

**Impacts of Trade Liberalization and Institutions on Labor Market  
and Firm Productivity in Vietnamese Manufacturing**

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## List of Abbreviations

AFTA	ASEAN Free Trade Area
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
CEPT	Common Effective Preferential Tariff
DANIDA	Danish International Development Agency
DCs	Developing Countries
ERP	Effective Rate of Protection
EU	European Union
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GSO	Vietnamese General Statistics Office
IC	Investment Climate
ISO	International Organization for Standardization
MFN	Most Favoured Nation
MUTRAP	Vietnam Multilateral Trade Project
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
QR	Quasi Rents per Workers
R&D	Research and Development
SFA	Stochastic Frontier Analysis
SMEs	Small and medium Enterprises
TE	Technical Efficiency



VCCI	Vietnam Chamber of Commerce and Industry
VND	Vietnam Dong
WTO	World Trade Organization
2SLS	Two Stage Least Squares

# **1 Introduction**

## **1.1 Research Focus**

Vietnam has been a vibrant part of the world economy since opening up in 1986, becoming an official member of the World Trade Organization (WTO) in early 2007. This result is something of a sanction of a long process of trade reform and global integration. Indeed, Vietnam has strongly embarked on the trade liberalization process through involvement in many bilateral and multilateral agreements.

Vietnam's further economic integration simultaneously brings about benefits, opportunities and important challenges. For instance, this episode provides access to markets and helps to develop products in which Vietnam has comparative advantage. However, integration also presents new challenges for domestic industries in terms of facing difficulties in adjusting to the pressure of growing competition.

According to traditional trade theory, Vietnam's international integration may lead to trade expansion, labor market adjustments, accelerated technological innovation, efficiency gains and growth (Ernst, 2005). Furthermore, during the period of being a WTO member candidate, Vietnam had been required to establish a set of norms and institutions supporting the liberalization of markets and promoting the rule of law, contract enforcement and the evolution of an independent judicial system (Dordi et al., 2008). Additionally, implementing the commitments of the WTO can force Vietnam to improve its investment climate, subsequently rendering the predictability, security and transparency of market access for all economic sectors.

This dissertation therefore centers on the following key issues. First, what are the impacts of trade liberalization on employment and wages in Vietnamese manufacturing? Second, what determines productivity in Vietnamese manufacturing: the roles of technology and institutions? Third, what are the constraints of the investment climate on Vietnamese manufacturing technical

efficiency?<sup>1</sup> Towards such purposes, various econometric techniques are applied and different types of datasets used to investigate the impacts of trade liberalization and institutional reforms implemented in Vietnam on manufacturing industries in terms of employment and wage responses and firm productive performance.

## **1.2 Research Structure and Results**

The dissertation is structured as follows: Chapter 2 investigates how labor markets respond to trade liberalization. Chapter 3 considers the impacts of technological and institutional factors on firm productive performance, furthermore emphasizing the importance of the institutional environment in which enterprises operate on firm performance, serving as a gateway for the next chapter. Chapter 4 then analyzes the relationship between the quality of institutions and firm technical efficiency in greater detail, before Chapter 5 summarizes the results and concludes.

Chapter 2 is a joint work with Pham Thi Bich Ngoc and Holger Görg, using panel datasets at industry and firm levels for manufacturing sectors during 2003-2008, from the Vietnamese General Statistics Office (GSO) and Danish International Development Agency (DANIDA)'s small and medium enterprise (SME) surveys. This analysis is expected to provide the first comprehensive evidence on the labor market adjustments to trade liberalization and the distributive impact of this process in Vietnam.

We incorporate the approaches of Revenga (1997) and Ghazali (2011), which allow trade protection variables such as tariffs, quotas on output and inputs, custom duties to imports, and effective rate of protection (ERP) to achieve a direct effect on wages and employment at industry level, and an indirect impact at firm level. Methodologically, we use many types of estimations, the most important method of which applies trade policy variables, i.e. ERP and import penetration, as instruments for the endogenous independent variables, i.e. output and quasi rents. Overall, we find that trade liberalization has a negative effect on employment and wages. The approach on quasi rents further enables us to indicate heterogeneity in bargaining

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<sup>1</sup>The research focuses on manufacturing industries due to the two main reasons. The manufacturing industries contribute the largest share to Vietnam's GDP growth. And different from the other sectors, Vietnamese manufacturing is mostly affected by international integration owing to its export-oriented characteristics.

power across firms by gender and skill composition. A firm with a greater fraction of unskilled (production) or female workers shows a lower ability of workers to capture part of the quasi rents. These findings provide evidence for gender and skill earnings differentials within Vietnamese manufacturing. Furthermore, trade liberalization appears to reduce these earnings gaps, as in line with Ghazali (2011) for the cases of Tunisia. Additionally, trade unions and collective agreements seem to have a role in reducing the skill earning differentials. The analysis is in favor of a flexible model of wage setting that accommodates both the existence of rent sharing behavior and competitive wage determination.

Chapter 3 applies a Cobb-Douglas-type production to examine the impact of technological and institutional factors on firm performance, using firm level cross-section data collected in Vietnam as part of the 2009 World Bank Enterprise Survey. We use the non-parametric measure of productivity – labor productivity, which provides a simple and meaningful means of firm productive performance. Different from the related study of Goedhuys, Janz and Mohnen (2006), we deal with several econometric issues such as the endogeneity problem, heteroscedasticity and multicollinearity of institutional variables.

Using ordinary least squares and quantile regressions, we find that indirect technology factors, rather than R&D activities, have an impact on firm performance. The socio norms and networks of informal, rather than formal, institutions remain important as mechanisms in financing working capital or the investment purposes of private firms. Second, we empirically confirm the paradox of education and training in an emerging economy, providing evidence that an inadequately educated workforce can be considered as an economically and statistically significant obstacle for firm operation. Third, our results support the argument that beside resource- and industry-based views, an institution-based view could be the “third leg” within international business research (Peng, Wang, and Jiang, 2008), and that omitting the institutional environment in which enterprises operate could limit our understanding of factors affecting firm performance.

In chapter 4, we then extend the existing analysis to the constraints of the investment climate (the quality of institutions) on firm technical efficiency (one type of firm productive performance). Using the unique and latest panel dataset from the investment climate surveys of the World Bank in Vietnam in 2005 and 2009, this chapter calculates another measure of firm

productive performance – technical efficiency from a parametric production frontier. Firm level technical efficiency can be defined as the firm productivity gap to the best firms located on the production frontier. Unlike the related study of Kinda, Plane, and Véganzone-Varoudakis (2011), we attempt to deal with the endogeneity bias of investment climate variables by using the region-industry average of the investment climate variables, rather than the crude ones. Moreover, we do not use principle component analysis that generates a few composite indicators of investment climate to tackle the problem of multicollinearity. The approach applied for the selection of the investment climate variables goes from the general to the specific (e.g., Escribano and Guasch, 2005). Starting from a general model with all variables included at once, we then reduce this model to a simple one including relevant (significant) variables. In detail, the less significant variables are eliminated one by one, but ensuring the existence of at least one investment climate variable from each broad category (Infrastructure, Business-Government Relations, Crime and Legal Environment, Finance and Labor) for interpretive purposes.

We estimate the stochastic production frontiers by industry, to discover which sectors have a technical inefficiency component. Subsequently, we consider the impacts of investment climate on these inefficiency sectors, using time-varying inefficiency models. Similar to Kinda, Plane, and Véganzone-Varoudakis (2011), the results provide empirical evidence that the investment climate is significant for firm productive performance. We further indicate that the effect of the investment climate on firm efficiency varies according to firm size, export status and ownership. Additionally, panel data models and the quality of data allow us to investigate the improvement of technical efficiency by industry and the whole Vietnamese manufacturing during the period of deeper integration into the world economy. Methodologically, we show that time-varying inefficiency model for panel data is better than pooling data one-step stochastic frontier analysis in considering the whole manufacturing or industry specific technical efficiency impact of the investment climate, for a particular country. It is also possible to link our empirical work to recent literature placing the investment climate at the center of economic performance (see Kinda, Plane, and Véganzone-Varoudakis, 2011) by providing more specific evidence. Finally, the thesis concludes and offers an outlook for future research developments.

## 2 Trade Liberalization and Labor Market Adjustments

**ABSTRACT.**<sup>2</sup> Using both industry and firm level data sets during the period 2003-2008, this paper provides the first comprehensive investigation of the impact of trade liberalization on employment and wages in Vietnamese manufacturing. Overall, we find empirical evidence that trade liberalization has a negative effect on employment and wages. However, the impact magnitude is modest with a decline within 2.4%-3.5% in real wages and 0.76% and 0.17% reductions in industry and firm employment respectively on average over the period. We further investigate the effects of trade liberalization on gender and skill earning gaps and the role of trade unions by location. The analysis shows that trade liberalization appears to reduce the gender and skill earnings differentials.

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<sup>2</sup>This part is a joint work with Pham Thi Bich Ngoc and Holger Görg.

## 2.1 Introduction

Trade openness has historically gone hand in hand with better economic performance, in both developed and developing economies, creating new opportunities for workers, consumers and firms around the globe through a positive business climate, flexible labor markets, high-quality education and skill training systems (OECD, 2012). Still, once a developing country has opened up to international markets, concerns over employment and wage decline have been posed.

Trade particularly affects employment and wages in several ways. First, trade can increase per capita incomes through output growth, resulting in real average wage increases.<sup>3</sup> Second, increased exports and imports can raise productivity growth, creating higher skill and higher wage jobs.<sup>4</sup> However, trade liberalization may, at least in the short term, put pressure on less competitive industries, triggering unemployment and downward wage trends. Third, skill-biased technological change may increase demand for skilled labor, leading to wage inequality (Feenstra and Hanson, 1997). Fourth, the impact of trade liberalization possibly increases industry wage premium, which reflects industry rents. Furthermore, due to imperfect competition, different levels of rent sharing between firms and workers among industries can cause wage differentials (Ghazali, 2011).

Previous empirical studies have found conflicting results about labor market adjustment to trade liberalization which could manifest itself through increasing imports, exports, and offshoring, or decreasing tariffs and non-tariffs barriers, leading to changes in the effective rate of protection (ERP). For instance, Stone and Cepeda (2011) find that imports have a strong and positive effect on wages in 55 OECD and non-OECD countries, but Ravenga (1997) produces evidence of negative effects of trade reforms on employment and wages in Mexican manufacturing. Goldberg and Pavcnik (2005) find a positive relationship between tariffs and

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<sup>3</sup>The OECD Growth Study estimated that a 10 percentage point increase in trade openness translates over time into an increase of around 4% in per capita income in the OECD area. China and India demonstrate how policies that liberalize trade and investment can contribute to raising incomes in developing countries (OECD, 2012).

<sup>4</sup>Exporters in the United States on average pay wages that are about 6% higher than non-exporters (Bernard et al., 2007)

the industry wage premium. Focusing on the impact on employment, Sakurai (2004) concludes that increased trade negatively impacts employment for the case of Japan. By contrast, Sen (2002) points out that international trade caused positive employment growth in Bangladesh and Kenya. Currie and Harrison (1997) find no impact of trade openness on employment in Morocco.

The specific objective of this study is to investigate how labor markets respond to trade liberalization in Vietnam over the period 2003-2008. We follow and build upon the approach by Revenga (1997) and analyze the link between trade liberalization, employment and wages using empirical models at both the industry and firm level. As in Revenga (1997) we allow trade protection (measured as effective rate of protection and import penetration) to affect wages and employment directly at industry level and indirectly at firm level through changes in output and quasi rents. More specifically, in the firm level analysis, we use trade policy variables, i.e. effective rate of protection (ERP) and import penetration, as instruments for the endogenous independent variables, i.e. output and quasi rents. We use panel datasets at industry and firm levels for manufacturing sectors which come from the Vietnamese General Statistics Office (GSO) and the Danish International Development Agency (DANIDA)'s small and medium enterprise (SME) surveys.

