation is that SOEs may be subject to softer leverage constraints from the bank or enjoy privileged access to bank credit (Kokko and Sjoholm, 2007;Thai, 2008). This may also be the case for FOEs who may be able to fund themselves through foreign "mother companies" or international resources (Beck et al, 2006; Poncet et al., 2010).

Note that the literature so far yields mixed results on this issue. Berman and Hericourt (2008), Egger and Kesina (2013), and Stiebale (2011) report a negative relationship between leverage and the decision to export, while Fauceglia (2015) and Minetti and Zhu (2011) document a positive one.[47] Tang and Zhang (2012) distinguish exporter groups based on ownership similar to our analysis and find a more pronounced impact of leverage for SOEs and FOEs than for POEs. This is opposite to our results. All of these studies hypothesize a linear – monotonous – relation between leverage and the export decision.

Second, the tangible assets ratio enters positively and highly statistically significant at 1% level for POEs as well as for the other ownership types. Overall, it provides strong evidence that firms with a higher amount of tangible assets relative to their balance sheet size have a greater probability to be exporters. This result is consistent with literature such as Manova and Yu

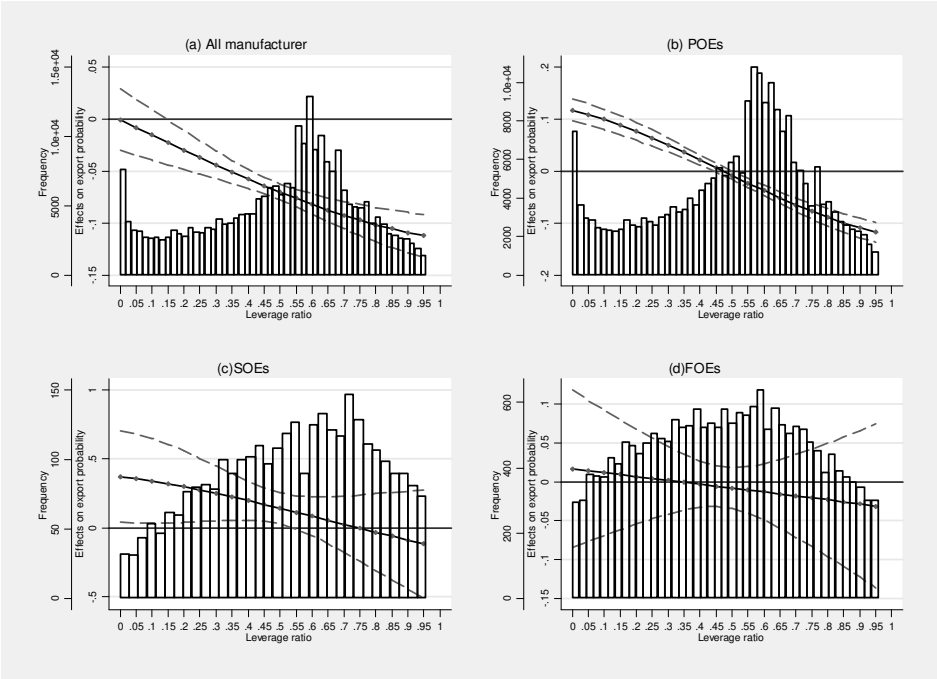
[46]The F-test has the null hypothesis that the quadratic term has a zero coefficient while the SML test has the null hypothesis that the relation between the leverage terms and the export decision is either monotonous or U-shaped. Both hypotheses are strongly rejected for POEs, but not for FOEs and SOEs.

[47] Note that the operationalization of leverage varies across studies.

(2016), Berman and Hericourt (2010), and Feenstra et al. (2014). It provides support for the hypothesis that a high tangible asset ratio can be interpreted as a high capacity to provide loan collateral in the form of pledgeable assets, hence relaxing borrowing constraints and enabling a firm to borrow to finance the exporting cost. Moreover, the highly significant estimated coefficients also reflect the prevalent traditional lending practice in developing countries. According to the report by Simavi and Wohlers (2007) on Viet Nam's current lending environment, the existence of tangible collateral is a sufficient condition to grand a loan to all types of firms. As a consequence, collateral constrained firms are less likely to export.

Third, productivity always enters highly significantly and positively in all estimations, confirming the self-selection hypothesis that the more efficient firms can enter the export market. This result is strongly in line with literature (Greenaway et al. 2007; Berman and Hericourt , 2010; Bernard et al. 2007; Minetti and Zhu, 2011).

Figure 4.1: Average marginal effects of Leverage ratio on export probability with 95% CI



Note: This figure displays average marginal effects of leverage ratio on export probability with 95% CI. The average marginal effect is represented by the solid line with marker. Confidence intervals are given by the dashed lines. The histogram of the leverage ratio's frequency distribution is plotted in the back of the figure.

Table 4.4: Borrowing constraints, productivity, and export decision

	All (1)	All (2)	POEs (3)	POEs (4)	SOEs (5)	SOEs (6)	FOEs (7)	FOEs (8)
Leverage ratio	-0.00432		0.853***		1.492*		0.0733	
	(0.08)		(0.10)		(0.79)		(0.23)	
Leverage ratio square	-0.378***		-0.904***		-1.004		-0.11	
	(0.08)		(0.09)		(0.76)		(0.23)	
Tangible asset ratio		1.642***		1.188***		1.411***		0.988***
		(0.03)		(0.04)		(0.34)		(0.10)
Productivity	0.127***	0.162***	0.131***	0.157***	0.180***	0.309***	0.0725***	0.131***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.05)	(0.05)	(0.02)	(0.02)
Capital intensity	-0.152***	-0.267***	-0.182***	-0.255***	-0.141***	-0.317***	-0.0648***	-0.152***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.04)	(0.06)	(0.01)	(0.02)
Assets	0.560***	0.567***	0.487***	0.503***	0.378***	0.449***	0.376***	0.353***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.04)	(0.05)	(0.02)	(0.01)
Age	0.0643***	0.0534***	0.120***	0.0998***	0.0213	0.0725	-0.0440**	0.00164
	(0.01)	(0.01)	(0.01)	(0.01)	(0.06)	(0.06)	(0.02)	(0.02)
Constant	-7.010***	-6.852***	-6.419***	-6.170***	-6.372***	-7.112***	-5.124***	-3.765***
	(0.26)	(0.22)	(0.32)	(0.24)	(0.59)	(0.60)	(0.51)	(0.50)
No.Obs	155608	160432	142186	145421	1234	1302	12060	13570
Baseline predicted probability (on average)	0.185	0.190	0.129	0.129	0.392	0.380	0.818	0.821
F test of the quadratic term	23.87		98.66		1.76		0.23	
	(0.00)		(0.00)		(0.18)		(0.63)	
SML tests for an inverse U-shape	na		9.02		0.6		0.32	
	na		0.00		(0.28)		(0.37)	
Pseudo-R-squared	0.321	0.339	0.258	0.268	0.255	0.261	0.149	0.147

Notes: POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers. Leverage ratio is Total debt/Total assets. Leverage ratio square is the square of Total debt/Total assets. Tangible asset ratio is Tangible assets/Total assets. Productivity is the logarithm of Net sales/Labour. Capital intensity is the logarithm of Net fixed asset/Labour. Assets is the logarithm of total assets. Age is the logarithm of firm's age. All estimations include year and industry dummies. Robust standard errors are into parentheses. All regressors, besides fixed effects, are one year lagged. na: not applicable. Significance levels: *10%,**5%,***1%.

Last, the control variables generally have plausible signs and are highly significant. The logarithm of size always has a positive effect on export probability. The magnitude of the coefficient for size is higher in POEs, suggesting that size is relatively more important for POEs than for other groups in entering export markets. The coefficients of the log of age are also positive and significant (with the exception of the state-owned and foreign-owned manufacturer sub-samples, in which some coefficients are non-significant), suggesting that exporting is more likely the older a firm is. The effect of capital intensity, as measured by the logarithm of the ratio between net fixed assets and total labour, is always negative, which is the opposite of what is commonly found in the literature (see Minetti and Zhu, 2011 and Fauceglia, 2015). Possibly, multicollinearity plays a role here. In this respect, we note that the descriptive statistics show that exporters in our sample on average are more capital intensive than non-exporters, which is opposite to our estimation result.

To sum up, for POEs higher leverage – beyond a threshold – and lower tangible assets significantly reduce the likelihood of becoming an exporting firm. This is consistent with the hypothesis that borrowing constraints can be an important impediment for firms to become exporters. For SOEs and FOEs leverage does not play a significant role, probably due to softer financing constraints, but tangible assets remain important. Furthermore, larger, older, more productive and less capital intensive firms have a higher probability to be exporters. POEs are less likely to export than SOEs which in turn are less likely to export than FOEs.

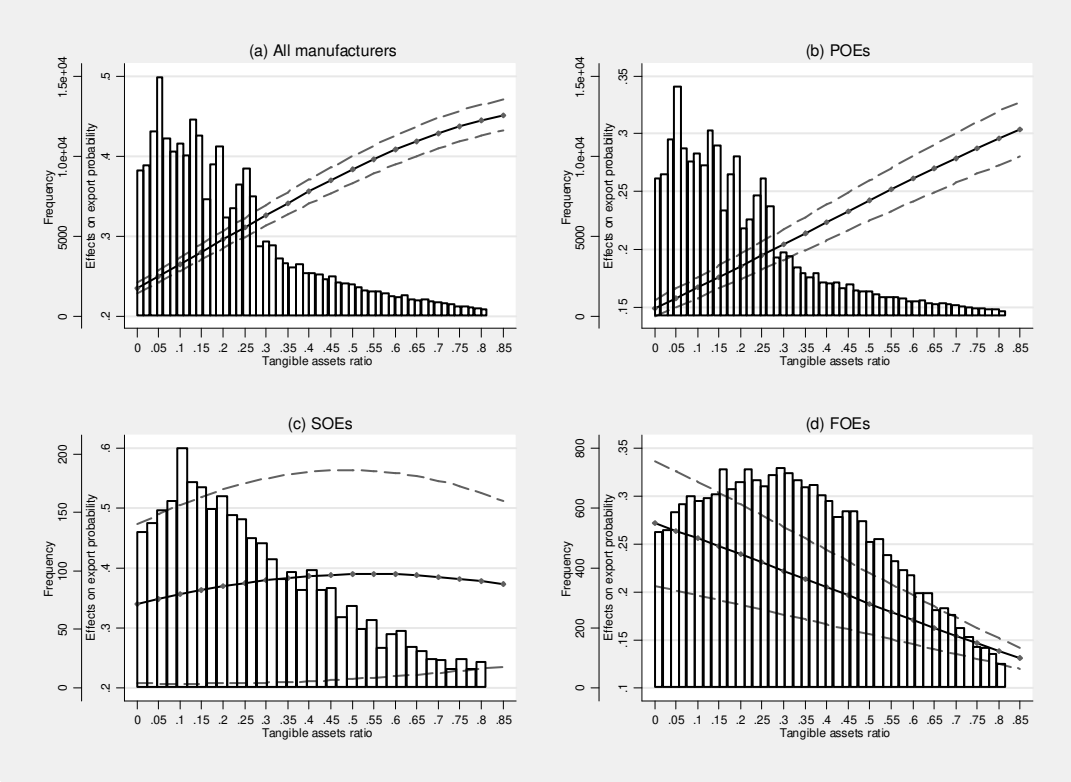
4.6.2 Marginal effects

Due to the probit estimation, the marginal effect of a change in one of the dependent variables on the export decision varies with the level of the dependent. The non-linear leverage effect reinforces the impact variation of leverage. To shed more light on the pattern of marginal effects at plausible, representative values (MER), we provide a graphical presentation and discussion, using the Table 4.4 estimates. We present the MER estimates together with lines indicating the 95 percent confidence interval. The histogram of the leverage ratio's frequency distribution is plotted in the back of the figure to provide information on the distribution of dependent variable that is

on the horizontal axis.[48]

Figure 4.1 presents the MER of leverage changes across its observed range of values, based on columns (1), (3), (5), and (7) in Table 4.4 for the respective ownership types. For the leverage ratio, we choose values between zero and one with step size 0.05. This grid choice allows for a good view on the variation in marginal effects while maintaining readability.

Figure 4.2: Average marginal effects of Tangible assets ratio on export probability with 95% CI



Note: This figure displays average marginal effects of tangible assets ratio on export probability with 95% CI. The average marginal effect is represented by the solid line with marker. Confidence intervals are given by the dashed lines. The histogram of the tangible assets ratio's frequency distribution is plotted in the back of the figure.

Consistent with findings in section 4.6.1, we observe that the marginal effect of leverage on the export probability for POEs is positive but decreasing up till a leverage ratio of 47 percent.

[48]The marginal effect of a continuous variable x is interpreted as the instantaneous rate of change of the export probability given a small change of the continuous variable x. The marginal effect of a continuous variable x at a representative value x=x1 is interpreted as the instantaneous rate of change of the export probability given a small change of x with an assumption that all firms in the sample have the value x=x1.

Beyond that, higher leverage increasingly impacts negatively on export probability. It is consistent with the idea that low leverage indicates access to external finance with room to expand funding, while high leverage become a burden and limits the scope for additional external funding. The histogram in figure 4.1(b) shows that the majority of observations (63.8% of the total firm-year observations of private manufacturers) are above this 47% threshold.[49] For SOEs, the pattern is similar to that of POEs, though only the positive effect at low leverage values is significant. For SOEs, the MER is substantially higher than for POEs at low debt levels. The threshold value is close to 75 percent, which is substantially higher than that of POEs. For FOEs no significant effects are found. Overall, it supports the hypothesis that POEs with high debt ratios face financial constraints which reduce their probability to export. SOEs and FOEs face softer finance constraints and are hampered less by high leverage in their export decision.

Figure 4.2 presents MERs for the tangible asset ratio as indicator of borrowing constraints. The design is does similar to Figure 4.1 but is based on columns (2),(4),(6), and (8) in Table 4.4.We choose a range from zero to 0.85 with 0.05 steps for the tangible asset ratio. First, the MER in figure 4.2 is significantly positive for all ownership types, indicating that a higher level of assets that can serve as collateral increases the likelihood of exporting. Second, the marginal effect is strongly increasing for POEs, roughly constant for SOEs, and marginally decreasing for FOEs. Especially for POEs, the majority of which has a relatively low tangible asset ratio, an increase in this ratio can substantially improve the firm's probability to export. For example, given the POEs sample standard deviation of tangible asset ratio of 0.165, and an average marginal effect at tangible asset ratio of 20% equal to 0.185, the effect of a one standard deviation increase in the tangible asset ratio is 0.03, which is substantial when compared to the baseline export probability of 0.129.[50]

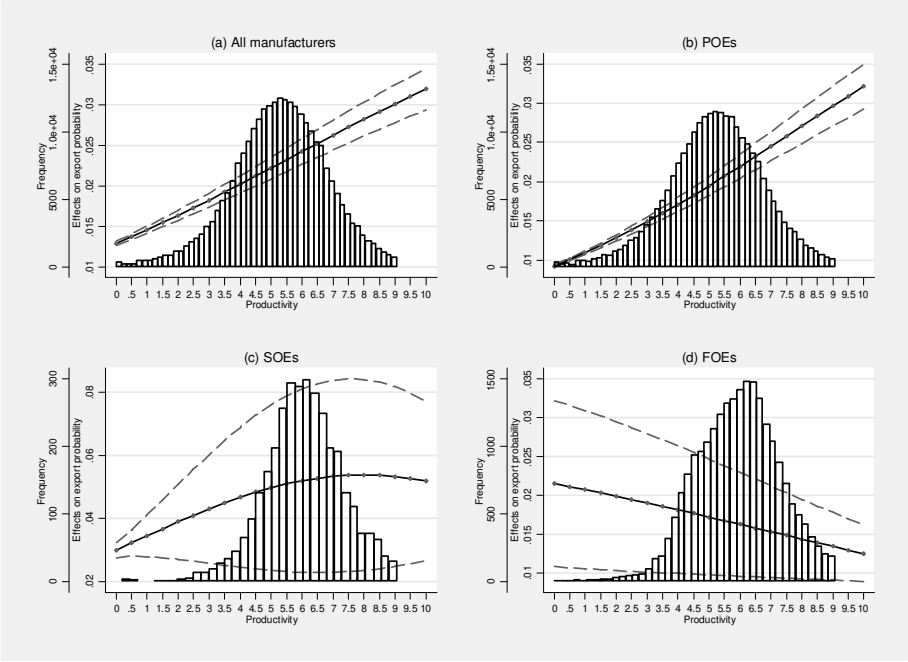
Figure 4.3 displays the MERs for productivity, with a layout similar to the previous figures. We choose a range of value from 0 to 10 with steps of 0.5 and use the estimated coefficients of the

[49]Our evidence corresponds to the finance-growth literature (Arcand et al. 2011, Reinhart and Rogoff, 2010) that debt finance beyond a threshold may harm growth. At the micro level, Coricelli et al. (2012) argue that the relationship between leverage and productivity growth is non-monotonic.