Since opening up to the world economy in 1986, Vietnam has strongly embarked on the trade liberalization process by being involved in many bilateral and multilateral agreements (Japan, China, US, ASEAN, APEC, EU, WTO), reflecting decreasing ERP and increasing import penetration due to tariff reductions. Based on this background, we show a negative impact of trade reforms on wages and employment at both industry and firm levels in Vietnamese manufacturing over the period 2003-2008. Additionally, the paper improves our understanding of trade liberalization effects by taking into account the rent sharing<sup>5</sup> between firms and employees as an adjustment mechanism to face trade policy changes. We find trade-induced decreases in quasi rents which represent a decline in wages.

The approach on quasi rents further allows us to identify heterogeneity in bargaining power across firms by gender and skill composition. A firm with a greater fraction of unskilled

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<sup>5</sup>Martins (2007) define rent sharing as “referring to a situation in which rents are shared by the firm, at least in some part, with the employees of that firm”.



(production) or female workers shows a lower ability of workers to capture part of the quasi rents. This finding provides evidence for gender and skill earning differentials in Vietnamese manufacturing. However, trade liberalization can moderate these gaps as in line with Ghazali (2011) for the case of Tunisia.<sup>6</sup> In addition, trade unions and collective agreements seem to have a role in reducing the skill earning inequality. To the best of our knowledge, these relationships have not been comprehensively investigated for the case of Vietnam.

The structure of this chapter is as follows. Section 2 and 3 respectively provide the literature and some facts on trade liberalization and labor markets. Section 4 presents the data and some preliminary evidence. Section 5 discusses the industry level analysis, while Section 6 presents the firm level results. The final section produces some conclusions.

## **2.2 Literature on Trade Liberalization and Labor Market**

The Heckscher-Ohlin model and its companion Stolper-Samuelson theorem (HO/SS) set up a theoretical background on the labor market effects of trade liberalization whereby trade openness increases the relative returns to abundant factor and lowers that of the scarce factor, expecting increases in wages and reduction in wage inequality. Some recent studies provide support for a HO/SS view of trade (see Friedman et al., 2012; Stone and Cepeda, 2011; Bernard et al., 2007) in contrast to the others which find rising wage gaps in both developed and developing countries (see Gottschalk and Smeeding, 1997; Berman, Bound, and Machin, 1998; Pavcnik, 2003). Growing wage inequality can be explained in part by the change in the structure of labor demand in favor of skilled workers, resulting from skill-biased technological change induced or accelerated by trade liberalization (Acemoglu, 2003). Particularly, the underlying causes of changes in labor demand in developing countries are based on the increase of capital flows and capital assets from developed to developing countries in the era of globalization (Feenstra and Hanson, 1997).

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<sup>6</sup>Ghazali (2011) indicates that trade reforms appear to have reduced wage inequality between skilled and unskilled labor in Tunisia.

Referring to employment adjustments, existing literature have found mixed results.<sup>7</sup> Difference in employment response to trade liberalization possibly depends on firm behavior in lower/higher profit periods or whether labor markets are in short run or long run. Firms can reduce their profit margins rather than adjusted employment or instead, they raise productivity of the existing workforce and efficiency gains can be achieved without firing labor (see Currie and Harrison, 1997; Tybout and Westbrook, 1995). Unemployment could increase in the short run due to external or domestic shocks but decline in the long run with permanent changes in trade liberalization when labor market returns to long-run employment equilibrium (Dutt, Mitra and Ranjan, 2009; Stone and Cepeda, 2011).

From another perspective, trade liberalization can impact wages and employment directly at industry level and indirectly at firm level. A reduction in trade protection that shifts industry product demand will tend to move employment in the same direction (Revena, 1997). Industry wage response in turn depends on wage-setting mechanism. With a competitive setting, wages react to market-clearing rates of labor supply and demand. In contrast, under imperfect competition, because of the presence of unions for instance, wage and employment adjustments could be based on industry wage premium.<sup>8</sup> Industry wage premium channel should be considered in short to medium term horizons where prevent free movements of workers across sectors. The premiums can take the form of industry rents in the trade models that introduce imperfect competition and rent sharing.

Although trade reforms are usually implemented at the industry level, firm-level wage and employment adjustments are expected to vary depending on firm characteristics, for example market power level, capital or labor intensity, or workforce composition. Also, the responses are based on a wage-setting mechanism which presents the bargaining power of workers with

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<sup>7</sup>For example, McMillan and Verduzco (2011) show that employment in manufacturing fell in Latin America, the Middle East and North Africa and in Sub-Saharan Africa but increased in East Asia and Eastern Europe. Exports can contribute to job creation (Heo and Park, 2008; Milner and Wright, 1998; Fu and Balasubramanyam, 2004). Gaston (1998) also shows that exports positively affect employment, but imports cause a negative impact in Australia.

<sup>8</sup>Goldberg and Pavcnik (2005) define it as the portion of individual wages that cannot explained by worker, firm, or job characteristics, but can be explained by the worker's industry affiliation.

the presence of unions or collective agreements. Revenga (1997) produces the results that many of the rents generated by trade protection were absorbed by workers in the form of a wage premium in Mexican manufacturing. Trade liberalization reduced the rents available to be captured by firms and workers. Ghazali (2011), following the approach of Revenga (1997) for the case of Tunisia, documents that the quasi rents reduction, which is one of the adjustment mechanisms used by Tunisian firms to face trade openness, reduces wage inequality as skilled labor was more able than unskilled labor to capture rents before trade reforms.

In regards to the role of union in dealing with the rent sharing, higher rates of unionization as well as higher coverage and coordination of collective bargaining have been found to be associated with higher wages, lower levels of income inequality and wage disparity, a lower gap between the wages of skilled and unskilled workers as well as a lower gap between men and women (Friedman et al. 2012; Aidt and Tzannatos, 2002; Hayter and Weinberg, 2011). On the contrary, Reinecke and Valenzuela (2011) argue that the potential role of unions and collective bargaining in improving the distribution of wages has been used in a very limited manner in Chile.

Meanwhile, rent sharing can reduce employment fluctuations to trade openness due to the presence of unions. Revenga (1997) shows that organized labor is important in Mexico. The restrictive labor market regulations in this country make it difficult and expensive to fire a worker. The author confirms that if wages contain a rent component, workers can be willing to trade off wages to preserve jobs. In contrast, Krugman (1996) argues that in countries with rigid wage setting institutions, trade may perhaps have larger effects on employment than wages. Görg and Görlich (2011) point out adjustments through employment levels in Germany as wage setting arrangements in this country was a high degree of inflexibility, which is done by large unions at the sectoral level.

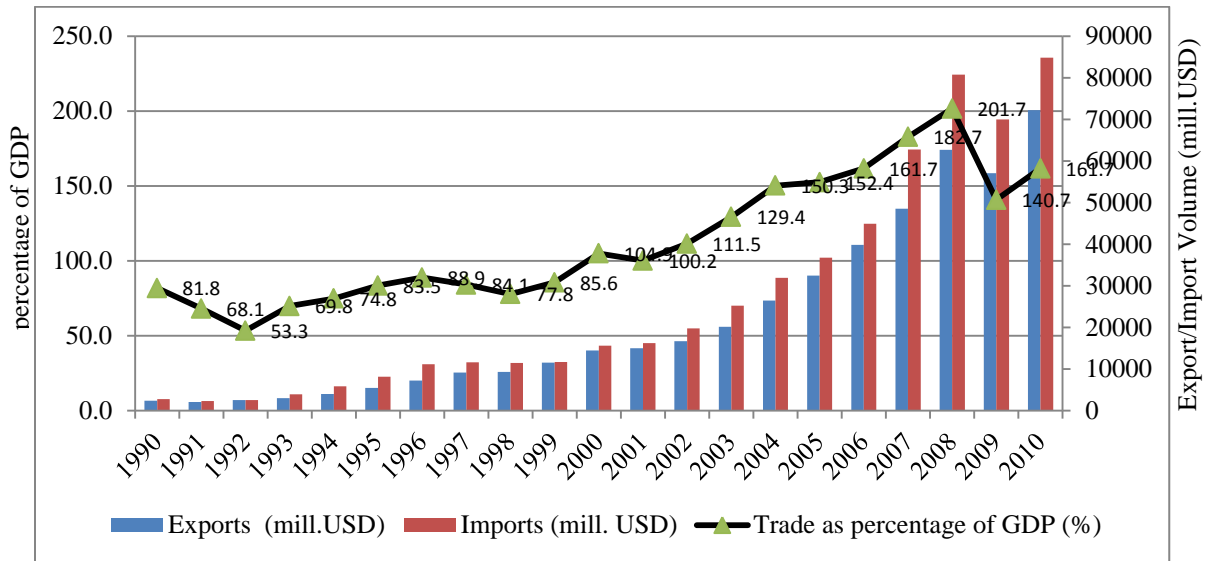
## **2.3 Labor Market in Vietnam under Trade Liberalization**

### **2.3.1 Trade liberalization and some Facts**

The economic restructuring process (called *Doi Moi*) started in 1986 when Vietnam transformed from a centrally-planned economy to a market-oriented economy. GDP growth accelerated to 9.8% annually from the early 1990s to 1998 then fell to 7.3% from 2000 to 2009 (GSO). The economic structure has changed with the tendency towards industrialization.

During the period 1990 to 2010, the contribution of the agriculture sector dropped from 38.7% to 20.9% while that of industry and construction, and service sectors changed from 22.7% and 38.6% to 40.2% and 38.9% respectively.

**Figure 2.1: Vietnam's Imports and Exports, 1990-2010**



Source: GSO (2006, 2011)

Vietnam's total export volume grew from around US\$ half a million to reach US\$ 71.6 billion in 2010, which is equivalent to an annual growth rate of 20% (GSO, 2006, 2011). Imports are generally higher than exports but trade deficits are not very large. Trade liberalization contributed to a growing intensity in terms of exports and imports relative to GDP (Figure 2.1).

Since opening up the economy, Vietnam has been party to multilateral and bilateral trade agreements and MFN agreements with over 80 nations (MUTRAP, 2011). For example, bilateral trade agreements with the European Union and the United States were signed in 1992 and 2000 respectively. Joining ASEAN in 1995, Vietnam started implementing tariff reductions under the Common Effective Preferential Tariff of the ASEAN Free Trade Area (CEPT/AFTA) which began in 2001 and was completed by the beginning of 2006. Agreements under ASEAN auspices with China and Japan came into effect in 2002 and 2003 respectively. The country joined APEC in 1998 and signed an MFN agreement with Japan a year later. In addition, as a member of the WTO since 2007, it is bound to many MFN agreements. Each

time such a major agreement was reached, Vietnam's trade with that region expanded, and these trade agreements were clearly an impetus to ongoing domestic economic reforms (Abbott, Bentzen and Tarp, 2009). In the period 1997-2003, average tariffs on merchandise were reduced slowly from 21% to 20.3% while ERP decreased quickly from 121% to 46% (Athukorala, 2004).