[50]For SOEs and FOEs, a similar evaluation at tangible asset ratio of 20% with the sample standard deviation for SOEs of 0.194 (for FOEs is 0.197), and average marginal effect of 0.376 (for FOEs is 0.229), one sd increase in tangible asset ratio amounts to a 7% and 4.5% increase in export probability for SOEs and FOEs, respectively.

leverage equations in columns 1, 3, 5, and 7.[51] For all ownership types, the MER of productivity is positive. Marginal effects are increasing in productivity for POEs and SOEs and marginally decreasing for FOEs. The decreasing MER for FOEs may be because FOEs have a high baseline export probability. Hence, an additional increase in productivity does not much increase the number of firms to export.

Figure 4.3: Average marginal effects of productivity on export probability with 95% CI



Note: This figure displays average marginal effects of productivity on export probability with 95% CI. The average marginal effect is represented by the solid line with marker. Confidence intervals are given by the dashed lines. The histogram of the productivity's frequency distribution is plotted in the back of the figure.

Overall, the graphs confirm the non-monotonic relationship between leverage and export probability for POEs. That is, leverage has a positive impact on the export decision when it is low, and becomes a constraint when it is higher than a threshold. Analysis of firms of different ownership reveals that SOEs and FOEs face a softer leverage constraint. Both the tangible asset ratio and productivity have significantly positive effects on the export decision for all ownership types.

[51]For ease of exposition, we only graph the MER estimates for productivity based on the estimation of the leverage equation. The results based on the estimation of the tangible asset ratio are qualitatively similar and are presented in Figure A 4.4 in the Appendix 4.

4.6.3 New exporters vs. Continuous exporters

We now turn to the difference between deciding to start exporting – from a starting situation of non-exporting – and deciding to maintain exporting – from a starting situation of exporting. Theoretical models implicitly stress the point that financial constraints specifically matter at entry due to the existence of sunk entry cost. We argue that financial constraints may also matter when a firm already is exporting. To investigate this issue we divide each sample into two sub-samples of non-exporters that may or may not start exporting on the one hand and exporters that may or may not keep exporting on the other. Table 4.5 contains the results in a similar format as Table 4.4.

Overall, the estimation results in Table 4.5 are quite similar to those in Table 4.4. We mainly find a non-monotonic – inverse U-shaped – relationship between leverage and the export decision for POEs, both for new exporters and continuous exporters. For almost all ownership types and specifications, the tangible asset ratio and productivity have significantly positive coefficients. Also, the pattern of estimated coefficients for the control variables is qualitatively similar in sign, size and significance to that of Table 4.4. Obviously, the baseline predicted probability to export is much higher – and the estimated intercept less negative – for the continuous exporters than for the new exporters. This is consistent with Table 4.2 which showed strong persistence: non-exporters have a high probability of not entering the export market, while exporters have a high probability of maintaining their presence in export markets. For a more detailed look of the effect of borrowing constraints and productivity on the export decision, we present MERs in Figures 4.4-4.5 whereby we focus on POEs.[52]

First, we graph the MERs of leverage and the tangible asset ratio on export decision in Figure 4.4.The pattern of the marginal effect of leverage is quite similar for new and continuous exporters. In both cases, the MER is positive at low leverage and negative at high leverage, with leverage significantly increases the probability to export, for continuous exporters the effect is insignificant. At high levels, the effect is significantly negative for both new and continuous exporters. The latter provides suggestive evidence that too high debt not only reduces a firm's

[52]For the sake of exposition, we only graph the MER estimates for POEs new exporters and continuous exporters based on the estimation in columns 5,6,7, and 8 of Table 4.5. The results for all manufacturers, SOEs, and FOEs are presented in Figure A4.4 in the Appendix 4a, 4b, and 4c, respectively. For SOEs and FOEs, the MERs are generally insignificant across the whole range of leverage values.

Table 4.5: Borrowing constraints, productivity, and export decision for new exporters and continuous exporters

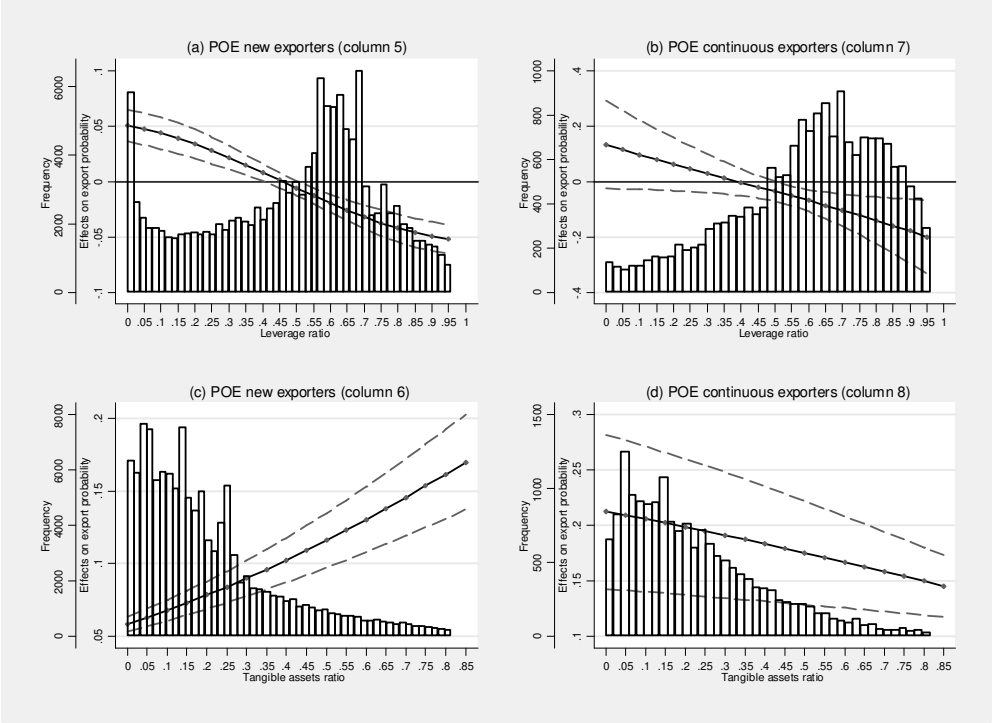
	New (1)	New (2)	Continuous (3)	Continuous (4)	New (5)	New (6)	Continuous (7)	Continuous (8)
	Panel A: All manufacturers and POEs							
	All	All	All	All	POE	POE	POE	POE
Leverage ratio	0.433***		-0.282		0.821***		0.440*	
	(0.14)		(0.20)		(0.16)		(0.25)	
Leverage ratio square	-0.684***		-0.109		-0.898***		-0.564**	
	(0.14)		(0.19)		(0.15)		(0.23)	
Tangible asset ratio		1.141***		1.078***		1.053***		0.662***
		(0.06)		(0.09)		(0.06)		(0.10)
Productivity	0.104***	0.132***	0.0915***	0.132***	0.0995***	0.127***	0.103***	0.129***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Capital intensity	-0.106***	-0.188***	-0.108***	-0.177***	-0.126***	-0.195***	-0.139***	-0.176***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Assets	0.446***	0.460***	0.317***	0.303***	0.428***	0.447***	0.272***	0.270***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.0383***	0.0337***	0.00482	0.0246	0.0751***	0.0675***	0.0801***	0.0813***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
Constant	-6.029***	-5.588***	-2.972***	-3.018***	-5.839***	-5.383***	-2.789***	-3.029***
	(0.36)	(0.29)	(0.62)	(0.64)	(0.44)	(0.31)	(1.03)	(0.83)
Baseline predicted probability	0.05	0.06	0.81	0.81	0.04	0.04	0.73	0.73
F test of the quadratic term	24.99		0.34		35.09		5.95	
	(0.00)		(0.56)		(0.00)		(0.01)	
SML tests for an inverse U-shape	3.14		na		5.26		1.74	
	(0 .00)		na		(0.00)		(0.04)	
No.Obs	94,403	96,667	19,712	20,882	92,013	94,051	12,159	12,378
Pseudo-R-squared	0.264	0.273	0.115	0.117	0.238	0.245	0.0923	0.0922

	Panel B: SOEs and FOEs							
	SOE	SOE	SOE	SOE	FOE	FOE	FOE	FOE
Leverage ratio	0.808		3.609**		0.606		-0.00637	
	(1.57)		(1.77)		(0.48)		(0.39)	
Leverage ratio square	-1.281		-2.812*		-0.822		-0.107	
	(1.48)		(1.66)		(0.50)		(0.39)	
Tangible asset ratio		1.709***		1.697**		0.303		0.894***
		(0.62)		(0.83)		(0.23)		(0.18)
Productivity	0.196**	0.381***	0.0606	0.224*	0.158***	0.181***	0.0913***	0.142***
	(0.10)	(0.09)	(0.14)	(0.13)	(0.03)	(0.03)	(0.03)	(0.03)
Capital intensity	-0.214***	-0.405***	-0.223**	-0.357***	-0.0144	-0.0581**	-0.0680***	-0.132***
	(0.08)	(0.10)	(0.10)	(0.12)	(0.03)	(0.03)	(0.02)	(0.03)
Assets	0.457***	0.500***	0.313***	0.299***	0.317***	0.304***	0.251***	0.224***
	(0.10)	(0.11)	(0.11)	(0.11)	(0.03)	(0.03)	(0.03)	(0.02)
Age	-0.0686	-0.0608	-0.089	0.0331	-0.0921**	-0.0644	-0.0042	0.0299
	(0.11)	(0.11)	(0.15)	(0.14)	(0.05)	(0.04)	(0.04)	(0.04)
Constant	-4.129***	-4.764***	-2.807**	-2.785**	-3.995***	-2.900***	-2.090***	-2.091***
	(1.05)	(1.02)	(1.41)	(1.37)	(0.55)	(0.65)	(0.78)	(0.78)
Baseline predicted probability	0.14	0.14	0.87	0.85	0.55	0.55	0.94	0.94
F test of the quadratic term	0.75		2.88		2.69		0.08	
	(0.39)		(0.09)		(0.10)		(0.80)	
SML tests for an inverse U-shape	0.51		1.14		1.27		na	
	(0.30)		(0.13)		(0.10)		na	
No.Obs	511	543	330	344	1,759	1,945	7,177	8,114
Pseudo-R-squared	0.279	0.291	0.173	0.156	0.162	0.156	0.0697	0.0694

Notes: New are new exporters; Continuous is continuous exporters. POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers. Leverage ratio is Total debt/Total assets. Leverage ratio square is the square of Total debt/Total assets. Tangible asset ratio is Tangible assets/Total assets. Productivity is the logarithm of Net sales/Labour. Capital intensity is the logarithm of Net fixed asset/Labour. Assets is the logarithm of total assets. Age is the logarithm of firm's age. All estimations include year and industry dummies. Robust standard errors are into parentheses. All regressors, besides fixed effects, are one year lagged. na: not applicable. Significance levels: *10%,**5%,***1%.

Figure 4.4: Average marginal effects of Leverage and tangible assets ratio on export probability with 95% CI

(Based on the estimations of columns (5), (6), (7), and (8) of Table 4.5)



Note: This figure displays average marginal effects of leverage ratio and tangible assets ratio on export probability with 95% CI. The average marginal effect is represented by the solid line with marker. Confidence intervals are given by the dashed lines. The histogram of the leverage ratio's frequency distribution is plotted in the back of the figure.

chance to enter export markets but also makes it more likely to exit when it is already exporting. This supports the idea that borrowing constraints may play a role after a firm has started to export. At high leverage ratios, the sensitivity of the export decision is higher for continuous exporters than for new exporters. That is, a further increase in leverage increases the probability for exporters to quit more than it decreases the probability for non-exporters to enter. In this respect, also note that continuous (POEs) exporters typically have higher leverage, and are larger and more productive than new exporters.[53]

[53]Literature that explores the difference between new exporters and continuous exporters generally confirms the superiority of continuous exporters (Alvarez, 2007; Greenaway et al. 2007).

We next examine the marginal effect (MER) of the tangible asset ratio on the export decision in Figure 4.4(c) and (d).The graphs show that the MER is positively significant in all cases. However, for new exporters, the MER increases, while for continuous exporters it decreases. Put differently, it is more important for non-exporters that consider entering the export markets to increase their tangible assets than it is for exporters that want to maintain active in exporting.

Figure 4.5 depicts the MER of productivity on the export decision. MER is always positive and. Comparisons of MER between POEs new exporters and POEs continuous exporters show that the MER of the later is decreasing while that of the former is increasing when productivity increases.

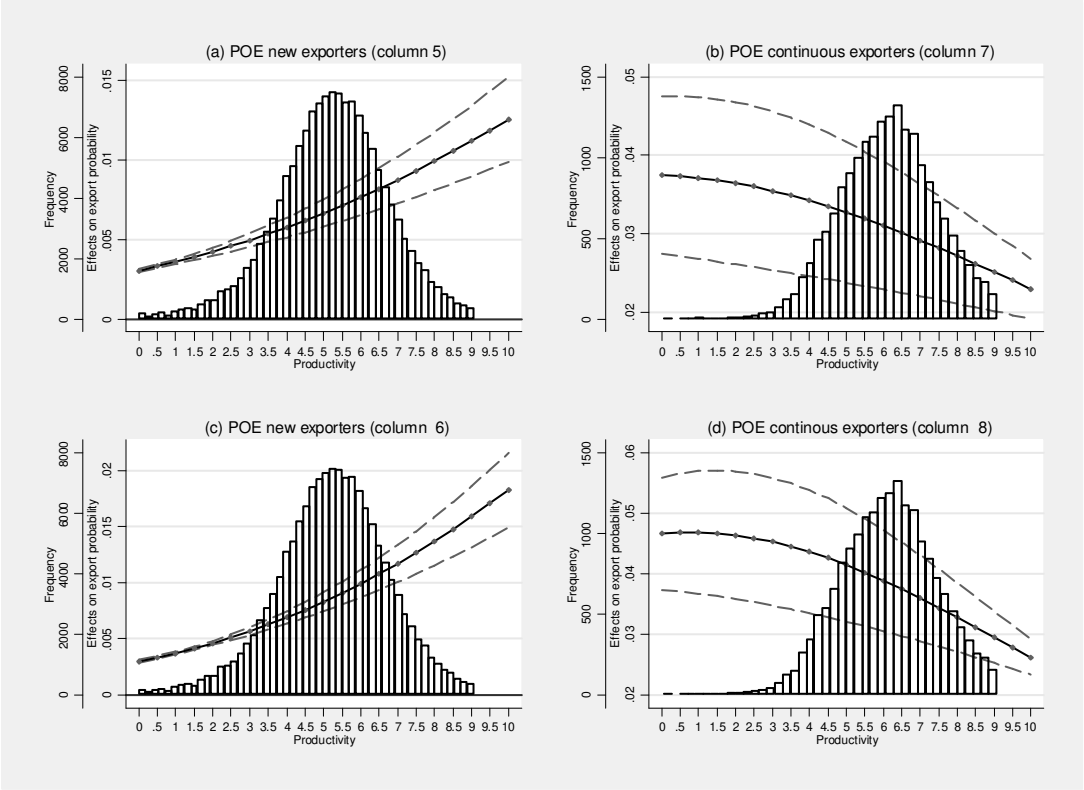
To sum up, first there is a strong persistence in export status. Non-exporters are more likely to not enter the export market, while exporters have more chance to remain exporting. Next, at high debt ratios, an increase in leverage reduces the chance to remain exporting more than the probability of joining the export market. In addition to that, increasing tangibility and productivity is more important for new exporters to increase their likelihood of exporting.

4.6.4 Interaction between borrowing constraints and productivity

So far, we have documented patterns of borrowing constraints and productivity for firms of different type of ownership. Overall, the observed patterns are consistent with the theoretical prediction of Chaney's model. That is, productivity is not the sole factor determining firm's export decision. Borrowing constraints as another source of firm's heterogeneity restrict firms from being exporters as well. According to Chaney (2005), only a subset of firms is subject to borrowing constraints. Those are firms with productivity that is not too low to be able to export but not too high to generate enough liquidity from domestic sales. In this section, we would like to examine to what extent the export decision of firms at various level of productivity is subject to borrowing constraints. To do so, we allow for the interaction between borrowing constraints and productivity in equation 4.4 and examine this relationship using the probit model. Obviously equation 4.3 is nested in equation 4.4. We use the likelihood-ratio test procedure to examine whether the extended model (equation 4.4) is a statistical improvement of the baseline one (equation 4.3)Table 4.6 presents the estimation results of equation 4.4 both for leverage and the tangible asset ratio. The likelihood ratio test results imply rejections of the null hypothesis that

Figure 4.5: Average marginal effects of productivity on export probability with 95% CI

Based on the estimations of columns (5), (6), (7), and (8) of Table 4.5



Note: This figure displays average marginal effects of productivity on export probability with 95% CI. The average marginal effect is represented by the solid line with marker. Confidence intervals are given by the dashed lines. The histogram of the productivity's frequency distribution is plotted in the back of the figure.

interaction terms have no explanatory power for the sample of all manufacturers, POEs. For FOEs, the null hypothesis is not rejected, while for SOEs the relevance of interaction effects is rejected for leverage but not for the tangible asset ratio. In the subsequent analysis we focus on POEs as they are the dominant group in the total sample and consistently show relevant interaction effects. The results for POEs suggest that the impact of borrowing constraints on export probability depends on a firm's position on the productivity distribution.

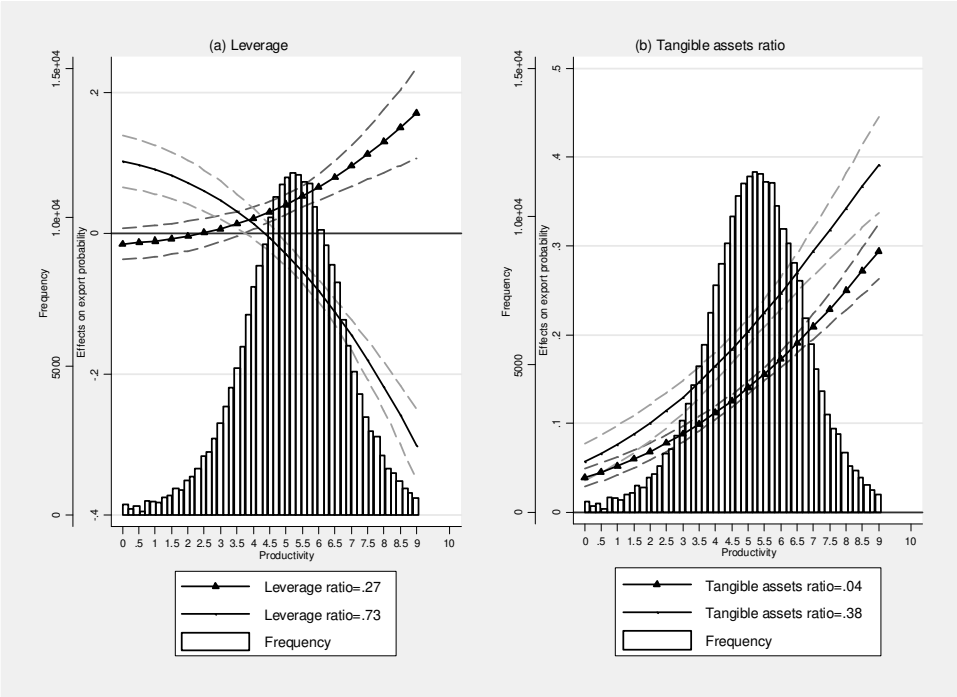
Due to the various non-linear specifications and interaction effects, interpretation of the sign and size of individual coefficients is infeasible. Instead, we graph the marginal effect of leverage and

Table 4.6: Borrowing constraints, productivity, interaction effects, and export decision

	All (1)	All (2)	POEs (3)	POEs (4)	SOEs (5)	SOEs (6)	FOEs (7)	FOEs (8)
Leverage ratio	-1.403***		-1.173***		0.265		1.07	
	(0.33)		(0.37)		(3.94)		(1.02)	
Leverage ratio square	1.924***		1.689***		0.247		-0.993	
	(0.33)		(0.37)		(3.78)		(1.07)	
Lev*Prod	0.223***		0.346***		0.205		-0.183	
	(0.06)		(0.07)		(0.66)		(0.18)	
Lev*Lev*Prod	-0.378***		-0.441***		-0.208		0.161	
	(0.06)		(0.07)		(0.62)		(0.19)	
Tangible asset ratio		1.135***		0.804***		3.987***		1.070***
		(0.11)		(0.13)		(1.12)		(0.32)
Tang*Prod		0.0946***		0.0714***		-0.451**		-0.0153
		(0.02)		(0.02)		(0.19)		(0.06)
Productivity	0.139***	0.144***	0.0978***	0.144***	0.142	0.424***	0.112***	0.135***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.17)	(0.07)	(0.04)	(0.02)
Capital intensity	-0.152***	-0.268***	-0.182***	-0.256***	-0.142***	-0.312***	-0.0644***	-0.152***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.04)	(0.06)	(0.01)	(0.02)
Assets	0.559***	0.566***	0.488***	0.502***	0.377***	0.458***	0.376***	0.353***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.04)	(0.05)	(0.02)	(0.01)
Age	0.0630***	0.0546***	0.119***	0.101***	0.0226	0.0757	-0.0447**	0.00129
	(0.01)	(0.01)	(0.01)	(0.01)	(0.06)	(0.06)	(0.02)	(0.02)
Constant	-7.043***	-6.734***	-6.226***	-6.088***	-6.141***	-7.921***	-5.312***	-3.788***
	(0.27)	(0.22)	(0.33)	(0.24)	(1.10)	(0.67)	(0.54)	(0.51)
LR test Chi-square	134.82	24.08	75.25	10.06	0.11	5.68	1.35	0.08
LR test p-value	0.00	0.00	0.00	0.00	0.94	0.02	0.51	0.78
Degree of freedom	2	1	2	1	2	1	2	1
No.Obs	155608	160432	142186	145421	1234	1302	12060	13570
Pseudo-R-squared	0.322	0.339	0.259	0.268	0.255	0.264	0.149	0.147

Notes: POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers. Leverage ratio is Total debt/Total assets. Leverage ratio square is the square of Total debt/Total assets. Tangible asset ratio is Tangible assets/Total assets. Productivity is the logarithm of Net sales/Labour. Capital intensity is the logarithm of Net fixed asset/Labour. Assets is the logarithm of total assets. Age is the logarithm of firm's age. All estimations include year and industry dummies. Robust standard errors are into parentheses. All regressors, besides fixed effects, are one year lagged. Significance levels: *10%,**5%,***1%.

Figure 4.6: Average Marginal Effects of (a) Leverage and (b) Tangible assets ratio on export probability with 95% CI- POEs



Note: This figure displays average marginal effects of leverage ratio and tangible assets ratio on export probability with 95% CI. The average marginal effect is represented by the solid line with marker. Confidence intervals are given by the dashed lines. The histogram of the leverage ratio's frequency distribution is plotted in the back of the figure (a), while that of the tangible asset ratio's frequency distribution is plotted in back of the figure (b).

tangibility on export probability at various levels of productivity in Figure 4.6.[54] We choose values plus and minus one standard deviation away from the mean for leverage and the tangible asset ratio respectively. This allows us to examine the joint impact of borrowing constraints and productivity on export probability.

Figure 4.6(a) displays the MER of leverage on export probability. For the medium and high productive firms (those firms on the right hand side of the histogram), borrowing constraints clearly matter: when leverage is low the MER is significantly positive and rises with productivity contributing to a higher export probability. When leverage is high on the other hand, the MER is

[54]We do not report the graphs of MER of leverage at representative values of leverage because they are almost identical to Figure 4.1 (based on Table 4.4). The MER of the tangible asset ratio and productivity at their own representative values are also not reported for the same reason. They are available upon request.

increasingly negative and decreases the firm's probability of exporting. For the low productive firms – who typically have a small probability to export anyway – the MER for low leverage is insignificant. It shows that access to borrowing does not significantly raise the firm's export probability, consistent with our expectations. For firms with low productivity and high leverage, the MER is significantly positive, which appears anomalous.

The MER of the tangible asset ratio is presented in Figure 4.6(b). The MER pattern for firms with a high versus low tangible asset ratio is similar. The MER is always significantly positive and rising with productivity. The higher a firm's productivity the higher the marginal effect of increasing tangibles on export probability is. But this effect is stronger for firms with high tangibles than for firms with low tangibles. This supports the idea of credit constraints – indicated by low tangibles - hurting a productive firm's export probability.

To sum up, the impact of borrowing constraints on export probability is subject to the level of productivity. Medium and high productive firms are more likely to export when leverage is low and the tangible asset ratio is high.

4.6.5 Sensitivity analysis

We test for the robustness of the results of our main analysis in Table 4.4, 4.5, and 4.6 with respect to two factors. First, we eliminate the year-observations that were obtained through interpolation. Second, we use total value added per unit of labour as an alternative indicator of productivity. We present the robustness test results in Tables 4.7, 4.8, 4.9, and 4.10, corresponding to the sample of all manufacturers, POEs, SOEs, and FOEs, respectively. Overall, our results appear to be relatively insensitive to the interpolation of the export status or the use of an alternative measure of productivity.

4.7 Conclusion

In this chapter, we focus on the impact of financial constraints and productivity on export probability for a large sample of Vietnamese firms. To this purpose, we use survey data to build a database for a sample of 103,425 manufacturers in Viet Nam over the period 2009-2014. Most of

Table 4.7: Robustness check for all manufacturers

				Panel A: Export status before interpolation				
					New	Continuous	New	Continuous
Leverage ratio	-0.268***	-1.471***			0.238*	-0.282		
	(0.08)	(0.34)			(0.14)	(0.20)		
Leverage ratio square	-0.139*	1.951***			-0.508***	-0.109		
	(0.08)	(0.35)			(0.14)	(0.19)		
Lev*Prod		0.189***						
		(0.06)						
Lev2*Prod		-0.342***						
		(0.06)						
Tangible asset ratio			1.577***	1.175***			1.032***	1.078***
			(0.03)	(0.11)			(0.06)	(0.09)
Tang* prod				0.0751***				
				(0.02)				
Productivity	0.140***	0.159***	0.174***	0.159***	0.120***	0.0915***	0.146***	0.132***
	(0.00)	(0.02)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Capital intensity	-0.164***	-0.164***	-0.275***	-0.277***	-0.113***	-0.108***	-0.189***	-0.177***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Assets	0.541***	0.541***	0.547***	0.547***	0.428***	0.317***	0.439***	0.303***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.0533***	0.0520***	0.0434***	0.0444***	0.0250**	0.00482	0.0206*	0.0246
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Constant	-6.781***	-6.845***	-6.658***	-6.565***	-5.861***	-2.972***	-5.430***	-3.018***
	(0.25)	(0.27)	(0.22)	(0.22)	(0.35)	(0.62)	(0.28)	(0.64)
Psuedo R2	0.315	0.316	0.331	0.331	0.257	0.115	0.264	0.117
No.Obs	143546	143546	147121	147121	82436	19712	83464	20882
				Panel B: Using value added as productivity				
Leverage ratio	0.240**	-0.101			0.410**	-0.251		
	(0.10)	(0.16)			(0.18)	(0.24)		
Leverage ratio square	-0.455***	-0.306**			-0.530***	-0.00704		
	(0.10)	(0.15)			(0.17)	(0.23)		
Lev*Prod		-0.371**						
		(0.15)						
Lev2*Prod		0.133						
		(0.15)						
Tangible asset ratio			1.716***	1.761***			1.393***	0.879***
			(0.04)	(0.06)			(0.08)	(0.10)
Tang* prod				0.0565				
				(0.05)				
Productivity	0.196***	0.349***	0.228***	0.216***	0.118***	0.171***	0.144***	0.180***
	(0.01)	(0.04)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Capital intensity	-0.170***	-0.170***	-0.281***	-0.281***	-0.127***	-0.130***	-0.219***	-0.177***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Assets	0.558***	0.556***	0.576***	0.576***	0.437***	0.309***	0.462***	0.310***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.120***	0.118***	0.114***	0.115***	0.0874***	0.0294	0.0853***	0.0444**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Constant	-6.823***	-6.667***	-6.048***	-6.058***	-4.620***	-2.418**	-4.541***	-3.750***
	(0.60)	(0.60)	(0.38)	(0.38)	(0.35)	(1.04)	(0.43)	(0.72)
Psuedo R2	0.294	0.295	0.313	0.313	0.228	0.109	0.241	0.112
No.Obs	112166	112166	113879	113879	74151	13436	75232	13956

Table 4.8: Robustness check for POEs manufacturers

Panel A: Export status before interpolation								
					New	Continuous	New	Continuous
Leverage ratio	0.637***	-1.111***			0.644***	0.440*		
	(0.10)	(0.39)			(0.16)	(0.25)		
Leverage ratio square	-0.709***	1.607***			-0.737***	-0.564**		
	(0.09)	(0.39)			(0.16)	(0.23)		
Lev*Prod		0.296***						
		(0.07)						
Lev2*Prod		-0.392***						
		(0.07)						
Tangible asset ratio			1.105***	0.827***			0.932***	0.662***
			(0.04)	(0.13)			(0.07)	(0.10)
Tang* prod				0.0517**				
				(0.02)				
Productivity	0.144***	0.121***	0.167***	0.158***	0.116***	0.103***	0.141***	0.129***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Capital intensity	-0.195***	-0.195***	-0.264***	-0.264***	-0.135***	-0.139***	-0.198***	-0.176***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Assets	0.470***	0.471***	0.484***	0.484***	0.410***	0.272***	0.426***	0.270***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.110***	0.109***	0.0902***	0.0908***	0.0620***	0.0801***	0.0545***	0.0813***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Constant	-6.224***	-6.086***	-6.000***	-5.941***	-5.693***	-2.789***	-5.236***	-3.029***
	(0.32)	(0.33)	(0.24)	(0.24)	(0.45)	(1.03)	(0.31)	(0.83)
Psuedo R2	0.253	0.254	0.261	0.261	0.232	0.0923	0.237	0.0922
No.Obs	130134	130134	132123	132123	80060	12159	80865	12378
Panel B: Using value added as productivity								
Leverage ratio	0.846***	0.645***			0.626***	0.332		
	(0.12)	(0.19)			(0.19)	(0.30)		
Leverage ratio square	-0.781***	-0.707***			-0.648***	-0.354		
	(0.11)	(0.18)			(0.18)	(0.27)		
Lev*Prod		-0.187						
		(0.16)						
Lev2*Prod		0.0409						
		(0.16)						
Tangible asset ratio			1.367***	1.346***			1.291***	0.457***
			(0.05)	(0.06)			(0.08)	(0.12)
Tang* prod				-0.0246				
				(0.05)				
Productivity	0.163***	0.254***	0.190***	0.195***	0.0976***	0.183***	0.117***	0.184***
	(0.01)	(0.04)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Capital intensity	-0.184***	-0.184***	-0.263***	-0.263***	-0.131***	-0.149***	-0.211***	-0.168***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Assets	0.503***	0.501***	0.528***	0.528***	0.426***	0.266***	0.455***	0.275***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.152***	0.151***	0.137***	0.137***	0.101***	0.0980***	0.0940***	0.0979***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Constant	-6.024***	-5.928***	-5.390***	-5.387***	-4.619***	-3.257***	-4.316***	-3.517***
	(0.53)	(0.53)	(0.33)	(0.33)	(0.35)	(0.82)	(0.40)	(0.72)
Psuedo R2	0.243	0.243	0.253	0.253	0.213	0.0914	0.223	0.0925
No.Obs	106240	106240	107347	107347	72793	9253	73772	9314