**Figure 2.2: Tendency of ERP and Import Penetration at Industry Level, 2003-2008**

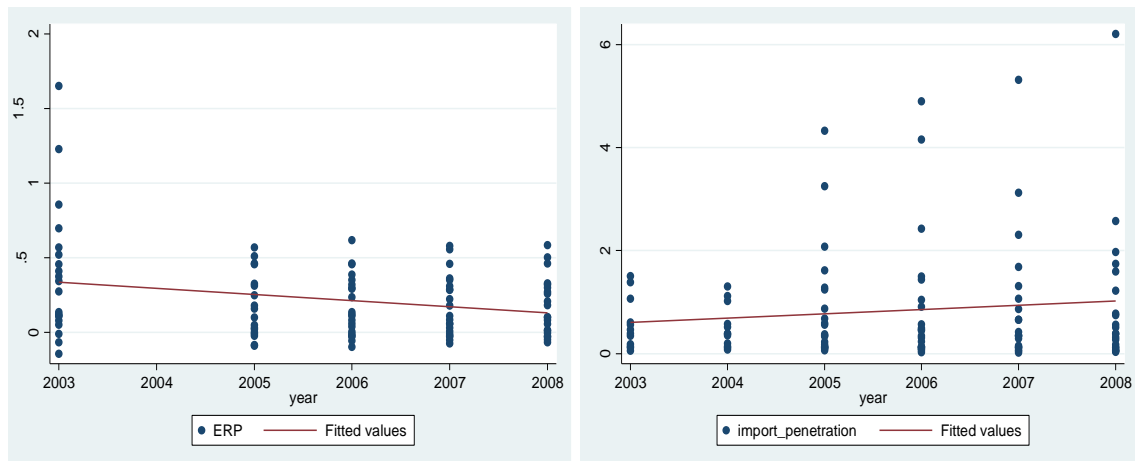


Figure 2.2 shows the trends in ERP and import penetration in the following years from 2003 to 2008, using the industry level data used in this study. As we can see, ERP continued a downward trend with values lower than 50%. Labor intensive sectors such as Wearing Apparel, Tanning and Dressing of Leather are more highly protected than others. ERP are positive for most industries; reflecting that returns to capital and labor are higher in these industries than they would have been in the absence of tariff protection. However, negative ERP shows that firms in these industries can be harmed by intervention, i.e. Manufacture of Refined Petroleum Products, or they would be worse off under free trade because of being highly supported by state intervention (*Appendix 2.1*).

The import penetration rate has an upward tendency from 2003 to 2008 (if we ignore the Coke and Refined Petroleum Products industry<sup>9</sup>), reflecting the gradual lifting of trade protection. However, import penetration rates still keep decreasing in many sectors including

<sup>9</sup>Vietnam exports crude oils but imports over 90% of refined oil and petroleum. The import penetration ratio of this industry is always over 3,000 % per year, which can mislead the average indicator for the whole economy.

Tanning and Dressing of Leather, Wearing apparel, Medical Precision and Optical Instruments (*Appendix 2.2*).

Under CEPT/AFTA, Vietnam is committed to reducing tariffs on all but few sensitive items from AFTA member countries to less than 5% by the year 2006. Within the WTO accession framework, the 2006 average tariff levels will be reduced from 17.4% to 13.4% after the implementation period, generally from 5 to 7 years. The average reduction of tariffs for industrial products is from 16.3% to 12.2% over 12 years. Vietnam's participation in the Information and Technology Agreement was the most significant, by which about 330 tariff lines for information technology products will be reduced to 0% over a period of 3-5 years. Its participation in the Textile and Clothing Agreement leads to a significant tariff reduction for these items, in particular textiles from 40% to 12%, and clothing from 50% to 20% (MUTRAP II, 2008).

### **2.3.2 Labor Market in Vietnam: An Overview**

Vietnam's population is estimated at approximately 89 million in 2010, of which over 61.6% is under 25 years of age. Approximately 15.5% of the population are considered to be trained or skilled workers (with elementary qualifications or higher) (MUTRAP, 2011). The labor force increased by 2.4 million to a total of 49.3 million persons from 2007 to 2009, together with an increase in the labor force participation rate of 2.1% to 76.5% in 2009. Labor has a tendency to move from the countryside to large cities like Hanoi, Ho Chi Minh city, leading to continuous increases in the proportion of the urban population of working age. For example, 1.8 million people moved during 2007-2009 (MOLISA<sup>10</sup>, 2010). The restructuring of state owned enterprises and opening up to foreign direct investment has led to a redistribution of the labor force, with workers moving from the state sector to private enterprises.

After WTO accession, employment continues to undergo structural changes with a decreasing share in the agriculture sector but increasing shares in the industry and service sectors. During the period 1999-2009, the percentage of workers in agriculture, forestry and fishing sectors reduced from 64.1% to 51.9%, while that in industry and construction and service sectors increased from 12.4% and 23.4% to 21.4% and 26.7% respectively. The

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<sup>10</sup>Ministry of Labor, Invalids and Social Affairs

unemployment and underemployment rates in urban areas are 4.6% and 3.3% in 2009 (GSO, 2000, 2010<sup>11</sup>).

Only 23.1% of the labor force are contracted employees, while the majority of workers are self-employed (38.47%) or work in a family business (38.43%). However, demand for skilled labor in Vietnam has increased. The rapid development of the private sector in Vietnam is the key cause behind the growing demand for labor (VCCI, 2008). In the period 2006-2008, 54% of employees were based in the private sector, 22.2% in the foreign invested sector, and 23.8% in the state sector. Taking into consideration the gender composition, female workers accounted for circa 44% of the total workforce. A larger proportion of female workers are present in industries such as manufactures of Wearing apparel, Dressing, or Leather Tanning and Dressing (82%-83%) while male workers tend to work in manufactures of Coke, Petroleum, Metal products or Transport Equipment (80%). Interestingly, more female than male workers appear in high-tech manufactures which produce office machinery, communication equipment, or medical instruments (70-75%) (GSO, 2010).

Wages of employees are subject to minimum rates determined by MOLISA at district levels and by enterprise ownership (e.g. VND 1.2 million per month, app. US\$ 70-75, in Hanoi 2008, for employees in foreign enterprises; and VND 0.8 million for those in domestic enterprise).<sup>12</sup> Average salary levels were highest in state enterprises, followed by FDI firms and non-state enterprises. For instance, the values are VND 4.067; 3.005; and 2.273 million per month in 2008 respectively. A worker in the manufacturing sector can, on average, earn VND 2.342 million per month in 2008 (GSO, 2010).

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<sup>11</sup>Statistical Year Book 2000, 2010 (GSO)

<sup>12</sup>The minimum wage in 2012 in Hanoi is VND 1.550 million for foreign enterprises, or VND 1.350 million for domestic enterprises.

## Overview on SMEs

**Table 2.1: Number and Share of SMEs by Size of Capital and Employees**

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total No. of enterprises	42,297	51,680	62,908	72,012	91,756	112,950	131,318	155,771	205,689
No. of SMEs and growth rates (No. of employees <300)	39,897 -	49,062 23.0%	59,831 21.9%	69,697 16.5%	88,222 26.6%	109,338 23.9%	127,593 16.7%	151,780 19.0%	201,580 32.8%
Shares of SMEs in total	94.3%	94.9%	95.1%	96.8%	96.1%	96.8%	97.2%	97.4%	98.0%
No. of SMEs and growth rates (Registered capital <10 VND billion)	36,306 -	44,670 23.0%	54,217 21.4%	61,977 14.3%	79,420 28.1%	98,232 23.7%	114,341 16.4%	131,888 15.3%	171,231 29.8%
Shares of SMEs in total	85.8%	86.4%	86.2%	86.1%	86.6%	87.0%	87.1%	84.7%	83.2%

*Source: Authors' calculations based on many versions of Statistical Year Books (GSO, 2001-2009)*

An enterprise is small or medium when its number of employees is lower than 300 or its registered capital is less than VND 10 billion (nearly US\$ 500,000). According to the GSO from 2001 to 2009, SMEs in the whole economy, on average, accounted for 96% of total enterprises in terms of employee size or 86% in terms of registered capital. The growth rate of SMEs in terms of number of employees or registered capital is around 22% annually (*Table 2.1*). Also, SMEs in the manufacturing sector accounted circa 87% of total manufacturing enterprises in terms of employee size in the period 2005-2009.

## 2.4 Data Descriptions

The industry level data used in this study come from the GSO, which is an institution directly under Ministry of Investment and Planning, conducting statistical operations and providing socio-economic statistical information at both micro- and macro- levels in Vietnam. The firm level data is obtained from the DANIDA's SME surveys collected in 2005, 2007 and 2009. The sample sizes are 2,603 in 2005 (representing 13.2% of total manufacturing



enterprises), 2,492 in 2007 (8.8%) and 2,492 in 2009 (5.1%). The SME surveys are funded by DANIDA and conducted by the Department of Economics, University of Copenhagen in collaboration with the Vietnamese Institute of Labor Science and Social Affairs (ILSSA) and Central Institute for Economic Management (CIEM). Although they are implemented in 10 selected provinces (Ha Noi, Phu Tho, Ha Tay, Hai Phong, Nghe An, Quang Nam, Khanh Hoa, Lam Dong, Ho Chi Minh City, and Long An), a stratified random sample was chosen such that the data set is representative at the provincial level. A rich and intensive range of questionnaires cover many modules such as general characteristics, enterprise history, production characteristics, employment, investments, etc.<sup>13</sup> Each survey in a year collects information for two previous years (e.g. the survey in 2005 aims to obtain data in the years 2004 and 2003).

Especially, the surveys are suitable for studies in labor markets. For example, the employment module produces information on employment by gender, full-time/ part-time status, occupation, workers' training, labor union, workers' benefit, recruiting and firing process, and wage setting process. Unfortunately, the survey does not specifically ask about educational or skill levels of the employees, only their occupation, i.e., managers, professionals, sales, service or production workers. Professionals are defined as those having university/college degree (Phan, 2009). Since the information on educational or skill levels of the employees are not given, we proxy for the skill composition of employment by using the share of production workers in total firm employment, as in Revenga (1997).<sup>14</sup>

Panel data sets are used for the empirical analysis, comprising 93 industry observations and 8,849 firm observations from 19 manufacturing sectors in the period 2003-2008. The firm-level data set retrieved from DANIDA is merged with the industry-level data, i.e. ERP and import penetration. ERP are collected from MUTRAP II (2008), MUTRAP III (2010) for the years

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<sup>13</sup>For instance, some studies, using the same source of data, investigate the role of unions (Torm, 2012), or the informal sector wage gap among Vietnamese micro-firms in Vietnam (Rand and Torm, 2012). Torm, Larsen, and Rand (2011) examine the impact of recruitment ties on wages in Vietnam.

<sup>14</sup>Skilled labor activities include engineering, management, administration, and general office tasks while the activities of unskilled workers include machine operation, production supervision, repair, maintenance and cleaning (Hanson and Harrison, 1995).

2005-2008 and Chu and Kalirajan (2011) for the year 2003.<sup>15</sup> ERP in 2004 are assumed equal to the indicator in 2003 due to lack of data. Import penetration ratios are calculated based on data collected from the GSO's reports on International Merchandise trade of Vietnam in several years.<sup>16</sup>

Table 2.2 presents means and standard deviations of key variables, separated into two periods 2003-05 and 2006-08 at industry and firm levels. The calculation strategy and explanations for these variables are given in *Appendix 2.3*. Vietnam is involved more in trade liberalization in the latter period when completing the AFTA agreement in 2006 and joining the WTO in 2007. Thus ERP reduced to 17.7% in this period as tariff barriers were gradually lifted. The average import penetration ratio increased over this period, as would be expected.

Since liberalizing the economy, average industry employment increased, accompanied by a higher proportion of female workers. Average SME firm size was smaller in terms of employment, together with a reduction in the presence of male and production workers.<sup>17</sup> An SME's real output increased by 9.6% over the two periods. Wages, cost of capital and log capital stock/value added also increased. Real quasi rents per worker increased from 13.4 million VND to 20.5 million VND. Furthermore, the decreased share of production workers, representing a higher proportion of skilled workers in a firm, may strengthen the bargaining power.