Table 4.9: Robustness check for SOEs manufacturers

	Panel A: Export status before interpolation							
					New	Continuous	New	Continuous
Leverage ratio	1.520*	0.461			0.825	3.609**		
	(0.79)	(3.95)			(1.58)	(1.77)		
Leverage ratio square	-1.025	0.111			-1.295	-2.812*		
	(0.76)	(3.78)			(1.48)	(1.66)		
Lev*Prod		0.176						
		(0.66)						
Lev2*Prod		-0.188						
		(0.62)						
Tangible asset ratio			1.407***	3.930***			1.708***	1.697**
			(0.34)	(1.12)			(0.62)	(0.83)
Tang* prod				-0.442**				
				(0.19)				
Productivity	0.174***	0.145	0.305***	0.418***	0.192**	0.0606	0.378***	0.224*
	(0.05)	(0.17)	(0.05)	(0.07)	(0.10)	(0.14)	(0.09)	(0.13)
Capital intensity	-0.141***	-0.142***	-0.315***	-0.310***	-0.214***	-0.223**	-0.401***	-0.357***
	(0.04)	(0.04)	(0.06)	(0.06)	(0.08)	(0.10)	(0.10)	(0.12)
Assets	0.381***	0.380***	0.449***	0.458***	0.458***	0.313***	0.498***	0.299***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.10)	(0.11)	(0.11)	(0.11)
Age	0.0218	0.0227	0.0738	0.0767	-0.0681	-0.089	-0.0591	0.0331
	(0.06)	(0.06)	(0.06)	(0.06)	(0.11)	(0.15)	(0.11)	(0.14)
Constant	-6.383***	-6.204***	-7.107***	-7.899***	-4.126***	-2.807**	-4.760***	-2.785**
	(0.59)	(1.11)	(0.60)	(0.66)	(1.05)	(1.41)	(1.02)	(1.37)
Psuedo R2	0.256	0.256	0.261	0.264	0.279	0.173	0.291	0.156
No.Obs	1233	1233	1299	1299	510	330	540	344
	Panel B: Using value added as productivity							
Leverage ratio	2.958**	4.430**			2.247	7.677***		
	(1.32)	(1.73)			(3.14)	(2.47)		
Leverage ratio square	-1.897	-3.375**			-2.901	-6.290**		
	(1.23)	(1.62)			(2.82)	(2.45)		
Lev*Prod		2.772*						
		(1.52)						
Lev2*Prod		-2.695**						
		(1.35)						
Tangible asset ratio			0.967	1.138*			3.641***	2.201*
			(0.60)	(0.66)			(1.33)	(1.17)
Tang* prod				0.335				
				(0.45)				
Productivity	0.0139	-0.55	0.0523	-0.0391	-0.239	-0.212	-0.0177	-0.147
	(0.09)	(0.41)	(0.08)	(0.14)	(0.16)	(0.25)	(0.14)	(0.18)
Capital intensity	-0.0322	-0.0333	-0.132	-0.129	-0.0965	-0.275**	-0.458**	-0.510**
	(0.06)	(0.07)	(0.09)	(0.09)	(0.13)	(0.14)	(0.19)	(0.21)
Assets	0.393***	0.397***	0.449***	0.449***	0.573***	0.039	0.742***	0.203
	(0.07)	(0.07)	(0.08)	(0.08)	(0.15)	(0.19)	(0.19)	(0.22)
Age	-0.0763	-0.0714	-0.00139	-0.00765	-0.121	-0.201	-0.119	-0.232
	(0.09)	(0.10)	(0.09)	(0.09)	(0.23)	(0.22)	(0.19)	(0.25)
Constant	-5.203***	-5.530***	-4.789***	-4.842***	-5.221***	1.292	-6.951***	1.741
	(0.85)	(0.92)	(0.93)	(0.93)	(1.61)	(2.21)	(1.69)	(2.27)
Psuedo R2	0.231	0.236	0.206	0.207	0.331	0.215	0.337	0.195
No.Obs	495	495	506	506	192	154	206	156

Table 4.10: Robustness check for FOEs manufacturers

	Panel A: Export status before interpolation							
					New	Continuous	New	Continuous
Leverage ratio	0.0718	1.108			0.592	-0.00637		
	(0.23)	(1.02)			(0.48)	(0.39)		
Leverage ratio square	-0.106	-1.048			-0.795	-0.107		
	(0.23)	(1.07)			(0.50)	(0.39)		
Lev*Prod		-0.189						
		(0.18)						
Lev2*Prod		0.172						
		(0.19)						
Tangible asset ratio			0.985***	1.056***			0.295	0.894***
			(0.10)	(0.32)			(0.23)	(0.18)
Tang* prod				-0.0133				
				(0.06)				
Productivity	0.0731***	0.113***	0.130***	0.134***	0.160***	0.0913***	0.183***	0.142***
	(0.02)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Capital intensity	-0.0652***	-0.0648***	-0.152***	-0.152***	-0.0146	-0.0680***	-0.0580*	-0.132***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
Assets	0.375***	0.375***	0.352***	0.352***	0.314***	0.251***	0.303***	0.224***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)	(0.02)
Age	-0.0445**	-0.0451**	0.000915	0.000618	-0.0928**	-0.0042	-0.0654	0.0299
	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)	(0.04)
Constant	-5.118***	-5.308***	-3.756***	-3.777***	-3.981***	-2.090***	-2.889***	-2.091***
	(0.51)	(0.54)	(0.50)	(0.51)	(0.55)	(0.78)	(0.65)	(0.78)
Psuedo R2	0.149	0.149	0.147	0.147	0.162	0.0697	0.155	0.0694
No.Obs	12055	12055	13564	13564	1754	7177	1939	8114
	Panel B: Using value added as productivity							
Leverage ratio	0.611*	0.672*			1.304*	0.00968		
	(0.34)	(0.39)			(0.67)	(0.50)		
Leverage ratio square	-0.676**	-0.797**			-1.302*	0.0269		
	(0.34)	(0.40)			(0.71)	(0.51)		
Lev*Prod		0.0954						
		(0.34)						
Lev2*Prod		-0.204						
		(0.37)						
Tangible asset ratio			0.567***	0.518***			0.161	0.424*
			(0.16)	(0.18)			(0.34)	(0.23)
Tang* prod				-0.0774				
				(0.12)				
Productivity	0.0470*	0.0588	0.0720***	0.0931**	0.118*	0.0459	0.166***	0.0554
	(0.03)	(0.07)	(0.03)	(0.04)	(0.06)	(0.04)	(0.06)	(0.04)
Capital intensity	-0.0322*	-0.0314*	-0.0761***	-0.0763***	0.0196	-0.0673**	-0.0269	-0.0769**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.04)	(0.03)
Assets	0.386***	0.386***	0.367***	0.367***	0.292***	0.288***	0.295***	0.256***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.05)	(0.03)
Age	-0.0173	-0.0172	0.027	0.0264	-0.0303	-0.0304	0.00961	-0.008
	(0.03)	(0.03)	(0.03)	(0.03)	(0.07)	(0.05)	(0.07)	(0.05)
Constant	-4.473***	-4.476***	-4.144***	-4.129***	-3.097***	-1.606**	-2.897***	-1.346**
	(0.94)	(0.93)	(0.93)	(0.93)	(0.80)	(0.65)	(0.79)	(0.64)
Psuedo R2	0.15	0.15	0.145	0.145	0.116	0.0821	0.114	0.0737
No.Obs	5352	5352	5948	5948	800	3942	883	4394

the manufacturers are private-owned (POEs). In addition, there are some state-owned (SOEs) and foreign-owned (FOEs) manufacturers. Overall, the data show there is strong persistence in export status: in any given year, non-exporting firms only have a small unconditional probability to start exporting. Similarly, exporting firms only have a small unconditional probability to stop exporting. Stylized facts show that exporters in our sample are considerably more productive, larger, more capital intensive, and older than non-exporters, which is consistent with the literature. SOEs and particularly FOEs are – unsurprisingly – more likely to export than privately owned manufacturers.

To more precisely analyse the role of financial constraints, productivity, and their interaction in the decision to export, we use a probit model. In the analysis, we control for size, age, and capital intensity. To capture other unobserved determinants we also include industry and year fixed effects. We find strong results for POEs and relatively weak ones for the other two groups.

Our results suggest that borrowing constraints significantly affect export decision for POEs. Different from other literature, we find that manufacturers face a non-constant effect of borrowing constraints on export decision. That is, the relationship between leverage and export probability for POEs manufacturers is concave. At low leverage levels, more borrowing increases a firm's exporting probability. At high leverage, more borrowing decreases this probability. Furthermore, the results indicate that borrowing constraints matter both for the decision to start exporting and for the decision to continue exporting, and more so for the latter. Finally, when we include the interaction between productivity and borrowing constraints, the results show that medium and high productive POEs depend more on borrowing constraints than the low productive ones. Our results are robust to sensitivity checks.

One limitation of our research is that the studied period is the aftermath of the 2008 global financial crisis. As the international financial crisis affects the cost and availability of external finance (Foley and Manova, 2014) future research should account for the impact of the crisis on the relationship between borrowing constraints and export to gauge more robust picture on this nexus.

Appendix 4

Table A4.1: How private manufacturers are selected into the survey over years

	2009				2010				2011			
Labours	C. 1	C. 2	C.3	C.4	C. 1	C. 2	C.3	C.4	C. 1	C. 2	C.3	C.4
<10	15%	15%	100%	15%	10%	20%	100%	20%	100%	100%	100%	100%
20-Oct	15%	100%	100%	100%	10%	20%	100%	20%	100%	100%	100%	100%
20-30	15%	100%	100%	100%	20%	20%	100%	100%	100%	100%	100%	100%
30-50	100%	100%	100%	100%	20%	100%	100%	100%	100%	100%	100%	100%
50-100	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
>100	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	2012				2013				2014			
Labours	C. 1	C. 2	C.3	C.4	C. 1	C. 2	C.3	C.4	C. 1	C.2	C.3	C.4
<10	10%	20%	100%	20%	10%	20%	100%	20%	10%	20%	100%	20%
20-Oct	10%	20%	100%	20%	10%	20%	100%	20%	10%	20%	100%	20%
20-30	20%	20%	100%	100%	10%	20%	100%	100%	10%	20%	100%	100%
30-50	20%	100%	100%	100%	10%	20%	100%	100%	10%	20%	100%	100%
50-100	100%	100%	100%	100%	20%	100%	100%	100%	20%	100%	100%	100%
>100	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Note:

C: category

C.1 : firms in Ho Chi Minh, Ha Noi;

C.2: Da Nang, Binh Duong, Dong Nai, Hai Phong;

C.3: firms in small provinces with total firms<1000: Ha Giang, Cao Bang, Bac Kan, Tuyen Quang, Lao Cai, Dien Bien, Lai Chau, Son La, Yen Bai, Hoa Binh, Lang Son, Phu Yen, Ninh Thuan, Kon Tum, Đak Nong, Tra Vinh, Hau Giang, Bac Lieu.

C.4: firms in the rest of provinces; within each industry, firms are chosen randomly.

%: percentage of manufacturers are selected into the survey.

Table A4.2: Before and after fill in missing export status for firms with ESS_{t-1}=$ESSt_{+1}$=0 and ESS_t is missing

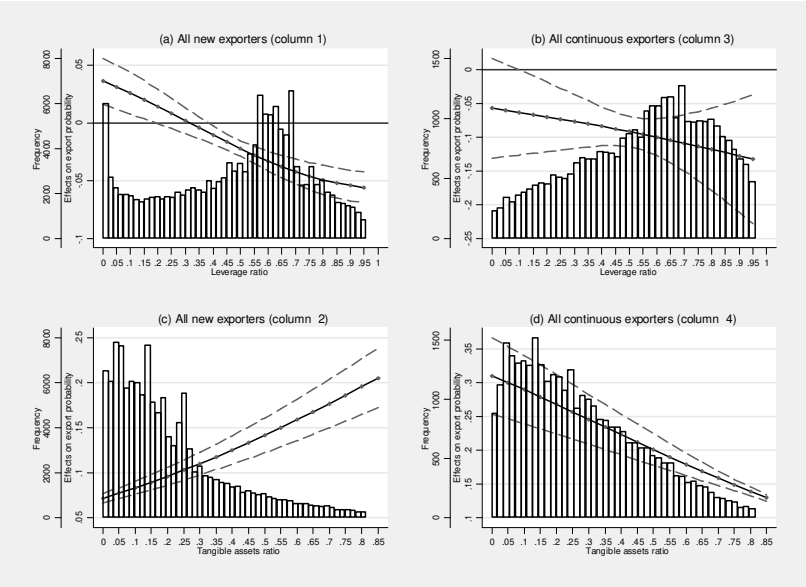
	Before		After	
ESS	0	1	0	1
2010	20,013	6,051	20,013	6,051
2011	54,977	11,086	55,010	11,086
2012	21,626	9,672	46,933	9,672
2013	60,621	12,706	60,641	12,706
2014	64,530	12,719	64,531	12,719
Total	221,767	52,234	247,128	52,234

Table A4.3: Variable definition

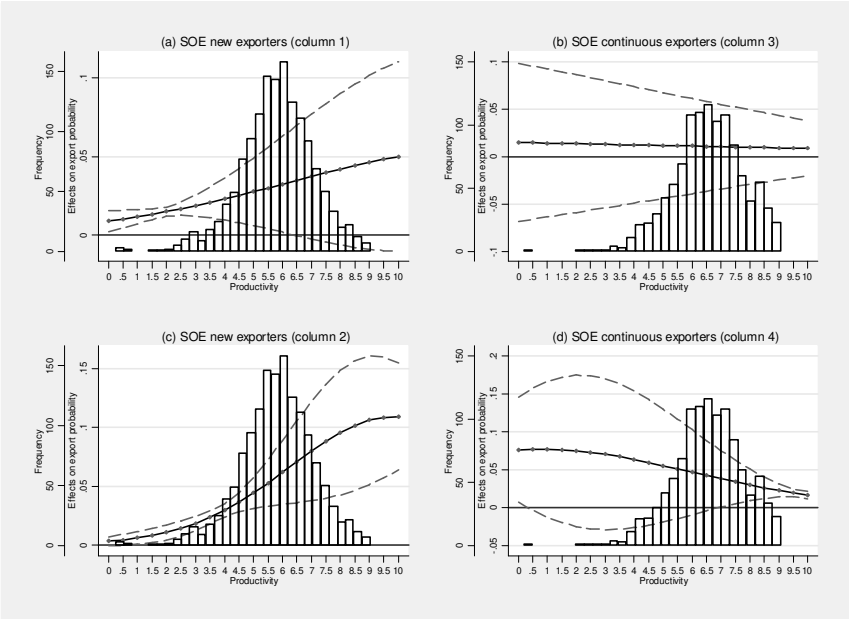
Variable		Definition
Export decision		Export status, equal to 1 if firm export in that year, 0 otherwise
Leverage ratio	Total debt/total assets	Total debt over total assets. Calculated as average of year.
Tangible asset ratio	Tangible asset/total assets	Net tangible assets over total assets. Calculated as average of year.
Productivity	Net sales/labour	Net sales over total labours, expressed in logarithmic form in the regressions. Net sales is calculated at end-of-year, labour is calculated as average of year.
Capital intensity	Net fixed assets/labour	Net fixed assets over total labours, expressed in logarithmic form in regressions. Calculated as average of year.
Age	Log of age	Firm's age is defined as number of year since the starting business date, expressed in logarithmic form in regressions.
Assets	Log of total assets	Total assets, expressed in logarithmic form in regressions. Calculated as average of year.
Value added/labour	Value added/labour	Value added over total labours, value added is equal to net sales minus materials, expressed in logarithmic form in regressions.

Figure A4.4

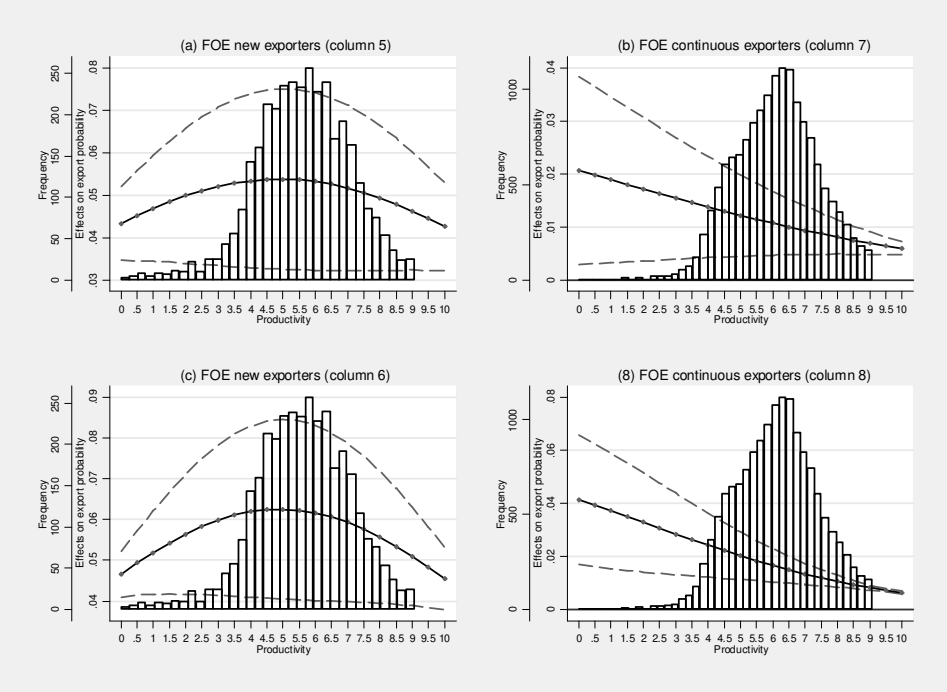
Average marginal effect of leverage with 95% CIs- for all manufacturers based on the estimation of Table 4.5



Average marginal effect of productivity with 95% CIs- for SOEs based on the estimation of Table 4.5



Average marginal effect of productivity with 95% CIs- for FOEs based on the estimation of Table 4.5



Chapter 5
Learning by exporting: The case of Vietnamese manufacturers

5.1 Introduction

Increasing productivity through exports is one central goal of the export-led growth strategy many countries pursue. Direct interaction with buyers can potentially enhance productivity directly by spurring the diffusion of advanced technology and technical know-how or indirectly via competition with other international sellers. Theoretical and empirical evidence shows that exporters are more productive than non-exporters, but this effect can either be self-selecting, whereby firms increase their productivity before beginning to export, or a case of learning by exporting (LBE), whereby firms increase their productivity as the consequence of exporting. Regarding self-selection, a substantial amount of recent work has shown that higher productivity occurs before firms participate in export markets; only relatively more productive firms can make export decisions after covering sunk costs (Robert and Tybout, 1997; Bernard and Jensen, 1999; Melitz, 2003; Helpman et al.,2004). At the same time, regarding LBE, a small line of research argues that firms may enhance their productivity through exporting (for example, Aw et al., 2000; Van Biesebroeck,2005; and De Loecker, 2007). Current evidence is therefore mixed.