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<sup>15</sup>ERP of an industry is measured by industry value added at domestic price, divided by that at world price, then minus 100%. This approach is applied by Trinh and Kobayashi (2012) for the Vietnamese manufacturing industries.

<sup>16</sup>Theoretically, import penetration ratios should be measured as the share of imports in domestic demand (imports/[production + import – exports]); however, there are problems with measuring domestic demand in some industries, which give rise to inconsistencies such as negative domestic demand (Jenkins, 2004).

<sup>17</sup>Shares of female and production workers are only available for the years 2004, 2006, and 2008. We assumed these indicators in the previous years are the same as at the current years.

**Table 2.2: Summary Statistics, 2003-2008**

<b>Variables</b> <i>(Mean and Standard Deviations)</i>	<b>Industry-level data</b>		<b>Firm-level data</b>	
	<i>2003-5</i>	<i>2006-8</i>	<i>2003-5</i>	<i>2006-8</i>
Total employment	123,911 [148,278]	161,136 [188,384]	18.99 [128.59]	15.46 [34.74]
- <i>Share of female workers (%)</i>	44.9 [18.9]	48.6 [19.6]	33.8 [27.1]	35.1 [26.5]
- <i>Share of production workers (%)</i>			78.5 [18.7]	65.7 [19.8]
Real output (bill. VND)	25,500 [28,500]	41,300 [45,300]	2.5 [17.5]	2.74 [12.3]
Real annual earnings per worker (mill. VND)	17.9 [8.7]	20.6 [7.8]	7.51 [10.5]	10.8 [11.5]
ERP (%)	28.97 [36.90]	17.70 [19.55]		
Import penetration ratio (%) <i>(Except Manufacture of Coke and Refined Petroleum)</i>	70.3 [84.3]	94.0 [132.5]		
Cost of capital (mill. VND)			29.5 [377]	62.2 [526]
Price raw materials (mill. VND)			1,810 [14,700]	1,910 [9,210]
Real quasi rents per worker (mill. VND)			13.4 [103]	20.5 [82.8]
Log Capital stock/Value Added			1.134 [1.326]	1.160 [1.230]

\* *Standard Deviations are in parentheses.*

## 2.5 Employment and Wage Effects of Trade Liberalization at the Industry-Level

We start off by investigating the impact of trade liberalization on employment and wages using industry level data. To do so, we follow Milner and Wright (1998) and Revenga (1997) and estimate simple reduced form employment and wage equations in the following form,

$$\ln L_{jt} = \sigma_0 + \sigma_1 \ln W_{jt} + \sigma_2 \ln Q_{jt} + \sigma_3 \text{TL}_{jt} + d_j + d_t + \varepsilon_{it} \quad (2.1)$$

and

$$\ln W_{jt} = \omega_0 + \omega_1 \ln L_{jt} + \omega_2 \ln Q_{jt} + \omega_3 \text{TL}_{jt} + d_j + d_t + v_{it} \quad (2.2)$$

where  $L_{jt}$ ,  $W_{jt}$ ,  $Q_{jt}$  is respectively total employment, the average real wage measured in terms of annual earnings, and total output, in industry  $j$  at time  $t$ .<sup>18</sup>  $\text{TL}_{jt}$  is a vector of trade liberalization variables, including ERP and import penetration. The equations also include time ( $t$ ) and industry ( $j$ ) specific effects. All nominal variables are deflated by producer price index.

The results in Table 2.3 present the industry-level employment and wage responses to trade liberalization. For the purpose of estimations, equations (1) and (2) are differenced in order to transform out the specific effects, then the OLS and within estimates are applied. Unlike time specific effects, industry specific effects are eliminated by the difference transformation of variables.

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<sup>18</sup>This labor demand equation can be derived based on a Cobb-Douglas production function, assuming that the cost of capital is captured by time dummies (Milner and Wright, 1998).

**Table 2.3: Industry Employment and Wage Equations with OLS and Within Estimates**

	Employment		Wages	
	OLS (1)	Within (2)	OLS (3)	Within (4)
Employment			-0.523*** (0.112)	-0.657*** (0.057)
Average real wage	-0.639*** (0.123)	-0.829* (0.445)		
Output	0.101 (0.168)	-0.050 (0.195)	0.026 (0.174)	-0.097 (0.278)
ERP	0.061 (0.213)	0.045 (0.162)	0.110* (0.063)	0.166 (0.114)
Import penetration	-0.016** (0.006)	-0.020*** (0.004)	-0.006* (0.003)	-0.013* (0.006)
Year dummies	Yes	Yes	Yes	Yes
R-squared	0.52	0.69	0.38	0.58
Observations	60	60	60	60

*Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.*

*(2) Robust standard errors in parentheses.*

*(3) All regressions include a constant term.*

Columns 1 and 2 provide the results for the estimated employment equation. Increases in average wage rates cause a fall in employment, whereas changes in industry output and ERP appear to have no impact on demand for labor. Furthermore, the results indicate the negative and significant impact of rising imports on employment. An increase in import penetration from 57% to 95% is associated with a mere 0.76% ( $=0.38 \times 0.02$ ) decline in labor demand. Alternatively, we only find evidence for a modest impact of the increasing import penetration on industry-level employment. This finding could potentially reflect the existence of rent sharing agreements between firms and workers in Vietnam. As explained by Revenga (1997) “to the extent that the dissipation of rents is fully absorbed through lower industry wages there need not be any effect on employment”.

Columns 3 and 4 present the similar findings for the estimated wage equation in the same period. The results for the wage effect of trade liberalization are more statistically significant

compared to those obtained for employment. The coefficient on import penetration is negative and statistically significant, indicating that an increase in imports reduced real wage. However, the implied wage responses are minor: an increase in import penetration from 57% to 95% is associated only with a 0.49% ( $=0.38*0.013$ ) decline in real wages. Furthermore, the coefficient on ERP is significant in OLS or closes to being significant in within estimates implies that reduction in ERP is associated with decreasing industry wages. A decline in ERP from 39% to 17% reduced real industry wages by 2.4%-3.5%.

In sum, the existence of a minor negative employment effect of trade liberalization seems to support the rent sharing model. Furthermore, as proposed by Feliciano (1994) and Currie and Harrison (1997), we can also link this phenomena to the existence of restrictions to the firing of workers and the imperfections of product market in Vietnam. By contrast, the industry regression reveals a bigger negative association between trade reform and wages. Unfortunately, the industry-level analysis cannot go further in explaining what causes the trade-induced decline in wages and employment in Vietnam. Hence, we now turn to a firm-level analysis in order to look more closely at possible channels.

## **2.6 Employment and Wage Effects of Trade Liberalization at the Firm-Level**

Our analysis at the firm level follows closely Revenga (1997), Ghazali (2011) and Abowd and Lemieux (1993). We adopt a wage-setting model allowing for the presence of rent-sharing behavior under union influence, and competitive wage determination. Accordingly, firms and the union bargain only over wages, and then employment is set unilaterally by the firm at the level that maximize its profit.

$$w_{it} = \delta_i w_{it}^U + (1 - \delta_i) w_{it}^A = \delta_i (w_{it}^U - w_{it}^A) + w_{it}^A \quad (2.3)$$

where  $\delta_i$  reflects the bargaining power of worker in firm  $i$ ,  $w_{it}^U$  is the union's preferred wage outcome, and  $w_{it}^A$  is the alternative/outside wage, representing comparative wage (assumed to be the wage in the corresponding industry). As the union's preferred wage outcome is not observed,  $(w_{it}^U - w_{it}^A)$  could represent product market competition, namely the quasi rents per worker. Equation (2.3) can be rearranged as:

$$w_{it} = \alpha\delta_i QR(w_{it}) + w_{it}^A \quad \text{with } \alpha \leq 1 \quad (2.4)$$

where  $\alpha\delta_i$  is considered as a quasi-rent-splitting parameter, reflecting how much of the quasi rents is captured by the union.<sup>19</sup>

If there is heterogeneity in workers' bargaining power, we can rewrite equation (2.4) as follows, with  $\bar{\delta}$  the average bargaining power parameter across firms and  $\alpha\delta_i = \alpha\bar{\delta} + \epsilon_i$ :

$$w_{it} = \alpha\bar{\delta} QR(w_{it}) + w_{it}^A + \epsilon_i QR(w_{it}) \quad (2.5)$$

Trade liberalization is likely to imply a reduction in sector rent (Ghazali, 2011). Such impact would be captured by changes in quasi rents per worker at the firm level (Revenga, 1997). At the same time, the error component in equation (2.5) is likely to be correlated with the regressor  $QR(w_{it})$ . Thus, we need to use instrumental variables estimation. As shocks to quasi rents per worker are likely to result from shocks to product demand or shocks to the costs of production. Trade policy changes that may reflect exogenous demand shocks would be relevant instruments, which can influence the behavior of both firms and unions.<sup>20</sup>

For the empirical implementation, we apply the following equation for firm wage determination:

$$\ln W_{it} = \varphi_i + \tau_t + \delta_1 \ln QR_{it} + \delta_2 \ln W_t^A + \delta_3 \ln K\_VA_{it} + v_{it} \quad (2.6)$$

where  $W_{it}, W_t^A, QR_{it}$  are as above. All nominal variables are deflated by the producer price index.  $\varphi_i, \tau_t$  are firm and time fixed effects. We include the ratio of capital to value added  $K\_VA_{it}$  that shows the firm efficiency in using capital stock and, hence, can determine wages (Ghazali, 2011).

Through the rent sharing approach, trade policy changes can affect firm-level wages through two different channels: (1) Changes in industry-level trade barriers should have a direct

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<sup>19</sup>As in Revenga (1997), quasi rents per worker are constructed as  $QR_{it} = (Y_{it} - M_{it} - r_{it}K_{it} - w_{it}^A N_{it}) / N_{it}$  where  $Y_{it}$  is sales,  $M_{it}$  is the cost of material inputs,  $r_{it}K_{it}$  is the cost of capital inputs,  $N_{it}$  is total employment in firm  $i$  at time  $t$ .

<sup>20</sup>Abowd and Lemieux (1993) rely on export and import price indexes as the instruments for quasi rents in the case of Canadian firms. Alternatively, Revenga (1997) uses industry-level tariffs and quotas for the case of Mexican manufacturing.

impact on the outside wage by shifting the total industry labor demand; and (2) Trade liberalization is able to reduce the sector rents and, hence, to reduce the rent component of wages in the firms where rent-sharing exists. We use two trade policy instruments for quasi rents per worker, namely, the ERP (e.g., Ghazali, 2011; Krishna, Poole, and Senses, 2012)<sup>21</sup> and import penetration (e.g., Feliciano, 2001; Kien and Heo, 2009).

In the empirical analysis we also augment equation (2.6) by adding some more independent variables and instruments depending on our purposes in investigating skilled-unskilled and male-female wage gaps under the impacts of trade liberalization and the role of unions.

As regards a firm's employment response to trade liberalization, changes in trade policy can influence employment through their effect on wage setting. If workers are willing to trade off wages (e.g., by giving away rents), they may be able to preserve jobs. In the case workers prefer to maintain the level of wages, a larger employment effect may be observed. Furthermore, trade policy changes directly affect employment by shifting firm's output. As a result, output is endogenously determined in the firm-level employment equation. Therefore, we also use ERP and import penetration as instrumental variables.

$$\ln L_{it} = \varphi_i + \tau_t + \phi_1 \ln W_{it} + \phi_2 \ln W_{it}^A + \phi_3 \ln Q_{it} + \phi_4 \ln C_{it} + \phi_5 \ln K\_VA_{it} + u_{it} \quad (2.7)$$

where  $L_{it}$ ,  $W_{it}$ ,  $W_{it}^A$ ,  $Q_{it}$ ,  $C_{it}$ ,  $K\_VA_{it}$  are respectively the number of workers, annual average real wage, annual industry real wage, real output, the cost of capital, and the ratio of capital to value added in firm  $i$  at time  $t$ .  $u_{it}$  is the disturbance term.

We begin the empirical analysis with the firm-level employment equation to observe the magnitude of the implied employment response to trade policy changes. We then identify the effect of trade liberalization on firm wages in several steps. First, we explore the importance of rent sharing in firm-level wage determination. Second, we measure the size of firm quasi rents that are affected by trade policy variables and their interactions with the gender composition of a firm's labor force. For further analyses and robustness checks, we also consider heterogeneity

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<sup>21</sup>Goldberg and Pavcnik (2004, 2005) and Ghazali (2011) emphasize that ERP changes during trade reform episodes are not sector-uniform. ERP movements in many developing countries result from government decisions to fulfill the GATT and WTO directives that bound the behavior of firms or unions in influencing trade policy changes. Hence, this would minimize the endogeneity risk.



in bargaining power depending on the skill composition of the workforce and the role of trade union location. Apart from firm fixed effects and year effects, we also add industry fixed effects to control for unobserved time-invariant industry characteristics.<sup>22</sup>

The two stage least squares (2SLS) estimation of equation (2.7) is reported in Table 2.4. The dependent variable is the log of total employment. The independent variables are the firm and industry real annual average wage, the price raw materials, and real output. Instruments used for the endogenous real output variable are ERP and import penetration.

We report the  $F$ -statistic for the relevance of excluded instruments (associated  $p$ -value) from the first-stage regression. When the  $F$ -statistic is small (or the corresponding  $p$ -value is large), the instrumental variable estimates and confidence intervals would be unreliable. We find that our instruments are appropriate on this criterion. Furthermore, the instruments are valid as indicated by the Sargan test for overidentifying restrictions, which cannot reject the hypothesis of the instrument validity. Additionally, the Durbin-Wu-Hausman test rejects the null hypothesis that the specified endogenous regressor (real output variable) can be treated as exogenous.

The first stage estimates reveal a negative and significant effect of increased imports on firm real output, though the point estimate is small (-0.004). The coefficient on ERP gets the expected sign but is statistically insignificant. The second stage estimates indicate statistically significant parameters for the firm real output and average wage. By contrast, the coefficients on the industry real wage, the cost of capital, and the capital stock to value added are insignificant.

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<sup>22</sup>Goldberg and Pavcnik (2005) find that workers in protected sectors earn less than workers with similar observable characteristics in unprotected sectors when they do not control for unobserved time-invariant industry characteristics. With industry fixed effects, the result reverses: trade protection increases relative wages.

**Table 2.4: Results of 2SLS Firm Employment Equations**

	2SLS (First stage)	2SLS (Second stage)
	Dependent variable: real output	Dependent variable: firm employment
Real output		1.193** (0.465)
Firm real wage	0.525*** (0.020)	-0.858*** (0.245)
Industry real wage	0.051 (0.051)	-0.005 (0.054)
Cost of capital	0.138*** (0.009)	-0.084 (0.065)
Capital stock/Value added	-0.149*** (0.017)	0.052 (0.071)
ERP	0.056 (0.071)	
Import penetration	-0.004* (0.002)	
Firm fixed effects	Yes	Yes
Year effects	Yes	Yes
Instruments		ERP Import penetration
<i>F</i> -test ( <i>p</i> -value)	0.077	
Sargan test ( <i>p</i> -value)		0.697
Durbin-Wu-Hausman test ( <i>p</i> -value)		0.001
Observations	3907	3907

*Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.  
(2) Standard errors in parentheses.*

Empirically, the findings give evidence that increases in import penetration that reduce firm output have a negative effect on employment. Based on the first stage estimates, an increase in import penetration from 57% to 95% reduces firm output by 0.15% ( $=0.38 \times 0.004$ ). This in turn is associated with a decline in employment by only 0.18% ( $=0.15\% \times 1.193\%$ ). In addition, reductions in ERP do not have any significant effect on output and therefore have no impact on employment. Combining these results with those obtained from the industry-level equation, we can argue that there is minor impact of trade liberalization on employment in Vietnamese manufacturing, as in line with Currie and Harrison (1997) and Feliciano (2001).

We now turn to estimating wage effects. In the industry level analysis we found that there is a negative relationship between trade reforms and wages. In the firm-level analysis, it is possible to explore the mechanisms for that adjustment.

**Table 2.5: Within Estimates of Firm Wage Equations**

<b>Dependent variable: Firm real average wage</b>			
	(1)	(2)	(3)
Quasi rents per worker (QR)	0.165*** (0.005)	0.218*** (0.038)	0.226*** (0.016)
QR*[QR-avg(QR)]		0.007 (0.012)	
QR*female share			-0.055*** (0.015)
Industry real wage	0.380*** (0.055)	0.227*** (0.083)	0.396*** (0.060)
Capital stock/Value added	-0.052*** (0.006)	-0.042*** (.010)	-0.057*** (0.007)
Firm fixed effects	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
R-squared	0.39	0.34	0.42
Observations	8849	3969	7072

*Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.*

*(2) Standard errors in parentheses.*

*(3) All regressions include a constant term*

Table 2.5 gives results from estimating equation (2.6) using a within estimator. We find evidence for a positive and strongly significant relationship between firm real wage and quasi rents per worker that is robust to various specifications. Hence, rent sharing appears to be an important component of wage determination in Vietnam. Technically, the quasi-rent-splitting parameter determines how much of the quasi rents is captured by the union. In the case these rents are completely transferred to union members, we can have a simple figure from the coefficient on the quasi rents per worker in column 1 that, on average, union members get earnings that are about 16% higher than non-union members (the estimate of the quasi-rent-splitting parameter is 0.16). This finding to some extent is in line with the results by Torm (2012). Using matched employer-employee panel data, she empirically indicates an average union wage gap of about 13% in Vietnam's SMEs over the 2007-2009.

The coefficients on the industry real wage and the capital stock to value added have expected signs and are highly significant across specifications. This indicates that firm wages are also affected by industry labor market conditions and the efficiency in using capital input. Following Abowd and Lemieux (1993), Revenga (1997), and Ghazali (2011), we also include a term  $QR*[QR-avg(QR)]$  that measures the deviation of firm-level quasi rents from the sample

average. Similar to Revenga (1997), however, we do not find evidence for heterogeneity in bargaining power for firms in the same sector, as indicated by the statistically insignificant coefficient on this variable.

In column 3, we incorporate an interaction variable that allows the quasi-rent-splitting parameter to vary systematically with the proportion of female workers in the firm workforce. The coefficient on this interaction variable is negative and significant, which shows that the quasi-rent-splitting parameter is inversely correlated with the proportion of female workers in total firm employment. The point estimate is small (-0.055), but gives evidence of male-female earnings inequality in Vietnam.<sup>23</sup> The higher the proportion of female workers, the lower the ability of workers to capture part of the quasi rents.

In case that quasi rents per worker variable is endogenous, the within estimates above might be biased and inconsistent. To deal with this problem, an instrumental variables approach will be used for the endogenous quasi rents per worker. Instruments for QR are ERP and import penetration.

The 2SLS regressions are presented in Table 2.6. The result in column 2 supports the flexible model of wage setting that captures both the existence of rent sharing behavior and competitive wage determination. However, the first estimates result in column 1 does not show any statistically significant impact of ERP and import penetration on QR. It might be due to the fact that these chosen instruments are weak as the  $F$ -test point shows ( $p$ -value = 0.179).

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<sup>23</sup>Torm (2012) finds evidence that there is a substantial gender wage gap with male earnings being between 14% - 18% higher than for women.

In order to attain relevant instruments, the existence of gender earnings differentials in the trade liberalization episode suggests to further include interaction variables that permit trade policy changes to vary with the proportion of the female workers in the firm labor force. Therefore, besides trade policy variables, we also add their interactions with the gender composition of the firm workforce as instruments for QR. *F*-test and Sargan test now indicate the relevance and validity of the chosen instruments. The Durbin-Wu-Hausman test rejects the null hypothesis of exogeneity of the endogenous variable.

Columns 3 and 4 present the 2SLS estimation results with the interaction variables. The first estimates show a positive and significant effect of ERP on quasi rents per worker. Furthermore, the results point out the gender composition of the workforce appears to be highly relevant. The higher the proportion of female workers in the firm, the less trade liberalization decreases the quasi rents per worker. Hence, these findings indicate that trade liberalization may reduce the gender earnings gap in Vietnam.

The second stage estimates also show a positive and highly significant coefficient on quasi rents per worker. This indicates that decreases in ERP that reduce quasi rents have a negative effect on wages. This is not the case for the import ratio, however. A decrease in ERP from 39% to 17% reduces quasi rents by a 5.4%. This in turn is associated with a 2.6% decline in firm wages. Combining this finding with the industry-level wage estimates, we find wage declines in an interval of 2.4%-3.5% in Vietnamese manufacturing over the 2003-2008 period that is due to trade liberalization.

**Table 2.6: Results of 2SLS Firm Wage Equations Regarding Gender Composition**

	2SLS (First stage)	2SLS (Second stage)	2SLS (First stage)	2SLS (Second stage)
	Dependent variable: quasi rents per worker	Dependent variable: firm average real wage	Dependent variable: quasi rents per worker	Dependent variable: firm average real wage
	(1)	(2)	(3)	(4)
Quasi rents per worker		0.549* (0.291)		0.487*** (0.112)
Industry real wage	-0.501*** (0.079)	0.374*** (0.141)	-0.529*** (0.079)	0.340*** (0.067)
Capital stock/Value added	-0.309*** (0.019)	0.074 (0.091)	-0.304*** (0.019)	0.054 (0.036)
ERP	-0.103 (0.088)		0.246* (0.140)	
ERP*female share			-0.650*** (0.196)	
Import penetration	0.005 (0.004)		-0.003 (.006)	
Import penetration*female share			0.031** (0.015)	
Firm fixed effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Instruments	ERP			ERP
	Import penetration			ERP*female share
				Import penetration
				Importpenet*femaleshare
<i>F</i> -test ( <i>p</i> -value)	0.179		0.000	
Sargan test ( <i>p</i> -value)		0.853		0.891
Durbin-Wu-Hausman test ( <i>p</i> -value)		0.052		0.000
Observations	6564	6564	6549	6549

Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively. (2) Standard errors in parentheses.

### **Further analyses and robustness checks**

The potential heterogeneity in bargaining power and the existence of union wage gaps suggest that workers do vary in their ability to extract rents across firms and regions. Determinants of this differential ability might come from the influence of unions in the local market and the skill composition of the firm workforce.

We reestimate equation (2.5) now allowing for interactions of the trade policy variables and the skill composition of a firm's workforce in the first stage estimation. To further check robustness, we add two cost variables in real terms (cost of capital and price raw materials) and one interaction variable that allows the quasi-rent-splitting parameter to vary systematically with the fraction of unskilled workers in the second step. Furthermore, we also add industry fixed effects to control for unobserved time-invariant industry characteristics to the specification.

Results are reported in Table 2.7. The estimated coefficient on quasi rents per worker is consistent across various specifications and highly significant in both sign and magnitude. The quasi-rent-splitting parameter gets the similar value of about 0.34 across specifications, implying that 34% of quasi rents is captured by the union when skill composition of the firm workforce and industry fixed effects are taken into account.