Some important pieces are still missing from the literature. First, the method to detect the LBE effect remains a subject of some debate. The inconclusive series of results is not surprising given

the variation in methodologies used to assess LBE. The centre of the debate is the self-selective effect itself (selection bias); firms that participate in export markets differ significantly from those that do not. In stylized facts, which this paper also confirms, exporters are more productive, larger, older, and less borrowing-constrained than are non-exporters (Duong et al., 2019). Second, the main variable of interest, productivity, is difficult to estimate due to limitations in data.

In this paper, I firstly attempt to estimate productivity using the Olley-Pakes (1996) methodology. I also estimate productivity using the De Loecker (2013) and Levinsohn and Petrin (2003) approaches to test whether the main results are sensitive to the choice of productivity estimation methodology. Next, I estimate the LBE effect at the firm level using propensity score matching and difference-in-differences. I use a comprehensive dataset on Vietnamese private manufacturers covering 2009 to 2014.

LBE is estimated in three steps. The first step is to estimate the probability that a firm starts exporting based on a set of observable variables. Such estimates provide intuitive results regarding which firm-specific variables determine a firm's export decision, showing significant differences in productivity, labour intensity, borrowing constraints, and size between firms that start to export and those that do not. This confirms that selection bias must be considered when analysing LBE. The second step is to use the nearest-neighbour matching algorithm to create a sample of matched couples: one "treated" firm (which started exporting) with one "control" firm (which did not export). Each exporting firm may be matched with up to five control firms based on their closest propensity scores. In a last step, I apply the difference-in-differences technique on the matched sample to estimate the learning effect not only at the time of treatment (the period in which the firm starts to export) but also over subsequent periods. I test the robustness of the results by comparing different methods of measuring productivity.

The results suggest that an LBE effect exists for Vietnamese firms during the 2009 to 2014 period that is significant, large in magnitude, and robust across matching methodologies and approaches to estimating total factor productivity (TFP). In addition, the learning effect is most concentrated in the first two years of exporting, diminishing after that to become statistically insignificant.

The remainder of the paper is structured as follows. Section 5.2 overviews related literature. Section 5.3 details the data, measurement of variables, and descriptive statistics. Section 5.4

describes the empirical strategy. Finally, Section 5.5 reports the empirical findings and robustness checks, and Section 5.6 concludes.

5.2 Literature review

The dominant stylized fact that exporters are more productive than non-exporters has triggered a debate on whether productivity is the cause or result of participating in export markets. The first view, the "self-selection" hypothesis, proposes that only productive firms can generate sufficient profits from exporting to recover sunk entry costs. This line of literature has been backed up by widespread and robust findings. Aw and Hwang (1995), Robert and Tybout (1997), Bernard and Jensen (1999), Melitz (2003), and Helpman et al. (2004) all offer theoretical and empirical evidence to support that more productive firms self-select into export markets.

The second view, the "learning-by-exporting" (LBE) hypothesis, argues that productivity improvement results from exporting for two reasons. First, exporters may gain access to advanced knowledge and technology by interacting with buyers; for instance, buyers may help sellers meet their quality standards (Grossman and Helpman, 1990; Evenson and Westphal, 1995). Studying Taiwanese firms, Westphal (2002) suggests that the motivation to explore profit opportunities in the international market may stimulate firms to improve their efficiency. In a similar vein, investigating Canadian manufacturers, Baldwin and Gu (2003) concluded that new innovations, technology transfer, and investment in absorptive capacity are important channels for LBE. Keller (2009) supports this view, providing evidence that technology spills over through international trade and the activity of multinational enterprises.

Second, competition on the international market may induce firms to increase their efficiency to stay competitive (Damijan and Kostevc, 2006; De Loecker and Koujianou, 2014; De Loecker and Van Biesebroeck, 2016). Bernard and Wagner (1997) for Germany; Clerides et al. (1998) for Columbia, Mexico, and Morocco; Bernard and Jensen (1999) for the United States; Aw et al. (2000) for Taiwan and Korea; Delgado et al. (2002) for Spain; and Vu et al. (2016) for Viet Nam all find strong evidence for self-selection and only modest support for the LBE hypothesis. Proposing non-parametric tests for the LBE hypothesis, Delgado et al. (2002) find only weak evidence in favour of LBE. Keller (2004) comprehensively surveys the literature on the various sources of productivity, finding no econometric evidence for a strong learning effect.

In contrast to the above studies, some literature has documented evidence on the existence of the learning effect. Castellani (2002) for Italy; Blalock and Gertler (2004) for Indonesia; Greenaway and Yu (2004) for the UK; Van Biesebroeck (2005) for sub-Saharan Africa; Yang and Mallick (2010) and Dai and Yu (2013) for China; and Timoshenko (2015) for Colombia have found evidence that exporting leads to productivity improvement. Huang and Yang (2016) investigated the productivity of Vietnamese manufacturers from 2000 to 2009 and estimate the impact of trade rather than exports on productivity, due to data limitations.[55]Although they confirm trade positively impacts productivity, this should not be considered evidence of LBE, because imports are another source of productivity improvement (Keller, 2004). Newman et al. (2017) apply the Arellano and Bond (1991) difference generalized-method-of-moments estimator to a similar data set as used by Huang and Yang (2016) but for the period from 2005 to 2012, finding that exports have a positive effect on productivity for Vietnamese firms. However, they roughly measure productivity using the value added per worker, which is subject to selection bias stemming from firms' exits.

One common theme in the literature that favours the existence of the LBE effect is that the observed increase in productivity happens mostly in the first few years after a firm starts to export. Indeed, the LBE effect is not constant but is instead subject to the law of diminishing returns. This characteristic of learning was first mentioned byArrow (1962): "learning associated with repetition of essentially the same problem is subject to sharply diminishing returns. … To have steadily increasing performance, then, implies that the stimulus situations must themselves be steadily evolving rather than merely repeating" (pp. 155–156). For LBE in this regard, it is plausible that the knowledge and technology gaps narrowover time. In a meta-analysis of 33 empirical papers that consider the LBE hypothesis, Martins and Yang (2009)conclude that firms from developing nations experience higher LBE effects than those from developed nations. Moreover, they find that the LBE effects mainly occur in the first year after starting to export, and diminish thereafter. In a similar vein, Girma et al. (2004), studying UK firms by applying matching and difference-in-differences techniques, find that firms learn the most in the first two years following market entry. In an attempt to explain the diminishing LBE effect, Damijan and Kostevc (2006) argue that the transient increase in observed productivity after starting to export

[55]Export status was omitted from the survey before 2010.

might be attributed to increasing capacity utilization, while Garcíaet al. (2012) and Dai and Yu (2013) suggest that productivity gains are large and lasting for firms with pre-export research and development.

All in all, the literature offers mixed support for the LBE hypothesis, reinforcing the need for further examination of the impact of exporting on productivity. Strikingly, most studies have not accounted for the selection bias that arises from firm exit or firm selection into exporting. The present study attempts to overcome some of the limitations of the existing literature by estimating productivity while accounting for the selection bias caused by firm exits. Propensity score matching and difference-in-differences enable assessment of the possible learning effects of entering export markets while taking into account the fact that more productive firms self-select into exporting.

5.3 Data description

5.3.1 Data

This paper uses firm-level survey data on Vietnamese manufacturing firms from 2009 to 2014. The source data set has detailed, firm-level balance sheet and income statement information, as well as export status and ownership type. All data are in million Viet Nam dong. I focus in this paper on private manufacturers, the group which dominates the dataset, yielding a sample of 101,082 private manufacturers and 388,588 firm-year observations. A manufacturing firm is defined as privately owned if its share of private ownership exceeds 50 percent.[56] One limitation of the data set is that export status, one of the main variables of interest, is sometimes missing, especially for2012. To overcome this, I interpolate export status for those firms with observed and equal export status in years t − 1 and t+1.[57] This adds 906 observations of positive export status and 27,863 observations of negative export status (see table A5.1 in the Appendix 5 for export status before and after interpolation). In order to track the evolution of TFP over the

[56]The private manufacturers are randomly selected into the survey to reflect the size, structure, and geographic distribution of all firms in Viet Nam. In detail, private manufacturers from rural provinces or with more than 100 workers are all included in the survey, while only a percentage of firms from big cities or with fewer than 100 workers are chosen.

[57]Duong et al. (2019) use a similar interpolation approach and compare across types of ownership.

minimum two-year window, I keep in the dataset only those firms with at least two consecutive observations on export status.

To obtain a clean sample and rule out outliers, I exclude firm-year observations if any of the following variables are smaller than zero: total assets, net fixed assets, net tangible assets, total wages, net sales, debt, or total labour. Moreover, I exclude firm-year observations if debt over total assets or tangible assets over total assets are larger than 1. In addition, I calculate value added, materials, capital stock, and capital expenditures and drop firm-year observations if any of those variables are equal to or below zero (see table A5.2 in the Appendix 5 for variable measurement methods). Last, I eliminate outliers, dropping the first and last percentiles of all variables. After excluding these observations, the sample database comprises 73,156 firms and325,134 firm-year observations covering the years 2009 to 2014.

5.3.2 Descriptive statistics

Table 5.1 reports the total number of firms and stylized statistics on export status and export dynamics.[58]The left side of the table displays the total numbers of firms and the percentages of firms that are non-exporters and exporters. The right side of the table displays the number of new and market-exiting exporters each year. New exporters for each year are defined as firms that did not export in the preceding year but export in the current year. Exiting exporters for each year are firms that exported in the preceding year but stop exporting in the current year. The entry rate is defined as the ratio between the number of new exporters in a given year and the number of non-exporters in the preceding year. The exit rate is the ratio between the number of exiting exporters in a given year and the number of exporters in the preceding year. Overall, the number of surveyed private manufacturers increases over time, indicating growth in the Vietnamese private sector. I also observe a large increase in the number of firms and large entry and exit rates in 2011, which is due to the survey design.[59] On average, only 12% of private manufacturers served the foreign market from2010 to 2014, with little variation across years.[60]The high exit rate across years is striking compared to the low entry rate. Of exporters in 2012, 26.8% left the market in

58 Firm-year observations for which export status is missing have been excluded.

[59]All firms had to participate in the survey in 2011, while only a percentage of firms completed the survey in the other years.

[60]I do not report 2009 due to missing export status for firms. However, I keep 2009 in the sample to measure the lagged performance of firms when examining export behavior in 2010.

Table 5.1: Export status, export entry and exit

				Export entry		Export exit	
Year t	Total firms	Non exporter	Exporter	New exporters	Entry rate	Exiting exporter	Exit rate
2010	19,732	87%	13%				
2011	54,245	88%	12%	2,520	14.7%	1,382	52.5%
2012	51,478	89%	11%	1,391	2.9%	1,145	18.2%
2013	64,808	88%	12%	1,530	3.4%	1,559	26.8%
2014	61,787	89%	11%	1,959	3.4%	2,425	31.8%
Total	252,050	88%[a]	12%[a]	7,400	6%[a]	6,511	32%[a]

Note: Non-exporter and Exporter refer to the percentage of firms with export status of zero (ESS_t=0) and one (ESS_t=1), respectively. New exporters is the number of observations with ESS_{t-1}=0 and ESS_t=1. Exiting exporters is the number of observations with ESS_{t-1}=1 and ESS_t=0. The entry rate is the ratio between the number of new exporters in year t and the number of non-exporters in year t-1. The exit rate is the ratio between the number of exiting exporters in year t and the number of exporters in year t-1. [a]: average.

Table 5.2: Descriptive statistics

	Exporters					Non-exporters					
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	t-test
Tangible asset ratio	25,372	0.21	0.17	0	0.81	184,420	0.18	0.17	0	0.81	-24.54 ***
Capital intensity	21,925	176	235	0	1,601	173,634	135	179	0	1,609	-29.82 ***
Size	26,254	50,57	68,66	160	357,325	214,456	10,783	25,478	148.5	357,314	-181.6 ***
Age	27,683	7.37	4.64	0	21	220,423	4.96	3.86	0	21	-95.09 ***

Note: Tangible asset ratio is the ratio between tangible asset and total assets. Capital intensity is the ratio between net fixed assets and labour. Size refers to total assets (in million Viet Nam dong), and age to the firm's age in years. t-test is the t-statistics of the mean equality test between exporters and non-exporters. Significance levels: *10%,**5%,***1%.

2013, while only 3.4% of non-exporters in 2012 joined export markets the following year. Non-exporting is thus more persistent than exporting. Nevertheless, across years, there is not much difference between the number of entrants into and the number of exits from the export market, keeping the overall percentage of exporters relatively stable.

Table 5.2 reports summary statistics of the control variables used for propensity score matching (except for productivity, which is presented separately in the following sections),broken down between exporters and non-exporters. The table also reports t-statistics for differences in the means of the variables of interest between exporters and non-exporters. The null hypothesis that there is no difference on average between exporters and non-exporters is always rejected at the 1% level. As expected, exporting firms on average tend to have a higher tangible asset ratio, higher capital intensity, larger size, and older age than non-exporters.

5.4 Empirical methodologies

To investigate the impact of exporting on productivity, I first estimate firm-level TFP, which is the main variable of interest. I then use TFP in the propensity-score matching methodology in combination with difference-in-differences to detect the gain in TFP from exporting.

5.4.1 Productivity estimation

Firm productivity is a crucial variable for detecting the LBE effect. Productivity can be measured roughly as value added per worker or net sales per worker (De Loecker, 2007) but is subject to the factor prices (Syverson, 2011). Conventionally, there are three standard approaches to estimation based on the Cobb-Douglas production function. The basic idea of all three is that (total factor) productivity is the sum of the estimated intercept and residual, reflecting variations in output not explained by inputs.

The first approach uses ordinary least squares (OLS) to estimate TFP from a three-factor Cobb-Douglas regression with the assumption of constant returns to scale. While simple, this approach has two econometric limitations that may bias the estimation of TFP. First, endogeneity is caused by the simultaneity of input decisions and productivity observed by the firm but not by econometricians. Second, selection bias arises when firms exit the sample because of low productivity. To account for both issues, Olley and Pakes (1996; henceforth OP) were the first to

introduce the second approach to estimating TFP, which uses investment as a proxy for unobserved productivity shocks. However, this creates a new problem; firms reporting zero investment must be dropped from the sample. Levinsohn and Petrin (2000; henceforth LP) offer a solution to this zero-investment issue with a third approach that uses intermediate inputs rather than investment as a proxy variable. Because most firms report positive amounts for intermediate inputs, such as materials or electricity, more observations may be retained in the sample with the LP approach. However, the LP approach does not account for selection bias. In their view, the efficiency gains from accounting for selection bias are very small in the context of the unbalanced panel.

Given the large annual exit rate of exporters in our sample, I am reluctant to use LP, which does not account for survival probability. Instead, I adopt the OP method to estimate firm-level TFP (henceforth TFP-OP) to control for endogeneity and selection bias. OP begins with the Cobb-Douglas production function:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_a a_{it} + \omega_{it} + e_{it} \quad (5.1)$$

where logarithmic value added y_{it}(output) is produced by the combined logarithmicinputs of capital stock k_{it}, labourl_{it}, and materials m_{it},; agea_{it}; and productivity ω_{it}. The error term,ϵ_{it}, reflects unobservable shocks and measurement error,is not correlated to input choices, and is independent and identically distributed. Both ω_{it} and $\epsilon_{it}$are unobservable by econometricians, but ω_{it} is supposed to be knowable by firms. Its value affects a firm's input choices, which raises the problem of simultaneity and leads to biased estimates of the coefficients in equation 5.1 when using OLS estimation. OP addressed the issue of simultaneity by using investment as a proxy for shocks, conditional on state variables. They show that investment monotonically increases in ω_{it} and can be expressed as a function of the capital stock k_{it}, productivityω_{it}, and agea_{it}as follows:

$$i_{it} = h_1(\omega_{it}, k_{it}, a_{it}) \qquad (5.2)$$

Pakes (1994, theorem 27) proves that (2) strictly increases in ω_{it} with positive investment, so equation 5.2 can be inverted to reveal ω_{it}:

$$\omega_{it} = h_1^{-1}(i_{it}, k_{it}, a_{it}) \qquad (5.3)$$

equation 5.3 allows us to calculate the unobserved productivity as a function of observed variables, which makes ω_{it}estimable. Defining the function $h_2(.)$ as$\beta_0 + \beta_k k_{it} + \beta_a a_{it}$ $+h_1^{-1}(i_{it}, k_{it}, a_{it})$, the production function can be rewritten as:

$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + h_2(.) + e_{it} \qquad (5.4)$$

In the first step, I estimate $h_2(.)$ using a second-order polynomial series in investment and capital and obtain consistent estimates of β_l and β_m.