For all specifications, the coefficients on the interaction variable  $QR*unskilled\ share$  are negative and statistically significant (or close to being significant once industry dummies are included) thus, confirming the evidence of skill earnings inequality in Vietnam.<sup>24</sup>

The significant and negative coefficient of  $ERP*unskilled\ share$ , furthermore, reveals that the higher the proportion of unskilled workers in the firm, the less trade liberalization decreases the quasi rents per worker. This suggests that the bargaining power of unskilled workers may increase following trade liberalization, as in line with a simple HO/SS story. Vietnam specializes in unskilled intensive goods, so trade liberalization means they expand in those goods, giving more power to the unskilled workers.

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<sup>24</sup>Torm (2012) indicates that a worker with education beyond secondary school has a wage that is about 12% higher than a worker with only basic education.

In columns 3 and 4 we do a similar exercise but only include firms located in the North and Centre of Vietnam. Given the historical and institutional context combined with the higher concentration of collective agreements in Ho Chi Minh City, south vs rest of country split may reveal interesting results relating to bargaining power of workers and skill earnings gap across regions.<sup>25</sup>

Column 4 shows that the size of the quasi-rent-splitting parameter is statistically unchanged. However, the coefficients on the interaction variable  $QR*unskilled\ share$ , trade policy variables and their interactions with the skill composition of the firm workforce are significantly larger in absolute value compared to those attained for all observations. They suggest that firm wages in the North and Centre are more influenced by the decline in ERP and the increase in imports. Also they reveal that earnings differential between skilled and unskilled labor is more serious in these regions than elsewhere. In column 5 and 6, industry fixed effects are added to the specification to control for unobserved time-invariant industry characteristics. The estimated coefficients on quasi rents per workers, the interaction variable, trade policy variables and their interactions with the skill composition of the firm workforce are in line with priors in terms of sign and statistical significance.

To sum up, the firm-level study provides evidence on negative effects of trade liberalization on employment and wages with similar magnitudes as industry-level analysis. The firm-level analysis also indicates that reductions in quasi rents and firm output in the period of trade reforms are channels for those adjustment mechanisms. Interestingly, increased imports play a

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<sup>25</sup> Before the reunification in 1975, southern trade unions were more independent toward the government than northern trade unions which were under the oversight of the Communist Party (Edwards and Phan, 2008). Despite the reunification, some of the ideological and institutional differences between the two parts of the country are long lasting through today (see Kim, 2008). Zhu et al. (2008) find that firms in Hanoi (the Vietnam's capital in the North) remain more oriented towards traditional personnel practices, including government wage scales and unions' involvement as government agents, whereas firms in Ho Chi Minh City (the biggest city in the South) have a higher rate of adoption of modern human resource management. It is estimated that only 20% of unionized private sector firms have collective agreements, although in HCMC, the figure is around 65% (Clarke, Lee, and Chi, 2007). Torm (2012) also documents that trade unions in southern firms might be more accountable to their members than the rest of the country.



minor part in reducing employment, while decreased ERP is responsible for a larger decline in wages.

## **2.7 Conclusion**

The vulnerability of wages and employment to trade liberalization is always concerned in developing countries, including Vietnam where has been strongly involved in trade openness in the recent years. Vietnam is characterized by the large proportion of SMEs and high rates of unskilled workers. Trade liberalization in this economy goes hand in hand with commitments to cut down tariffs when joining the AFTA and the WTO. Although trade affects labor market in different ways, the economic model in this study analyzes the response to trade liberalization through the industry wage premium, which in turn, represents rent sharing. By this approach, given trade policy variables such as ERP and import penetration could stimulate a direct effect on wages and employment at industry level but an indirect impact at firm level. Therefore, they are treated as instruments in order to deal with endogeneity in the firm-level analysis. Furthermore, this approach permits us to investigate factors such as worker gender or skill in capturing part of quasi rents.

Our econometric analysis suggests that there is a negative effect of trade liberalization through decreased ERP on wages in Vietnamese manufacturing, although the impact is moderate. As regarding import penetration, we find a negatively significant but minor impact on firm employment. That means imports might not be a cause for rising anxiety over increasing unemployment. In addition, we find evidence of gender and skill earning inequalities in Vietnamese manufacturing, and these gaps decrease under trade liberalization. Furthermore, when taking into account the influence of unions by region, trade unions and collective agreements seem to reduce the skill earnings differentials in Vietnamese manufacturing.

In conclusion, we should not have a negative look on the response of labor market to trade openness for the case of Vietnam. Instead of fearing trade liberalization, Vietnam should enhance domestic policies to protect unskilled or female workers by upgrading education and training level, strengthening the role of trade unions in firms, or launching policies to help enterprises improve their productivity in order to ensure greater fairness in the allocation of rents to workers and create more jobs.

**Table 2.7: Results of 2SLS Firm Wage Equations Regarding Skill Composition**

	All observations		Observations in the Centre and North		All observations	
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	QR	Firm real wage	QR	Firm real wage	QR	Firm real wage
	(1)	(2)	(3)	(4)	(5)	(6)
QR		0.342*** (0.097)		0.344*** (0.117)		0.338*** (0.092)
QR*unskilled share		-0.372** (0.146)		-0.404*** (0.155)		-0.263 (0.174)
Industry real wage	-0.593*** (0.112)	0.115 (0.077)	-0.692*** (0.152)	0.152 (0.095)	-0.888** (0.290)	0.358* (0.199)
Capital stock/Value added	-0.465*** (0.034)	-0.133** (0.054)	-0.462*** (0.052)	-0.144*** (0.053)	-0.478*** (0.034)	-0.087 (0.074)
Cost of capital	-0.002 (0.019)	-0.011 (0.008)	-0.035 (0.026)	-0.012 (0.013)	-0.009 (0.019)	-0.013 (0.008)
Price raw materials	0.186*** (0.030)	0.001 (0.024)	0.149*** (0.045)	-0.025 (0.024)	0.178*** (0.031)	-0.017 (0.030)
ERP	2.375*** (0.433)		2.765*** (0.580)		2.464*** (0.465)	
ERP*unskilled share	-2.788*** (0.539)		-3.209*** (0.705)		-2.821*** (0.556)	
Import penetration	-0.016 (0.022)		-0.018 (0.027)		-0.044 (0.033)	
Import penet*unskilled share	0.046 (0.030)		0.060* (0.035)		0.027 (0.031)	
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No	Yes	Yes
<i>F</i> -test ( <i>p</i> -value)	0.000		0.000		0.000	
Sargan test ( <i>p</i> -value)		0.282		0.409		0.567
Durbin-Wu-Hausman test ( <i>p</i> -value)		0.020		0.006		0.113
Observations	3023	3023	1889	1889	3023	3023

Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively. (2) Standard errors in parentheses.

## Appendix to Chapter 2

### Appendix 2.1: Effective Rate of Protection in Vietnam by Industry, 2003-2008

INDUSTRY	2003	2004	2005	2006	2007	2008
Food Products And Beverages	.522	-	.313	.299	.288	.273
Tobacco Products	.857	-	.457	.457	.46	.463
Textiles	1.23	-	.51	.618	.179	.183
Wearing Apparel; Dressing And Dyeing Of Fur	1.651	-		.136	.58	.584
Tanning And Dressing Of Leather ...	.698	-	.463	.463	.558	.503
Wood And Products Of Wood ...	.112	-	-.023	-.023	-.022	-.026
Paper And Paper Products	.412	-	.18	.236	.224	.208
Publishing, Printing And Reproduction Of Recorded Media	.137	-	.1	.12	.06	.1
Coke, Refined Petroleum Products And Nuclear Fuel		-	.05	-.0097	-.0094	-.0056
Chemicals And Chemical Products	.079	-	.022	.111	.11	.102
Rubber And Plastics Products	.345	-		.353	.351	.322
Other Non - metallic Mineral Products	.376	-	.25	.294	.284	.26
Basic Metals	-.067	-	-.01	-.096	-.074	-.067
Fabricated Metal Products ...	.053	-	.03	.0056	.0085	.012
Machinery And Equipment and etc.	-.142	-	-.085	-.057	-.051	-.048
Electrical Machinery And Apparatus and etc.	.12	-	.16	.059	.058	.058
Radio, Television And Communication Equipment	.11	-		.039	.032	.016
Medical, Precision And Optical Instruments ...	-.009	-	0	-.028	-.028	-.029
Motor Vehicles, Trailers And Semi - trailers	.571	-	.326	.32	.31	.3
Other transport equipment	.274	-	-.09	.083	.084	.083
Furniture; Manufacturing and etc.	.457	-	.57	.387	.361	.328

Source: MUTRAP II (2008), MUTRAP III (2010) for the years 2005-2008 and Chu and Kalirajan (2011) for the year 2003

## Appendix 2.2: Import Penetration in Vietnam by Industry, 2003-2008

<b>INDUSTRY</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
Food Products And Beverages	.135	.135	.129	.129	.154	.175
Tobacco Products	.18	.196	.064	.027	.017	.033
Textiles	1.506	1.121	1.285	1.041	1.065	1.223
Wearing Apparel; Dressing And Dyeing Of Fur	.345	.35	.116	.066	.052	.052
Tanning And Dressing Of Leather ...	.468	.386	.357	.307	.068	.071
Wood And Products Of Wood ...	-	-	.375	.45	.417	.386
Paper And Paper Products	.389	.393	.564	.572	.346	.561
Publishing, Printing And Reproduction Of Recorded Media	.058	.081	.091	.093	.112	.063
Coke, Refined Petroleum Products And Nuclear Fuel	36.107	35.483	38.626	33.057	56.571	30.624
Chemicals And Chemical Products	.607	.518	1.615	1.498	1.685	1.591
Rubber And Plastics Products	.562	.578	.339	.346	.357	.393
Other Non - metallic Mineral Products	.114	.112	.118	.102	.112	.119
Basic Metals	1.386	1.305	2.074	2.429	2.306	2.578
Fabricated Metal Products ...	-	-	.228	.234	.291	.275
Machinery And Equipment and etc.	-	-	4.329	4.901	5.315	6.204
Office, Accounting And Computing Machinery	-	-	.87	.909	.863	.511
Electrical Machinery And Apparatus and etc.	-	-	.588	.496	.655	.749
Radio, Television And Communication Equipment	-	-	1.244	1.435	1.315	1.972
Medical, Precision And Optical Instruments ...	-	-	3.248	4.154	3.124	1.746
Motor Vehicles, Trailers And Semi - trailers	1.064	1.02	.684	.468	.659	.78
Other transport equipment	-	-	.176	.13	.346	.314
Furniture; Manufacturing and etc.	-	-	.135	.131	.134	.126

*Source: Authors' calculations based on the GSO's reports on International Merchandise trade of Vietnam in several years*

### Appendix 2.3: Calculation Strategy and Explanations for Key Variables

Real output	Industry or firm output, deflated by the Producer Price Index (base year 2000; unit: bill.VND).
Employment	- Total number of worker in an industry; or, - Total number of full-time workers in firms at the year-end.
Real wage	- Average industry wage; or, - Total payments for employees divided by total firm employment, then deflated by the Producer Price Index (base year 2000; unit: mill. VND).
Cost of capital	Total interest payment of firms in a year, deflated by the Producer Price Index (base year 2000; unit: mill. VND).
Price raw materials	Value of raw materials used, deflated by the Producer Price Index (base year 2000; unit: mill. VND).
Real quasi rents per worker	$QR = (Y - M - r \cdot K - w^A \cdot N) / N$ , deflated by the Producer Price Index (base year 2000; unit: mill. VND), where Y, M, $r \cdot K$ , N respectively denote firm sales, the cost of material inputs, the cost of capital inputs, and total firm employment (Revena, 1997).
Capital stock/Value Added	Total physical assets at the year-end, divided by total value added, then deflated by the Producer Price Index (base year 2000).
ERP	Effective rate of protection, as in percentage, collected from MUTRAP II (2008), MUTRAP III (2010), and Chu and Kalirajan (2011).
Import penetration ratio	Percentage of imports in total output.

### **3 Technology, Institutions and Productivity: An Empirical Investigation**

**ABSTRACT.**<sup>26</sup> This chapter investigates the determinants of productivity in Vietnamese manufacturing industries. We analyze impacts of technology and institutions on firm productivity in considering different types of firms by productivity level. The findings give evidence that while indirect technological factors such as foreign ownership, ISO certificate, owning a website appear to keep consistent effects for all types of firms, institutional factors result in different impacts subject to low- or high-productivity firms. Also informal institutions seem to play an essential role in financing firm working capital and investment purposes.

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### 3.1 Introduction

Vietnam is in the early stage of its industrialization process with a high importance of manufacturing activities in the economy. Manufacturing industries contribute the largest share to GDP growth, although their contributions stagnated recently (31.9% of overall GDP growth in the period 2006 – 2009 compared with 31.7% in 2001 – 2005). Among many reasons highlighted in the literature are problems of low capital efficiency, labor productivity and inefficiency as well as the obstacles created by institutional environment (Nguyen & Pham, 2010).

The distortion of the market stimulates firms to speculate land and real estate rather than to invest in upgrading technology, developing new products, and improving employee skills. Also the lack of adequate intellectual property protection provides little intensive for firm innovation (Vietnam Competitiveness Report, 2010). Furthermore, scarcity of high-skill labor, low technological capability of domestic firms and weak forward and backward linkages between foreign-owned and domestic enterprises have prevented effective technology transfer (Tue Anh, 2009). Long (2011) finds no strong evidence supports technical efficiency improvement in Vietnamese manufacturing firms after this country became an official WTO member. Comparing the two newly industrialized nations in the South East Asian region, Prajogo et al. (2007) find insignificant differences between Thai and Vietnamese manufacturing firms with respect to manufacturing strategies, resources, and innovation performance. The effect of technology on product innovation, however, is significantly stronger among Thai firms than Vietnamese firms.

It is widely recognized that institutions are central to explain why some countries have performed better than others.<sup>27</sup> However, empirical evidence on the firm performance impact of institutions within countries is scarce, especially for individual firms. Vietnam is a suitable case for this study because the country has gone through a transition process and has a homogeneous political system and government structure. A high level of decentralization is the key factor leading to dispersed power across different parts of governments and regions (Vietnam

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<sup>27</sup>See, for example, Acemoglu and Robinson (2012) for a good discussion.

Competitiveness Report, 2010). Not surprisingly, economic performance is substantially different across regions.<sup>28</sup>

After a short period of over-excitement of joining the WTO from early 2007, GDP growth of the whole economy and GDP growth by manufacturing industries decreased tremendously. Recent achievements are lower than state's potential and capability. The quality of economic growth, productivity, efficiency and competitiveness are low and improved slowly (The Ninth Central Committee Conference of the Communist party, 2009). It is agreed that the weaknesses of the economy and manufacturing in the context of the global economic crisis could be overcome to some extent if the technological and institutional factors had not created obstacles to economic development (Vietnamese Business Forum Report, 2011).

This paper aims to provide evidence on the link between technology, institutions and productivity using firm level data collected in Vietnam as part of the World Bank Enterprise Survey 2009. Our study contributes to the limited literature on the firm performance effects of technology and institutions within the context of a single country in several ways. First, we provide a different but useful look of Vietnamese private firms. In order to understand what is going on in their operation, one should also pay attention to indirect and informal aspects. Indirect technology factors instead of R&D activities have impact on firm performance. Informal institutions—socio norms, networks rather than formal remain important as mechanisms in financing working capital or investment purposes of private firms.<sup>29</sup> Second, our paper empirically confirms the paradox of education and training in an emerging economy. Vietnam has a high rate of literacy (around 91% of the population aged 15 or older can read and write),

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<sup>28</sup>Tran, Grafton, and Kompas (2009) state that “The political system and government structures in Vietnam are identical everywhere but the implementation of the central government’s law and regulations varies across regions. In particular, differences are more pronounced between the north and the south of the country. History, geography and the complexity of laws and regulations are key factors explaining institutional variation”.

<sup>29</sup>Steer and Sen (2010) show empirical evidence that informal institutions—ties with friends and family, and social and business networks—contribute to the risk management by firms in the private sector even as the economy matures and new formal institutions gradually develop.



however, graduates are lack of practical knowledge and working skills.<sup>30</sup> Inadequately educated workforce is seen as an economically and statistically significant obstacle for firm operation. Third, this paper supports for the argument that beside resource- and industry-based views, institution-based view could be the “third leg” in international business research (Peng et al., 2008). Omitting institutional environment in which enterprises operate could limit our understanding of factors affecting firm performance. Fourth, our research attempt to deal with the endogeneity bias of institutional variables by using dummy variables instead of variables measured by index or variables instrumented by their mean value averaged across industry and region.<sup>31</sup>

We find evidence that some direct technological variables, for example, investing in research, patenting and licensing, labor training and educational level of top manager are insignificant. However, indirect technological factors such as foreign ownership, ISO certificate, owning a website and educational level of employee appear to have an impact on firm productivity. For institutional factors, there is no evidence that access to finance affects firm performance. Other institutional variables such as practices of competitors in the informal sectors, inadequately educated workforce, obstacles in policy and administration have different impact depending on firm level productivity.

The remainder of the chapter is organized as follows: the next section outlines literature review and issues to be explored. Section 3 describes research methodology. Section 4 is for data, variables and summary statistics. Econometric results are discussed in Section 5 and section 6 concludes.

## **3.2 Literature Review and Issues to be explored**

The importance of innovation and institutional factors in explaining productivity has long been recognized, although estimates of their empirical significance at the microeconomic level

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<sup>30</sup>A survey conducted by the Vietnam Student Association showed that 50% of graduates in Vietnam cannot find jobs in their field and those who have to be retrained account for a significant share (Vietnam Competitive Report, 2010). AmCham (2010) reported that 78% of the population aged 20 – 24 is untrained or lacks the necessary skills.

<sup>31</sup>This approach is, thus, somewhat in line with the approach used by Goedhuys, Janz and Mohnen (2006), Escribà-Folch (2009) and Steer and Sen (2010) for institutional variables.

have started to progress only more recently. There are a number of studies that assess the effect of different dimensions of the business environment on firm performance, however, the literature relating to firm productivity performance effects of innovation and institutions is somewhat less than satisfactory.<sup>32</sup>

Theoretically, one way of increasing productivity is through innovative activity such as inventing new technologies or investing in research, patenting and licensing (Baumol, 2002). However, this kind of activity requires large efforts and faces risks of failure. For innovation in developing countries (DCs) it may be more suitable to use existing technologies than to create new ones. Hence, the importance of building up a technological capability in adopting new technologies developed outside has been considered (Lall, 1992). Firms in DCs can access existing technologies by licensing contracts, cooperation agreements or receiving foreign investments together with training their workforce.

Besides technological activities, institutions that guide and shape human interactions have impacts on firm performance through incentives to invest (see Coase, 1998; Williamson, 1987). Efficient institutions can increase returns to economic activity, create new investment opportunities and fairer games for all types of formal sectors. On the other hand, bad institutions may lead businesses to undertake inefficient and costly alternative investment. Institutions can be formal rules including laws and regulations, property right, the court system or informal rules such as social norms, habits and practices, social conventions, networks.

Using firm level data on 70,000 enterprises in 107 countries, Aterido, Hallward-Driemeier and Pagés (2007) regress employment growth on the investment climate constraints controlling for a variety of firm characteristics. They find that low access to finance and ineffective business regulations reduce the growth of all firms, especially micro and small firms. Corruption and poor infrastructure create growth bottlenecks for medium and large firms.

Goedhuys, Janz and Mohnen (2006) use a micro data set from the World Bank Investment Climate Survey to investigate how technology and institutions affect productivity in Tanzanian manufacturing firms. They evidence that only indirect technological variables (ISO certification,

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<sup>32</sup>For a review of the effects of technology and institutions on firm productivity, we refer to, e.g., Goedhuys, Janz and Mohnen (2006), and Dethier, Hirn, and Straub (2010).

foreign ownership and high education of the manager) appear to affect productivity, whereas institutional variables such as formal credit constraints, administrative burdens related to regulations, business support services and membership of a business association are highly significant and robust to different specifications of the model.

Hallward-Driemeier, Scott and Xu (2006) discuss how ownership and business climate impact on firm performance using the China investment climate survey 2000. They regress four different firm performance indicators (sales growth, investment rate, productivity and employment growth) on business climate indicators (measured as city-industry averages) and control variables. The results show that the variable ownership is significant, labor market flexibility weakly significant while there is no evidence that physical infrastructure and average access to finance affect firm performance.

### 3.3 Research Methodology

In order to examine the impact of technological and institutional factors on firm level productivity, we start off with a Cobb – Douglas – type production function similar to Goedhuys, Janz and Mohnen (2006).

$$Y_i = A(T_{1,i}, T_{2,i})K_i^\alpha L_i^\beta e^{\varepsilon_i} \quad (3.1)$$

Valued added  $Y_i$  is a function of traditional variables such as capital  $K_i$  and labor  $L_i$  as well as total factor productivity  $A$ . It means that  $Y_i$  can increase without an increase in the quantity of inputs  $K_i$ ,  $L_i$  once there is an increase in efficiency  $A$ . Technological variables  $T_{1,i}$  and institutional variables  $T_{2,i}$  are observable factors explaining differences in productivity. It is assumed that they do not affect the marginal productivity of capital and labor.

Productivity can be calculated as the ratio of an output to a specific factor or to all relevant factors of production. In this paper, we apply the non-parametric measure of productivity – labor productivity, which gives a simple and meaningful way of firm productivity performance.

Dividing both sides of equation (1) by  $L$  and taking logarithms we get:

$$\ln(Y_i/L_i) = \ln A(T_{1,i}, T_{2,i}) + \alpha \ln(K_i/L_i) + (\alpha + \beta - 1) \ln L_i + \varepsilon_i \quad (3.2)$$

In this equation, total factor productivity is assumed to be a linear function of technological and institutional variables. The coefficient for  $\ln L_i$  measures the deviation from constant returns to scale.

Furthermore, a firm can increase the labor productivity by operating at higher capacity so equation (3.2) can be adjusted like that:

$$\ln(Y_i/L_i) = \ln A(T_{1,i}, T_{2,i}) + \alpha \ln(K_i/L_i) + (\alpha + \beta - 1) \ln L_i + \gamma CU + \varepsilon_i \quad (3.3)$$

where variable CU is termed capital utilization and expected to be positive.

This equation is estimated using two different techniques: ordinary least squares (OLS) regression and quantile regression. While OLS is a useful tool for summarizing the average relationship between the outcome and its predictors, based on the conditional mean function, this provides only a partial view of the relationship. Heterogeneity in firm characteristics and abilities that are not reflected in explaining variables are assumed to be random and to vanish in the mean. Possible differences across firms are thus ruled out (Goedhuys, Janz and Mohnen, 2006). Therefore, if we want to have a more complete picture that provides information about the relationship between technology, institutions and productivity at different points in the conditional distribution of the productivity, Quantile regression is a statistical tool for building just that picture (Cameron & Trivedi, 2009). This type of regression has been employed in the international economics literature by, for example, Girma and Görg (2002).

Quantile regression is an extremum estimator but instead of minimizing the sum squared residuals like OLS, it minimizes the objective function:

$$Q(\delta_q) = \sum_{i: y_i \geq x'_i b} q |y_i - x'_i b_q| + \sum_{i: y_i < x'_i b} (1 - q) |y_i - x'_i b_q| \quad (3.4)$$

where  $0 < q < 1$  and  $b_q$  is used to reveal that different choices of  $q$  estimate different values of  $b$ .