In the second step, to address selection bias, I estimate survival probability χ_{it} at time t, which is determined by the probability that productivity at time t is greater than a survival threshold $\underline{\omega_{it-1}}$.

$$\chi_{it} = \begin{cases} 1 \; if \, \omega_{it-1} \geq \underline{\omega_{it-1}}(i_{it-1}, k_{it-1}, a_{it-1}) \\ 0 \end{cases} \qquad (5.5)$$

I estimate (5.5) using probit in a second-order polynomial of i_{it}, k_{it}, a_{it}.

In the third step, I estimate the coefficients of the capital stock k and age a, controlling for possible sample-selection bias resulting from less productive firms exiting the market (and therefore the sample). Current productivity is assumed to follow a Markov process, that is, productivity at time t includes expected productivity at time *t-1*:

$$\omega_{it} = g(\omega_{it-1}) + \xi_{it} \qquad (5.6)$$

Where $\omega_{it-1} = \widehat{h_2}(i_{it-1}, k_{it-1}, a_{it-1}) - \beta_k k_{it-1} - \beta_a a_{it-1}$and g(.) is the second-order polynomial.

$$y_{it} - \widehat{\beta_l} l_{it} - \widehat{\beta_m} m_{it} = \beta_k k_{it} + \beta_a a_{it} + g\big(\widehat{(h_2}(i_{it-1}, k_{it-1}, a_{it-1}) - \beta_k k_{it-1} - \beta_a a_{it-1}\big), \chi_{it}) + \epsilon_{it} \qquad (5.7)$$

I estimate (5.7) by non-linear least squares. Finally, TFP is computed as $\widehat{\omega}_{it} = y_{it} - (\hat{\beta}_l l_{it} + \beta mmit + \beta kkit + \beta aait)$.

While I use TFP-OP in the main text, I also adopt other TFP estimation approaches as alternative methods to check robustness. First, I use the LP method (henceforth TFP-LP).[61]Next, De Loecker (2013) modified the method to estimate TFP by incorporating lagged export status into the

[61] I use STATA's levpet command to implement estimation of firm-level TFP. For the technical details of the levpet estimation procedure, please refer to Petrin et al. (2004).

investment equation. I also estimate TFP following De Loecker (2013; henceforth TFP-ESS). Appendix A 5.3 contains the details of these alternative methodologies.

Table 5.3: TFP difference between exporters and non-exporters

	2010	2011	2012	2013	2014	2010-2014
TFP-OP						
Non-exporter	1.66	1.77	1.86	2.16	1.91	1.91
Exporters	1.78	1.98	1.95	2.19	2.01	2.02
Different	0.12	0.21	0.08	0.03	0.10	0.11
t-test	-6.54***	-17.24***	-7.18***	-3.34***	-9.29***	-20.22***
TFP-ESS						
Non-exporter	1.69	1.80	1.90	2.20	1.94	1.94
Exporters	1.81	2.01	1.97	2.22	2.03	2.05
Different	0.11	0.21	0.07	0.02	0.09	0.10
t-test	-6.11***	-17.08***	-6.30***	-2.50**	-8.58***	-18.89***
TFP-LP						
Non-exporter	3.70	3.59	3.65	3.89	3.66	3.71
Exporters	4.19	4.33	4.32	4.49	4.34	4.36
Different	0.49	0.73	0.67	0.60	0.68	0.65
t-test	-21.52***	-49.87***	-55.83***	-57.99***	-62.71***	-0.65***

Note: TFP-OP, TFP-ESS, TFP-LP are the logarithm of TFP estimated by the methodologies suggested by Olley and Pakes (1996) (OP), by the OP method using export status as a control variable (De Loecker, 2013), and by Levinsohn and Petrin (2003) (LP), respectively. Non-exporters are firms with zero export status. Exporters are firms with positive export status. Mean values of TFP are reported by export status and by year. t-test is the t-statistics of the mean equality test between exporters and non-exporters. Significance levels: *10%,**5%,***1%.

Following Yasar et al. (2008), our analysis uses the following variables in the TFP calculation. Value added, *y*, is measured as net sales minus materials. Labour, *l*, is the amount of labour. Capital, *k*, is the cost of tangible assets. Intermediate inputs, materials, *m*, is equal to cost of goods sold, plus administrative and selling expenses, minus depreciation and total wages. Investment, *i*, is calculated as the change in capital plus depreciation.[62]To capture TFP in real terms, I deflate the above variables using appropriate deflators. Following Imrohoroglu and Tuzel (2014), I adopt the GDP deflator for value added and the price deflator for inputs. Data on input

[62] In our dataset, only a small set of firms have to report investment. To avoid the loss of many observations, and following Pavcnik (2002), Van Beveren (2012), and Imrohoroglu and Tüzel (2014),I construct investment for the missing observations by adopting the law of motion of capital, $k_{it+1} = (1 - \delta_{it})k_{it} + i_{it}$, where k_{it},δ_{it}, and i_{it} are the capital stock, depreciation rate, and investment in year t, respectively.

and output deflators are taken from World Development Indicator. All variables for the TFP calculation are expressed logarithmically (see table A5.4 in the Appendix 5 or summary statistics of the variables used to estimate TFP).

Table 5.3 reports the difference-in-difference in TFP between exporters and non-exporters for each year and for the full (not matched) sample.. Throughout years in the sample, firms that export always have higher have higher productivity than firms that do not, and t-tests indicate that these differences are always statistically significant. Using the alternative TFP measures TFP-ESS and TFP-LP confirms this productivity premium of exporters over non-exporters. The estimated productivity difference is relatively high when using TFP-LP, perhaps because the method does not account for survival probability. The next section formalizes the relationship between exporting and productivity to detect productivity gains due to exporting.

5.4.2 Propensity score matching and difference-in-differences analysis

The results from Table 5.3 in Section 5.4.1 shows that firms that export are significantly different on average from firms that do not export in terms of productivity.[63]However, potential selection bias makes it difficult to assess whether differences in productivity between exporters and non-exporters are driven by the decision to participate in exporting or by learning from exporting. Clearly, it is impossible to observe the productivity of exporters in the counterfactual case: had they not engaged in exporting to begin with. Propensity score matching is one approach to adjust for selection bias. The basic idea is to find firms in the large group of non-exporters which are similar to firms which start to export in terms of a set of observable characteristics, *X*. The difference-in-differences method can then detect the impact of exporting on productivity.[64]

To start, I rescale the time period such that a firm starts exporting at *s*=0. Following De Loecker (2007), I create a dummy $START_{i,t}$whichtakes the value of 1 if firm *i* starts to export in year *t* and 0 otherwise. I denote w_{is}^{1}as the productivity of firm *i* at time s when firm *i* successfully enters the export market at time *s*=0 for$s \geq 0$.$w_{is}^{0}$is the productivity had firm *i* not started exporting at time*s*=0 for$s \geq 0$. The gain from exporting at time *s* is then:

[63]See also Bernard and Jensen (1999) and Greenaway and Yu (2004).

[64]Literature that uses a combination of these two methodologies includes, among others, Dai and Yu (2013); Girma, Greenaway, and Kneller (2004);and Wagner (2002).

$$w_{is}^{1} - w_{is}^{0} \qquad (5.8)$$

I observew_{is}^{1} but not w_{is}^{0}, asthe latteris a counterfactual. Therefore, I construct a control group which includes one or more firms with similar characteristics in year *s*=−1 but which did not start exporting at year *s*=0. Equation 5.8 then becomes:

$$E\{w_{is}^{1}|START_{i,0} = 1, X_{i,-1}\} - E\{w_{is}^{0}|START_{i,0} = 0, X_{i,-1}\}, s \geq 0 \qquad (5.9)$$

$X_{i,-1}$is a vector of observable characteristics of firm *i* one year before starting to export. Following Greenaway and Kneller (2007) and Rosenbaum and Rubin (1983b), I use the method of propensity score matching, which reduces the dimensionality problem by using the probability of receiving treatment conditional on the multidimensional vector $X_{i,-1}$.

Next, I estimate the probability of starting to export (or "propensity score") using a probit model. The probability of starting to export in year *s*=0 is a function of a firm's characteristics in the year before it starts to export, along with full sets of industry and year dummies.

$$\mathrm{P}(START_{i,0} = 1) = F(X_{i,-1}, D_{i,0})((X_{i,-1}, D_{i,0}) \qquad (5.10)$$

$D_{i,0}$comprisesfull sets of industry and year dummies, andX_{it-1} includes the one-year lags of the firm's age, size, productivity, capital intensity, and borrowing constraints.[65]Firm age, size, and capital intensity have often been found to be important determinants of firm's export decisions (Aw and Hwang,1994; Bernard and Jensen, 1999). Productivity is the crucial determinant, as only the most productive firms are able to export profitably (Melitz, 2003). Borrowing constraints have recently been introduced into the trade literature as another dimension of firm heterogeneity in trade (Channey, 2005; Manova, 2013; Muuls, 2015; Duong,2019). I use the tangible asset ratio as an appropriate proxy for borrowing constraints, measuring the extent to which firms are limited in their external borrowing.

Estimating equation 5.10 yields the predicted probability of becoming an exporter at time *t* for firm *i*. In the next step, I match those firms that actually started to export in year *s* (i.e., the treatment group) with those firms that were closest to them in terms of the probability of becoming exporters but did not export (i.e., the control group). For this matching, I adopt the one-

[65]Only variables that are unaffected by participation in export should be included, namely time-invariant and ex-ante (lagged) firms' observable characteristics. See also Caliendo and Kopeinig (2008).

one and five-one nearest neighbours with replacement techniques.[66] For one-one nearest-neighbour matching, for each firm in the treatment group, I search the control group for the firm with the closest propensity score. The five-nearest-neighbour matching is similar to the one-one method, except that five firms are selected in the control group. Note that the match is always performed at s=0 (at the time a firm starts to export) based on the characteristics at time s=−1.

I also check the validity of the matching by performing the Balancing Test (also known as the "Independence Assumption"), which requires that the first moments of the covariates do not differ between the treatment and control groups (i.e., test that $START_{i,0} \perp X_{i,-1}|p(X_{i,-1})$).

After obtaining a sample of matched pairs, I follow De Loecker (2007) to compare the productivity differences between the treatment and control groups using the difference-in-differences method. In detail, I estimate the LBE effect for each period s>=0, as follows:

$$\beta_{LBE}^{s} = \frac{1}{N_s}\sum_i \left(w_{is}^{t} - \frac{1}{k}\sum_{j\in C(i)} w_{js}^{c}\right) \qquad (5.11)$$

w_{is}^{t} , w_{js}^{c} are the productivity of the treatment and control firms, respectively. N_s is the number of matched pairs in year s. k is the number of matched controls for each treated firm, equal to one for one-nearest-neighbour matching and five for five-nearest-neighbour matching. *C(i)* is the set of matched controls corresponding to one treated firm. I am also interested in the productivity trajectory of firms after starting to export, so I compute the accumulated treatment effect or accumulated productivity after S years. The accumulated productivity is given by:

$$\beta_{LBEC}^{s} = \frac{1}{N_S}\sum_i \left(\sum_{s=0}^{S} w_{is}^{t} - \frac{1}{k}\sum_{s=0}^{S}\sum_{j\in C(i)} w_{js}^{c}\right) \qquad (5.12)$$

The beta in equation 5.12 estimates the productivity premium that new exporters gather over S years compared to non-exporters.

The learning effects in equations 5.11 and 5.12 are computed based on the estimated levels of productivity, which may be subject to measurement error due to inappropriate data used in the inputs and output of the TFP estimation. I attempt to alleviate this issue by using TFP growth

[66]The "replacement" technique allows untreated observations to be used more than once in matching, while the "without replacement" technique allows each untreated observation to be used only once. Matching with replacement reduces bias and improves matching quality, because the best-matched control (closest resemblance) to the treated set may be used multiple times (Caliendo and Kopeinig, 2008; Stuart, 2010).

rates instead of levels. I compute productivity growth on both a year-to-year basis and a year-to-pre-exporting basis. The learning effect based on productivity growth year-to-year is given by:

$$\beta_{LBEg}^{s} = \frac{1}{N_s}\sum_i \left(g_{is}^{t} - \frac{1}{k}\sum_{j\in C(i)} g_{js}^{c}\right) \qquad (5.13)$$

g_{is}^{t}andg_{js}^{c} are the productivity growth rates in year sfor the treatment and control groups, respectively, calculated as $g_{is}^{t} = (w_{is}^{t} g_{is}^{t} = (w_{is}^{t} - w_{is-1}^{t})/w_{is-1}^{t}$ and $g_{is}^{c} = (w_{js}^{c} g_{is}^{c} = (w_{js}^{c} - w_{js-1}^{c})/w_{js-1}^{c}$. Productivity growth year-to-pre-exporting is estimated similarly to equation 5.13, except that w_{is-1}^{t} and w_{js-1}^{c} become $w_{i,-1}^{t}$and $w_{j,-1}^{c}$, respectively.

5.5 Empirical results

In this section, I first estimate the probability of starting to export according to equation 5.10. After obtaining propensity scores, I begin to match firms with the nearest propensity scores. Once the matched pairs are identified, I estimate the learning effect using equations 5.11 to 5.13. This section concludes by testing the robustness of the results.

5.5.1 Propensity score matching

As a first step, I model firms export decisions using a probit model of the binary decision outcome, with the set of observable firm characteristics as explanatory variables. All explanatory variables (except for industry and year dummies) are lagged one year and thus pertain to the pre-exporting year. The results of this estimation, calculated with equation 5.10,arepresented in Table 5.4 and indicate that the probability to export is strongly affected by firm characteristics. The model suggests that a higher level of productivity increases the probability that a firm starts to export. The coefficient on TFP-OP is positive and significant at the 1% level. Furthermore, I find that borrowing constraints enter significantly; the higher the tangible asset ratio, the more likely a firm is to start exporting. Interpret this as a sign that a firm with lower borrowing constraints and easier access to funding is more likely to enter the export market. I also find that less capital-intensive, larger, and older firms are associated with a higher probability of joining the export market. All coefficients have the theoretically expected sign, except for the negative effect of capital intensity. At this point, a satisfactory explanation for this discrepancy is lacking.

The above results highlight the selection bias that must be considered in analyzing the learning effect from exporting. Firms that start exporting on average are different before they join export markets than firms that stay in domestic markets in terms of productivity, borrowing constraints, capital intensity, and size. To correctly assess the size and significance of the LBE effect, such differences must be accounted for using propensity-score matching (Caliendo and Kopeinig, 2008).

I next use the estimates in Table 5.4 to calculate propensity scores for each firm in the sample. I restrict the sample to firms with at least two consecutive observations regarding export status. I then use these propensity scores to create a control group based on the nearest-neighbour matching algorithms, with replacement.[67]I use the Balancing Test to assess how well the propensity-score matching performs.

Table 5.5 reports the results of the Balancing Test, which tests whether the matching procedure succeeds in removing any significant differences between the matched treatment and control groups in terms of their characteristics. Panel A displays the results using one-nearest-neighbour matching, and Panel B displays the same using five-nearest-neighbour matching. Column (1) shows the mean values of the variables in the vector *X* used to estimate the propensity scores for the treatment group.68 Columns (2) and (6) display the same for the unmatched control group.[69]Columns (3) and (7) report the t-test statistics for the differences in the means between the treatment and unmatched control groups. The null hypothesis that there is no difference on average between the treatment and unmatched control firms is always rejected at the 1% level (with the single exception of *Capital intensity*, for which the null hypothesis is rejected at the 10% level). These significant differences between treated (exporting) firms and unmatched control firms highlight the importance of selection bias; these differences must be accounted for before calculating the learning effect of exporting.

Columns (4) and (8) display the mean values for the control variables in the vector *X* for the matched control firms. The t-test statistics concerning significant differences in variables between

[67]Estimates are performed using the Stata module psmatch2 (Leuven and Sianesi, 2003).

[68]The mean values of the variables in the vector $X_{i,-1}$of the treatment group are identical in both one- and five-nearest-neighbour matching.

[69]The unmatched control group includes all non-exporters, including those which are not used as matches.

Table 5.4: First-stage probit regression results used to calculate propensity scores.

TFP-OP	0.039***
	(0.01)
Tangible asset ratio	1.067***
	(0.06)
Capital intensity	-0.189***
	(0.01)
Age	0.076***
	(0.01)
Size	0.420***
	(0.01)
Constant	-4.963***
	(0.30)
No.Obs	102,485
pseudo-R-squared	0.174
PSM	0.041

Note: TFP-OP is the logarithm of TFP calculated by the OP method. Tangible asset ratio is the ratio between tangible asset and total assets. Capital intensity is the ratio between net fixed assets and labour. Size refers to total assets (in million Viet Nam dong), and age to the firm's age in years. PSM (propensity score) indicates the predicted average probability of start exporting. All estimations include year and industry dummies. Standard errors are into parentheses. All regressors, apart from the fixed effects, are lagged one year. Significance levels: *10%,**5%,***1%.

Table 5.5: Matching results using nearest neighbor matching

	Panel A: One nearest neighbor					Panel B: Five nearest neighbor			
	Mean: treated group	Mean: unmatched control	*t*-stat	Mean: matched control	*t*-stat	Mean: unmatched control	*t*-stat	Mean: matched control	*t*-stat
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TFP-OP	1.97	1.94	-2.75***	1.99	1.27	1.94	-2.70***	1.97	0.01
Tangible asset ratio	0.22	0.20	-8.72***	0.22	-0.52	0.19	-9.63***	0.21	-1.92***
Capital intensity	4.25	4.20	-1.87*	4.25	-0.01	4.20	-1.98**	4.22	-0.91
Size	9.66	8.48	-55.35***	9.62	-1.22	8.36	-64.06***	9.46	-8.09***
Age	1.66	1.38	-21.21***	1.65	-0.67	1.34	-23.57***	1.62	-3.02***
Number of obs	3,301	77,262		3,020		67,929		12,353	

Note: TFP-OP is the logarithm of TFP calculated by the OP method. Tangible asset ratio is the ratio between tangible asset and total assets. Capital intensity is the logarithm of Net fixed asset/Labour. Size is the logarithm of total assets. Age is the logarithm of firm's age. All variables are one year lagged. t-test is the t-statistics of the mean equality test. Significance levels: *10%,**5%,***1%.

the treatment and the matched controls are shown in columns (5) and (9), respectively. The matching strategies using one nearest neighbor remove significant differences between the treatment and control groups. In contrast, five-nearest-neighbour matching retains significant differences between the treatment and the matched control groups for all variables except for *TFP-OP* and *Capital intensity*. The insignificance of the t-statistic may be attributed to the increase in sample size.

To conclude, the matching strategy using one nearest neighbour successfully removes the pre-exporting differences between export starters and non-exporters as measured by the variables in the vector *X*. Because the matching strategy using one-nearest neighbor performs better than the five-nearest-neighbour algorithm, I use this matching strategy for further analysis.

5.5.2 Difference-in-differences

After identifying the matched pairs, I test for the impact of exporting on productivity by comparing the productivity of firms that start exporting (the treatment) with control firms matched using the one-nearest-neighbour algorithm. I test for differences in productivity up to three years after they start to export, as calculated by equations 5.11-5.13, and present the results in Table 5.6.[70] I report the effect of learning on productivity level in row (a), the cumulative effect of learning on productivity level in row (b),the effect of learning on year-to-year productivity growth in row (c), and the effect of learning on productivity growth relative to the base year −1 in row (d). Note that the number of matched firms decreases with an extended time horizon.

Once firms start exporting, their TFP-OP diverges quickly from that of their non-exporting controls. The productivity premium is positive and statistically significant at the 5% level, not only in the year a firm starts to export but also in the following year. For example, the results in row (a)suggest that starting to export may lead to a productivity gap of 6.5% in the starting year.

This gap peaks at7.3% in the first year after starting to export, decreasing to 4.5% and5.0% in the next two years, where it becomes insignificant. The drop in the productivity premium in the second and third years may be caused by the narrowing of knowledge and technology gaps over

[70]Our dataset ranges from 2009 to 2014, but export status is missing for 2009. Therefore, the earliest year a firm is recognized as starting to export is 2011, which allows tracking firm productivity up to three years after starting to export.

Table 5.6: Estimated learning by exporting effect

TFP-OP	s=0	s=1	s=2	s=3
	(1)	(2)	(3)	(4)
(a) LBE (level)	0.065***	0.073**	0.045	0.050
Standard error	(0.016)	(0.027)	(0.032)	(0.058)
No.treated	3301	1345	895	294
(b) LBE (cumulative)	0.065***	0.160***	0.146**	0.166
Standard error	(0.016)	(0.044)	(0.070)	(0.160)
No.treated	3301	1345	895	294
(c) LBE growth y-t-y	-0.004	0.048	-0.587	0.060
Standard error	(0.151)	(0.070)	(0.371)	(0.085)
No.treated	3301	1342	773	251
(d) LBE growth y-t-(-1)	-0.004	-0.127	0.072	0.257
Standard error	(0.151)	(0.357)	(0.094)	(0.159)
No.treated	3301	1345	895	294

Note: TFP-OP is the logarithm of TFP calculated by the OP method. Standard errors are into parentheses. Significance levels: *10%,**5%,***1%.

time. Overall, these results suggest that participating in export markets has a significantly positive effect on productivity and that the learning effect mostly concentrates in the first two years of exporting.

Next, to test for the learning effect over longer time periods, I calculate a cumulative treatment effect for years s = 0, 1, 2, and 3.Row (b) displays the cumulative learning effect, which is significant at the 1% level except in year s=3. In detail, firms that started to export become 16% and 14.6% more productive after two and three years of exporting compared to non-exporting firms. The cumulative effect is insignificant in year s=3, which may be attributed to an increase in the standard error.

The productivity premium in the same year as exporting starts (s=0) is potentially due to either prepartions for exporting (at s=-1) or the sale abroad process (at s=0; De Loecker, 2007). Learning by exporting cannot occur at s=-1. Therefore, in order to examine whether the productivity gain at s=0 is due to learning by exporting (through contact with foreign buyers), I estimate productivity growth. The lower part of Table 5.6 displays productivity growth over years. The year-to-year growth is presented in row (c), while estimates of the growth rate

compared to the year before starting to export (s=-1) are presented in row (d). The estimated growth rates are generally either small or have large standard errors and are insignificant, even negative. This evidence suggests that exporters become more productive than non-exporters with respect to their pre-export productivity but do not necessarily grow faster than non-exporters in terms of productivity.

In summary, the learning effects from exporting mostly concentrate in terms of productivity level. Starting to export, that is, significantly increases productivity, but the learning effect is not constant over time. Firms achieve the most learning after two years of exporting, and this effect diminishes thereafter. Moreover, aside from the initial bump in productivity in the first few years of start exporting, new exporters increase their productivity no faster than do non-exporters.

5.5.3 Sensitivity analysis

5.5.3.1 First-stage probit regression

In this section, I check the robustness of our empirical results. First, I test whether the propensity score estimations are sensitive to different TFP measurements (TFP-LP and TFP-ESS instead of TFP-OP). Second, I test the sensitivity of the matching quality to using TFP-ESS or TFP-LP instead of TFP-OP. Last, I test if the learning effect is sensitive to TFP measurement method.

The propensity score used to identify the matched firms, derived from the estimation in equation 5.10, may be sensitive to the variables included in the vector $X_{i,-1}$.Here, Itest if the estimated probability of starting to export is sensitive to the use of TFP-ESS or TFP-LP instead of TFP-OP.[71] Table 5.7 presents the results. Column (1) displays the baseline result, which is identical to Table 5.4. Columns (2) and (3) repeat column (1) using TFP-ESS and TFP-LP, respectively, instead of TFP-OP. The bottom of Table 5.7 shows the average propensity score for starting to export for each specification.

To begin, I test for any impact of alternative TFP measures. The estimates using TFP-ESS are very similar to the base case in terms of significance level, sign and magnitude of coefficients and the explanatory power of the model. The estimates using TFP-LP are also similar to the base case in terms of significance level and sign of coefficients. The productivity coefficient is higher for

[71]Current literature sometimes uses the debt ratio instead of the tangible asset ratio as an alternative proxy for borrowing constraints. Unreported results show that both productivity and the debt ratio become insignificant in the probit estimation. This is due to non-linearities in the debt effect, as Duong et al. (2019) reported.

TFP-LP than the other TFP measures. This specification has a substantially larger number of observations (fewer missing observations) than the base case.[72] Although the explanatory power of the TFP-LP specification is higher than that of the base case, the average propensity score is lower.

Table 5.7: Robustness check: First-stage probit regression results used to calculate propensity scores.

	(1)	(2)	(3)
TFP-OP	0.039***		
	(0.01)		
TFP-ESS		0.038***	
		(0.01)	
TFP-LP			0.138***
			(0.01)
Tangible asset ratio	1.067***	1.067***	1.140***
	(0.06)	(0.06)	(0.06)
Cap/Labor	-0.189***	-0.190***	-0.192***
	(0.01)	(0.01)	(0.01)
Age	0.076***	0.076***	0.088***
	(0.01)	(0.01)	(0.01)
Size	0.420***	0.421***	0.382***
	(0.01)	(0.01)	(0.01)
Constant	-4.963***	-4.962***	-5.191***
	(0.30)	(0.30)	(0.28)
No.Obs	102,485	102,485	118,893
pseudo-R-squared	0.174	0.174	0.186
PSM	0.041	0.041	0.037

Note: TFP-LP is the logarithm of TFP calculated by LP method. TFP-OP is the logarithm of TFP calculated by OP method. TFP-ESS is the logarithm of TFP calculated by OP method with modification suggested by De Loecker (2013). Tangible asset ratio is the ratio between tangible asset and total assets. Capital intensity is the ratio between net fixed assets and labour. Size refers to total assets (in million Viet Nam dong), and age to the firm's age in years. PSM (propensity score) indicates the predicted average probability of start exporting. All estimations include year and industry dummies. Standard errors are into parentheses. All regressors, apart from the fixed effects, are lagged one year. Significance levels: *10%,**5%,***1%.

[72]TFP estimates by the LP method have an advantage over other methods in terms of data, because data (non-zero) material costs are available for a larger set of firms.

Overall, the sign and magnitude of all variables across all specifications do not change dramatically. The next section focuses on the sensitivities of the main results to alternative measures of TFP.

5.5.3.2 Matching quality and learning effects

The measure of TFP used in the main analysis is based on the Olley-Pakes approach, which enables us to account for endogeneity and selection bias, as analysed in Section 5.4.1. In this section, I showed that the average propensity score for starting to export remains unchanged when using TFP-ESS but decreased somewhat when using TFP-LP as a proxy for productivity. I further test if the use of TFP-ESS or TFP-LP has any impact on matching quality and, therefore, the identified learning effect. This section thus repeats the main analysis presented in Tables 5.5 and 5.6 using TFP-ESS or TFP-LP instead of TFP-OP.

To begin, I check the matching quality when using TFP-ESS and TFP-LP, with results presented in Tables 5.8 and 5.9, respectively. The matching quality with TFP-ESS is very similar to the base case (Table 5.5). With TFP-LP, the match quality is weaker than the benchmark results (again, Table 5.5) in terms of significance. The null hypothesis that there is no difference between the treatment and control groups is rejected at the 5% level for most control variables when using TFP-LP. However, using TFP-LP adds 159 firms to the treatment sample.

Next, I estimate the learning effect using alternative measurements of TFP. The results using TFP-ESS and TFP-LP are presented in Tables 5.10 and5.11, respectively. Using TFP-ESS, the learning effects in most years are roughly similar to the key results reported above but are larger in magnitude and somewhat more significant. Introducing export status as a state variable in the TFP-OP estimation leads to a higher estimated productivity gain. Notably, De Loecker (2007),in estimating the learning effect for Slovenia, also finds higher estimated learning effects using TFP-ESS as compared to TFP-OP.

Table 5.11 reports the results when using TFP-LP. The learning effects are larger than in the base case(TFP-OP) and are strongly significant. For example, using one-nearest-neighbour matching shows that firms that start to export experience a productivity premium of 17.2% in both the starting year and the first year compared to the firms that do not. The cumulative learning effect is 36.5% in the first year and reaches77.1% after four years of exporting. The magnitude of the learning effect estimated using TFP-LP is larger potentially because the LP method estimates

larger TFP than do the other methods (see Table 5.3). As shown in the lower part of Table 5.11,there is also evidence using the TFP-LP method of a faster growth rate in productivity for new exporters compared to non-exporters, albeit only in the starting year. Moreover, productivity growth compared to the year before starting to export (s= −1) is positive and significant at the 1% level for the first three years of exporting.

Tying it all together, the results indicate that, after controlling for selection bias caused by the exit of less productive firms from and the selection of highly productive firms into exporting, starting to export can have a significantly positive effect on productivity. This effect concentrates in the first two to three years of exporting, thereafter becoming small and insignificant. These results are robust across different methods of measuring TFP. There is little evidence that exporters grow their productivity faster than do non-exporters.

5.6 Conclusion

Much empirical literature has assessed the learning-by-exporting effect or, to a narrower extent, productivity gains from exporting. Implicit in this analysis is the assumption that exporters learn through competition with sellers and interaction with buyers in the international market. Selection bias is the main challenge in estimating such an effect; that is, firms that start to export differ from firms that do not. Less productive firms stop exporting, and highly productive firms self-select into exporting. This paper accounts for selection bias by applying proper methods of measuring productivity and using a propensity score methodology with nearest-neighbour matching. In particular, I obtain TFP estimates that are free from endogeneity and selection bias by using the methodology of Olley and Pakes (1996). I further explore the potential role of previous export status on productivity by following De Loecker (2013). I also use the TFP measurement of Levisohn and Petrin (2003) that uses intermediate inputs instead of investment as a proxy for productivity. After obtaining the TFP estimates, I apply propensity-score matching using the nearest-neighbour matching method to correct for selection bias. This method selects a control group of non-exporting firms whose probabilities of starting to export are closest to those of the exporting firms. The productivity of this control group is used as a counterfactual for that of the treatment (exporters) group in the absence of an export decision. Then, I use the difference-in-differences approach to examine the impact of exporting on productivity.

The results indicate that firms do learn from exporting. Firms beginning to export display significant productivity improvements that are visible not only when the firm starts to export but also in the following year. Firms learn the most within the first few years of exporting. Although exporters display a higher level of productivity in comparison to non-exporters, their productivity does not necessarily grow faster over time.

These results should be interpreted with caution. Data limitations restrict the analysis to only capture learning effects for up to three years after firms start exporting. Consequently, whether the learning effect decreases after the third year remains unclear. Furthermore, the analysis does not extend to the possible causes or factors changing the size of the productivity premium, whether these may be export intensity, export destination, or firms 'absorptive capacity for technology.

These results have important implications. Much of the recent policy debate on strategies of export-led growth has questioned the effectiveness of export-oriented policy on firm productivity. This paper suggests that exporting can positively improve firm-level productivity and hence drive aggregate productivity.

Table 5.8: Robustness check: Matching results using nearest neighbour matching- TFP-ESS

	Panel A: One nearest neighbor					Panel B: Five nearest neighbor			
	Mean: treated group	Mean: unmatched control	*t*-stat	Mean: matched control	*t*-stat	Mean: unmatched control	*t*-stat	Mean: matched control	*t*-stat
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TFP-ESS	2.00	1.98	-2.05*	1.99	-0.58	1.98	-1.95*	2.00	-0.52
Tangible asset ratio	0.22	0.20	-8.70***	0.22	-0.79	0.19	-9.90***	0.21	-1.84*
Capital /labor	4.25	4.21	-1.82*	4.22	-0.77	4.20	-2.14*	4.22	-0.92
Size	9.66	8.49	-55.30***	9.60	-1.71*	8.36	-64.10***	9.46	-7.94***
Age	1.66	1.38	-21.18***	1.64	-1.17	1.35	-23.40***	1.61	-3.39***
Number of obs	3,301	77,271		3,011		67,996		12,286	

Note: TFP-ESS is the logarithm of TFP calculated by the OP method using export status as a control variable (De Loecker, 2013)..Tangible asset ratio is the ratio between tangible asset and total assets. Cap/Labor is the logarithm of Net fixed asset/Labour. Size is the logarithm of total assets. Age is the logarithm of firm's age. All variables are one year lagged. Significance levels: *10%,**5%,***1%.

Table 5.9: Robustness check: Matching results using nearest neighbour matching- TFP-LP

	Panel A: One nearest neighbor					Panel B: Five nearest neighbor			
	Mean: treated group	Mean: unmatched control	*t*-stat	Mean: matched control	*t*-stat	Mean: unmatched control	*t*-stat	Mean: matched control	*t*-stat
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TFP-LP	4.28	3.77	-39.38***	4.25	-2.48**	3.73	-43.19***	4.19	-6.89***
Tangible asset ratio	0.22	0.19	-10.00**	0.22	-0.69	0.19	-10.99***	0.21	-1.82*
Capital /labor	4.27	4.25	-0.86	4.23	-1.03	4.25	-0.96	4.26	-0.34
Size	9.66	8.40	-60.74***	9.60	-1.87*	8.29	-69.39***	9.45	-8.81***
Age	1.66	1.34	-24.29***	1.65	-0.73	1.31	-26.62***	1.62	-3.14***
Number of obs	3,460	95,842		3,147		86,141		12,848	

Note: TFP-LP is the logarithm of TFP calculated by LP method. Tangible asset ratio is the ratio between tangible asset and total assets. Capital/labor is the logarithm of Net fixed asset/Labour. Size is the logarithm of total assets. Age is the logarithm of firm's age. All variables are one year lagged. Significance levels: *10%,**5%,***1%.

Table 5.10: Robustness check: Estimated learning by exporting effect-TFP-ESS

TFP-ESS	s=0	s=1	s=2	s=3
	(1)	(2)	(3)	(4)
(a) LBE (level)	0.071***	0.078***	0.113***	-0.021
Standard error	(0.016)	(0.027)	(0.034)	(0.055)
No.treated	3301	1348	861	315
(b) LBE (cumulative)	0.071***	0.150***	0.291***	-0.030
Standard error	(0.016)	(0.043)	(0.069)	(0.150)
No.treated	3301	1348	861	315
(c) LBE growth y-t-y	-0.141	0.016	0.503	0.417**
Standard error	(0.105)	(0.050)	(0.451)	(0.209)
No.treated	3301	1341	738	267
(d) LBE growth y-t-(-1)	-0.141	-0.032	0.044	0.217
Standard error	(0.105)	(0.136)	(0.166)	(0.361)
No.treated	3301	1348	861	315

Note: TFP-ESS is the logarithm of TFP calculated by the OP method using export status as a control variable (De Loecker, 2013). Standard errors are into parentheses. Significance levels: *10%,**5%,***1%.

Table 5.11: :Robustness check: Estimated learning by exporting effect-TFP-LP

TFP-LP	s=0	s=1	s=2	s=3
	(1)	(2)	(3)	(4)
(a) LBE (level)	0.172***	0.172***	0.167***	0.198***
Standard error	(0.017)	(0.029)	(0.033)	(0.061)
No.treated	3460	1499	977	360
(b) LBE (cumulative)	0.172***	0.365***	0.495***	0.771***
Standard error	(0.017)	(0.047)	(0.073)	(0.147)
No.treated	3460	1499	977	360
(c) LBE growth y-t-y	0.058***	-0.007	-0.066	-0.028
Standard error	(0.013)	(0.013)	(0.072)	(0.034)
No.treated	3460	1491	852	317
(d) LBE growth y-t-(-1)	0.058***	0.044***	0.047***	0.016
Standard error	(0.013)	(0.013)	(0.017)	(0.020)
No.treated	3460	1499	977	360

Note: TFP-LP is the logarithm of TFP calculated by the LP method. Standard errors are into parentheses. Significance levels: *10%,**5%,***1%.

Appendix 5

Table A5.1. Export status before and after interpolation (before cleaning).

year	ESS		ESS1		ESS2	
	0	1	0	1	0	1
2009	0	0	0	0	0	0
2010	19,742	2,769	19,742	2,769	19,742	2,769
2011	57,331	6,829	57,367	6,829	57,367	6,832
2012	21,806	5,131	49,614	5,131	49,614	6,031
2013	62,451	7,975	62,470	7,975	62,470	7,978
2014	66,168	7,626	66,168	7,626	66,168	7,626
Total	227,498	30,330	255,361	30,330	255,361	31,236

Note: ESS: export status before interpolation. ESS_1: export status after the first interpolation: missing export status is filled for firms with $ESS_{t-1}=ESS_{t+1}=0$ and missing ESS_t. ESS_2: export status after the second interpolation: missing export status is filled for firms with $ESS1_{t-1}=ESS1_{t+1}=1$ and missing $ESS1_t$.

Table A5.2: Variable definitions and measurement

Variable	Definition
TFP	Total Factor Productivity, measured by different techniques, expressed in logarithmic form in regressions.
ESS	Export status, equal to 1 if firm export in that year, 0 otherwise
START	Starting to export dummy, equal to 1 if firm start exporting in that year, 0 otherwise
y	Value added (output), is equal to net sales less materials, deflated by the GDP deflator, expressed in logarithmic form in regression.
l	Labour input, is equal to number of employees, expressed in logarithmic form in regression.
k	Capital, is equal to the cost of tangible assets, deflated by price deflator, expressed in logarithmic form in regressions.
m	Materials, is equal to the costs of goods sold plus administrative and selling expenses minus depreciation and wages, deflated by the price deflator, expressed in logarithmic form in regressions.
i	Investment, is measured as the change in capital plus depreciation, deflated by the price deflator, expressed in logarithmic form in regressions.
Age	Firm's age is defined as number of years since the starting business date, expressed in logarithmic form in regressions.
Size	Total assets, expressed in logarithmic form in regression. Calculated as the average of year t-1 and year t, in millions Viet Nam dong.
Capital intensity	Net fixed assets over labour, expressed in logarithmic form in regressions. Calculated as the average of year t-1 and year t.
Tangible asset ratio	Net tangible assets over total assets. Calculated as the average of year t-1 and year t

A5.3: TFP estimation

TFP-LP

Levinsohn and Petrin (2003) begin by the Cobb-Douglas production function

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + e_{it} \qquad (5.14)$$

wherey_{it},l_{it}, k_{it}, ω_{it} are the logarithm of the value –added, labor, capital, and producitivy, respectively.

LP assumed that the demand for intermediate input, m, is monotonically increasing in ω_{it}, and can be expressed as a function of the capital stock and productivity as follows

$$m_{it} = h_3(\omega_{it}, k_{it})$$

By inverting this equation, unobservable heterogeneity can be represented as a function of two observed inputs

$$\omega_{it} = h_3^{-1}(m_{it}, k_{it}) \qquad (5.15)$$

Following OP, LP also assume that productivity is governed by a first-order Markov process like equation 5.6 in the main text. Equation 5.15 allows us to display the unobserved productivity by a function of observed variables, therefore estimable. Defining the function $h_4(m_{it}, k_{it})$=$\beta_0 + \beta_k k_{it} + \omega_{it}(m_{it}, k_{it})$, the production function can be rewritten as:

$$y_{it} = \beta_l l_{it} + h_4(m_{it}, k_{it}) + e_{it}$$

Using OLS with a third-order polynomial approximation in k_{it} and m_{it} in place of $h_4(.)$, I obtain the estimation of β_l and $h_4(.)$.

$$\widehat{h_4}(.) = \hat{y}_{it} - \widehat{\beta_l} l_{it}$$

For any candidate value of β_k^*, I estimate $\widehat{\omega}_{it}$ using $\widehat{\omega}_{it}$=$\widehat{h_4}(.) - \beta_k^* k_{it}$

The consistent (nonparametric) approximation to $E(\omega_{it}\widehat{|\omega_{it}}_{-1})$is given by the predicted values from the regression$\widehat{\omega}_{it}\widehat{\omega}_{it} = \gamma_0 + \gamma_1\omega_{it-1} + \gamma_2\omega_{it-1}^2 + \gamma_3\omega_{it-1}^3 + \epsilon_{it}$

The sample residual of the production function is $\widehat{e_{it} + \xi_{it}}$=$y_{it} - \widehat{\beta_l} l_{it} - \beta_k^* k_{it} - E(\omega_{it}\widehat{|\omega_{it}}_{-1})$

The estimates of $\widehat{\beta_k}$ is defined as the solution to

$$\min_{\beta_k^*} \sum_{it} (y_{it} - \widehat{\beta}_l l_{it} - \beta_k^* k_{it} - E(\widehat{\omega_{it}|\omega_{it-1}})^2$$

Finally, the TFP-LP is measured by$\widehat{\omega}_{it} = \exp\ (y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it}\ \ )$

TFP-ESS

De Loecker (2013) revises the OP estimation procedure by introducing the current export status (e_{it}) in the estimation to allow for different market structure and factor prices. Equation 5.6 becomes

$$\omega_{it} = g(\omega_{it-1}, e_{it-1}) + \xi_{it}$$

In the first step, the investment function in equation 5.2 become $i_{it} = h_5(\omega_{it}, k_{it}, a_{it}, e_{it})$, hence the productivity function becomes $\omega_{it} = h_5^{-1}(i_{it}, k_{it}, a_{it}, e_{it})$. The estimation in the first step is similar to the TFP-OP estimation. Next, the survival probability is assumed to depend on e_{it}, so equation 5.5 in the main text is estimated using second-order polynomial of i_{it}, k_{it} , $a_{it}$and e_{it}. Similarly, $\widehat{h_2}(i_{it-1}, k_{it-1}, a_{it-1})$ in equation 5.4 becomes $\widehat{h_6}(i_{it-1}, k_{it-1}, a_{it-1}, e_{it-1})$. The rest of the calculation is similar to the TFP-OP.

Table A5.4. Descriptive statistics of variables used in TFP estimation

Variable	Obs	Mean	Std. Dev.	Min	Max
Value added	318,632	1,485	4,130	-749	45,310
Capital stock	318,487	2,119	5,992	0	63,206
Investment	164,780	1,124	2,873	0	30,418
Material	271,591	12,486	36,026	6	377,194
Labor	314,387	28	58	1	557

Note: Value added, capital stock, material, investment are after deflation, in millions Viet Nam dong. Labor is number of people. See table A 5.2 in Appendix 5 for variable definitions.

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Nederlandse samenvatting

Economische integratie is van groot belang voor het succes van hervormingen in overgangseconomieën. Dit proefschrift draagt bij aan de kennis over het economische integratie proces in Oost-Azië, met name Vietnam, en over de gevolgen daarvan voor het vrij verkeer van kapitaal en goederen, en voor de relatie tussen productiviteit en internationale handel. Vietnam is de laatste decennia een steeds grotere rol in de internationale handel gaan spelen, zeker nadat het veel van de bestaande belemmeringen in het grensoverschrijdende financiële verkeer heeft weggenomen. Ondanks de toenemende integratie tussen Vietnam en andere Oost-Aziatische landen, blijft Vietnam in veel opzichten echter nog achter. Meer specifiek onderzoekt dit proefschrift de interactie tussen financieringsmogelijkheden, internationale handel en productiviteit op bedrijfsniveau, met behulp van een uitgebreide database van Vietnamese bedrijven gedurende de periode 2009-2014. De resultaten laten zien dat een beperkte toegang tot externe financiering, in combinatie met een lage productiviteit de deelname aan de export belemmeren. Bovendien worden deze bedrijven productiever door te leren van exporteren. Hieronder volgt een korte samenvatting per hoofdstuk van de belangrijkste resultaten in het proefschrift.

Hoofdstuk 2 geeft een overzicht van het hervormingsproces van de Vietnamese economie en de ontwikkeling van de economische integratie tussen Vietnam en andere Oost-Aziatische landen in recente decennia. Daarin heeft de Vietnamese economie een opmerkelijke groei doorgemaakt. Productiviteitgroei is daarbij de sleutel tot de transitie naar een hoger inkomensniveau. In het hoofdstuk laat ik zien dat ook de intraregionale economische integratie aanzienlijk is toegenomen. Alhoewel de integratie tussen Vietnam en andere Oost-Aziatische landen blijft toenemen, heeft Vietnam de eerdere achterstand nog niet ingelopen.

In hoofdstuk 3 ligt de nadruk op het financiële integratieproces in Oost-Azië. Ik onderzoek de mate en de ontwikkeling van de financiële integratie in Oost-Aziatische landen voor de periode 2002-2018 met behulp van verschillende empirische maatstaven. Ik gebruik aandelenkoersen en –rendementen met dagelijkse frequentie. Omdat de periode de ingrijpende financiële crisis van

2008 omvat, verdeel ik de totale steekproefperiode in drie deelperioden (vóór de crisis, tijdens de crisis en na de crisis).

De analyse laat zien dat de ontwikkeling van financiële integratie geleidelijk verloopt. Bovendien komt de mate van financiële integratie ruwweg overeen met het niveau van economische ontwikkeling. Hoge-inkomenslanden zijn financieel meer geïntegreerd dan lage-inkomenslanden. Japan is de meest geïntegreerde economie, Vietnam de minst geïntegreerde. Niettemin geldt ook voor Vietnam dat de correlatie van aandelenrendementen met een regionale marktindex langzaam toeneemt. Een belangrijk implicatie van de lage marktcorrelatie is dat Vietnam relatief meer kans biedt voor investeerders om te profiteren van diversificatievoordelen.

Hoofdstuk 4 verbindt financiële integratie met handelsintegratie en bestudeert het effect van (restricties op) financiering op internationale handel op bedrijfsniveau. Ik onderzoek in hoeverre de beperkte toegang tot externe financiering, in combinatie met lage productiviteit, invloed heeft op de exportkansen van een bedrijf. Met behulp van een uitgebreide database van Vietnamese bedrijven gedurende de periode 2009-2014, laat ik zien dat kredietbeperkingen inderdaad een belangrijke rol spelen bij de exportbeslissing. Er bestaat een omgekeerd U-vormig verband tussen de schuldquote - *leverage* - en de kans op export voor private ondernemingen. Zowel een erg lage schuldquote, een indicatie voor het geen toegang hebben tot bankwezen of financiële markten, als een erg hoge schuldquote, een indicatie dat de maximale financieringsruimte bereikt is, beperken de kans op exporteren. Het kantelpunt ligt bij een schuldquote van ongeveer 47 procent. Daarvoor is er sprake van een afnemend positief marginaal effect op exporteren, daarna wordt het effect negatief. In de praktijk zijn kredietbeperkingen van belang voor zowel startende exporteurs als bestaande exporteurs. Maar het effect is groter voor de laatste groep. Middelgrote en hoogproductieve bedrijven zijn gevoeliger voor kredietbeperkingen dan laagproductieve bedrijven. De beleidsimplicatie van dit hoofdstuk is duidelijk: het verbeteren van de mogelijkheden voor externe financiering kan private bedrijven helpen om aan de internationale handel deel te gaan nemen.

Hoofdstuk 5 gaat in op het *learning-by-exporting* (LBE) effect. Dit effect veronderstelt dat bedrijven hun productiviteit kunnen verhogen door te gaan exporteren. In de analyse gebruik ik dezelfde dataset als in hoofdstuk 4, die gegevens bevat voor een grote en representatieve groep Vietnamese bedrijven voor de periode 2009-2014. Omdat productiviteit op bedrijfsniveau niet

direct observeerbaar is, maak ik gebruik van de meest recente methoden om en schatting te maken van de bedrijfsproductiviteit. Deze methoden corrigeren ook voor selectie-bias. Vervolgens gebruik ik *propensity score matching* en *difference-in-differences* methoden om het potentiele endogeniteitsprobleem dat alleen productieve bedrijven zullen exporteren te adresseren.

De resultaten laten zien dat het LBE effect significant positief is in de eerste jaren nadat een bedrijf gestart is met exporteren. Deze conclusie is robuust tegen alternatieve schattingsmethoden en verschillende productiviteitsmetingen.

Curriculum Vitae

An Thi Thuy Duong (An) was born in Quang Ngai, Vietnam in 1982. She graduated from Banking University of Ho Chi Minh City in 2004. Then she worked in the financial industry in Vietnam while teaching at Banking University of Ho Chi Minh city. She was awarded a full scholarship from the Korean government for a master study in 2007. She earned the master degree at KDI School of Public policy and Management in South Korea in 2008. During 2008-2013, she worked at the Faculty of Finance at the Banking University of Ho Chi Minh city. In 2012, she was promoted as the head of the Securities markets Department. In 2013, she was nominated for the Nuffic grant to pursue a doctorate at Utrecht University in the Netherlands. She then became a Ph.D. candidate at Utrecht University School of Economics (U.S.E). During 2013-2015, she joined the Research Master's program in Multidisciplinary Economics at U.S.E. She completed her Ph.D. dissertation by the end of 2019. As of January 2020, she works as a lecturer at the Faculty of Finance of Banking University of Ho Chi Minh city. An's main research interests include capital flows, economic integration, trade, and productivity, with emphasis on empirical applications.

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