If  $q = 0.25$ , much more weight is placed on prediction for observations with  $y_i < x'_i b$  (the low-productivity firms) than for observations with  $y_i \geq x'_i b$  (the high-productivity firms). The lower quartile presents the less productive firms.

If  $q = 0.5$ , giving the least absolute deviations estimator. In the median regression, the coefficients will be estimated by minimizing the absolute deviations from the median. As an estimate of central tendency, the median is a resistant measure that is not as greatly affected by outliers as is the mean.

If  $q = 0.75$ , much more weight is placed on prediction for observations with  $y_i \geq x_i'b$  (the high-productivity firms) than for observations with  $y_i < x_i'b$  (the low-productivity firms). The upper quartile presents the high productive firms.

### 3.4 Data, Variables and Summary Statistics

The data are derived from the Enterprise Survey undertaken in Vietnam by the World Bank in 2009. The survey covers 1,053 firms in five regions containing 14 provinces – Red River Delta (Ha Noi, Ha Tay, Hai Duong, and Hai Phong), the North Central Coast (Thanh Hoa, Nghe An), Mekong River Delta (Can Tho, Long An, Tien Giang), South Central Coast (Khanh Hoa, Da Nang) and South East (Ho Chi Minh City, Binh Duong, Dong Nai). The data are stratified by industry, establishment size and region with 808 enterprises selected from the manufacturing sector. Excluding observations with missing information, we have a total of 545 observations available for the analysis. No firm is owned 100% by Government/State.

Table 3.1 indicates that firms in low-technology and labor-intensive industries accounts for over 70% of the enterprise sample. Majority of them are medium and large firms, and mainly distribute in the South and the North of Vietnam.

**Table 3.1: Composition of Sample in Terms of Industry, Region and Firm Size**

Industry	Region			Total
	North	Centre	South	
Food	31	30	54	115
Textiles	24	02	65	91
Garments	32	14	54	100
Non metallic products	44	29	59	132
Metallic products	40	24	43	107
Total	171	99	275	545
<b>Firm size (number of employee)</b>				

<b>Industry</b>	<b>5 – 19</b>	<b>20 – 99</b>	<b>100+</b>	<b>Total</b>
Food	30	41	44	115
Textiles	16	44	31	91
Garments	9	29	62	100
Non metallic products	14	53	65	132
Metallic products	29	42	36	197
Total	98	209	238	545

The variables involved in the regression are defined as follows:

Labor productivity  $VA/L$  is measured by the value added per employee. Value added is the value of total sales minus costs of raw materials, intermediate goods, fuel and electricity. All values are for the year 2008.

The variable labor  $L$  is the number of total employees in the given year. It is the sum of permanent workers and adjusted temporary workers.<sup>33</sup> The number of adjusted temporary workers is the total number of paid short-term workers multiplied by the average length of employment for each of these workers and then divided by the average length of employment of permanent workers.

The capital input  $K$  is the firm's capital stock – the net value of fixed assets (net value of machinery, vehicles, equipments, land and building) by the end of the year 2008.

Part of total factor productivity is attributed to capital utilization. Firms can produce more with the same amount of inputs if they operate at higher capacity. The variable capacity utilization is percentage of capacity utilized.<sup>34</sup>

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<sup>33</sup>Enterprise Surveys Country Note Series (2011) shows that Vietnamese firms employ more temporary workers, on average nearly 36, compared with only 8 in other lower-middle-income economies.

<sup>34</sup>This variable is based on the question “In fiscal year, what was this establishment’s output produced as a proportion of the maximum output possible if using all facilities available (capacity utilization)?” in the World Bank Enterprise Survey – Manufacturing Module (2009).

Besides the traditional variables labor and capital, two additional sets of variables are constructed. One presents the technological issues that firms can choose to improve their technological capability in producing goods, another relates to the institutional environment in which firms operate.

Firms can build up a stock of technological knowledge through a knowledge accumulation process, for example, investing in research and development activities. The dummy variable *Patent*, a proxy variable for R&D, equals 1 for firms that have any patents registered in Vietnam or abroad and 0 if not. But more practically, firms can use technology from abroad through establishing ownership linkages or through licensing from foreign-owned companies in the case of developing countries. *Foreign* is a dummy variable, equals 1 if firms have foreign ownership and 0 otherwise. A firm is defined having foreign ownership when its foreign capital accounts for at least 10% of its total capital, following Nguyen and Ohta (2008). The dummy variable *License* is 1 for firms that use technology licensed from a foreign-owned company and 0 otherwise.

However, making use of technology or efficiently applying R&D results on production depends much on the educational level of the workers and the top manager as well as the firms' training activities. The dummy variable *Education of employee* is the average educational degree of a typical production worker in a firm, equals 1 if high school level or higher and 0 if under high school level. *Education of Top manager*, a dummy variable for top manager's educational level, is 1 if university degree or higher and 0 otherwise. The dummy variable *Training* equals 1 for firms offering formal training to their employees and 0 if not.

Furthermore, by attaining and maintaining the criteria of international quality certifications and owning a website, firms have the efficient ways to communicate, introduce themselves and get more chances to successfully access clients. These really make sense for firms in DCs to improve their performances and internationally integrate. In this analysis, *ISO certification* is a dummy variable that equals 1 if firms have an internationally-recognized quality certification such as ISO 9000, 9002 or 14000 and 0 otherwise. Another dummy variable *Internet* is 1 if firms own a website and 0 if not.

Institutions are increasingly viewed as key determinants of total factor productivity (Coe, Helpman, and Hoffmaister (2009) and, hence, of firm performance. The institutional environment in Vietnam has a profound influence on firm productivity (Tran, Grafton, and Kompas, 2009; Steer and Sen, 2010; Nguyen, Le, and Bryant, 2012). Based on the survey questionnaires and the feedbacks of respondents relating to the biggest obstacle faced by their firms, we focus on four institutions that have been emphasized in the literature for the regression analysis:<sup>35</sup>

- *Informal compete* equals 1 for firms report ‘Practices of competitors in the informal sector’ is obstacle for their business.
- *Access to Finance* is 1 if firms report ‘Access to finance’ which includes availability and cost, interest rate, fees and collateral requirements to be obstacle.
- *Labor problem* equals 1 if firms recognize that ‘Inadequately educated workforce’ severely hamper their current operations.
- *Governance* is 1 for firms report ‘Customs and trade regulations’, ‘Business licensing and permits’, ‘Tax administration’, ‘Tax rates’ severely hamper their performance.

Dummy variables are also introduced to control for variations across industries and regions as follows:

*Industry dummies*: because of the limited sizes of some original industries, we combine chemicals, plastics & rubber and non metallic mineral product into one group industry (called non metallic products) and basic metals, fabricated metal products and machinery and equipment

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<sup>35</sup>It is important to emphasize that these institutional variables mainly characterize the quality of institutions or institutional performance. They do not reflect forms of institutions or institutional designs. The paper of Coe, Helpman, and Hoffmaister (2009) is a good example of using institutional performance rather than institutional designs. They use various proxies for institutions such as ease of doing business, quality of tertiary education, patent protection, and legal origins. Le and Cheong (2010), however, indicate that the above institutional performance measures often change and are therefore relatively more prone to endogeneity problems as compared to institutional designs. Unlike Coe, Helpman, and Hoffmaister (2009), we create dummy variables instead of variables measured by index as various proxies for institutions. It seems to be a reliable approach. We do not find significant differences in the estimated coefficients with and without institutional variables in the models. The results are reported in *Appendix 3.1*.



into another group industry (named metallic products), making a new classification of five industries in the manufacturing sector. There are four industry dummies with Food industry as the reference group.

*Region dummies:* due to the differences in industrial development degree among regions, we combine Central North, Southern Central Coastal into one region (called the Centre) and Mekong River Delta and South East into another region (called the South). There are two region dummies with the North as the reference group.

Summary statistics of the variables used in the regression analyses are presented in Table 3.2. With respect to the sample makeup, the firm innovative activities are so limited. Only 5% of the enterprise sample have any patents registered and less than 10% use technology licensed from a foreign-owned company. Despite the educational degree of workers, on average, is high school level or higher, 41% of the firm surveyed offer formal training to their employees. About 44% of these enterprises own a website and 27% have an internationally-recognized quality certifications. Related to institutional problems, practices of competitors in the informal sector and access to finance are the main concerns of the enterprise sample. They account for over 50% of the obstacles firms face in their business.

**Table 3.2: Summary Statistics**

	<b>Obs</b>	<b>Mean</b>	<b>Standard Dev</b>	<b>Expected sign</b>
<b>Dependent variable</b>				
Log value added per employee	437	18.14	1.15	
<b>Traditional variables</b>				
Log Labor	544	4.41	1.44	+/-
Log (Capital/Labor)	431	18.06	1.45	+
Capital Utilization	534	0.77	0.18	+
<b>Technological variables</b>				
Patent	538	0.05		+
Foreign	543	0.13		+
License	542	0.09		+
Education of employee	538	0.50		+
Education of top manager	537	0.67		+

Training	541	0.41	+
ISO certification	544	0.27	+
Internet	545	0.44	+
<b>Institutional variables</b>			
Informal compete	541	0.54	-
Access to Finance	543	0.50	-
Labor problem	536	0.06	-
Governance	545	0.15	-

The coefficients of firm productivity and technological variables presented in Tables 3.3 confirm the correlations between firm productivity and technological factors. The statistics show that firm performance is positively correlated with the foreign ownership, license, education of employee, education of manager, labor training, ISO certificate, and owning a website. The result from Table 3.4 indicates the negative relationship between firm productivity and obstacles from institutional environment, however, none of these correlation coefficients is statistically significant.<sup>36</sup> Thus, it is imperative to control for variations across industries, regions and firm level productivity in order to obtain consistent estimates of the impact of technology and institutions on firm productivity.

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<sup>36</sup>We also check the multicollinearity among the predictors. The VIF values for these variables are lower than 2.5 (mean VIF = 1.43). There is no multicollinearity in our regressors.

**Table 3.3: Correlation of Firm Productivity and Technological Factors**

	<b>Log (VA/L)</b>	<b>Patent</b>	<b>Foreign</b>	<b>License</b>	<b>Educ of Emp.</b>	<b>Educ of Man.</b>	<b>Training</b>	<b>ISO Cer.</b>	<b>Internet</b>
<b>Log (VA/L)</b>	1.000								
<b>Patent</b>	0.051	1.000							
<b>Foreign</b>	0.228*	-0.012	1.000						
<b>License</b>	0.103*	0.047	0.131*	1.000					
<b>Educ of Emp.</b>	0.166*	-0.006	-0.024	0.125*	1.000				
<b>Educ of Man.</b>	0.140*	0.034	0.269*	0.163*	0.195*	1.000			
<b>Training</b>	0.115*	0.123*	0.107*	0.209*	0.116*	0.267*	1.000		
<b>ISO Cer.</b>	0.275*	0.111*	0.153*	0.242*	0.125*	0.342*	0.363*	1.000	
<b>Internet</b>	0.245*	0.120*	0.062	0.169*	0.153*	0.255*	0.329*	0.347*	1.000

*Note: \* indicates significance at the 5% level or lower*

**Table 3.4: Correlation of Firm Productivity and Institutional Factors**

	<b>Log (VA/L)</b>	<b>Informal compete</b>	<b>Access to Finance</b>	<b>Labor problem</b>	<b>Governance</b>
<b>Log (VA/L)</b>	1.000				
<b>Informal compete</b>	-0.073	1.000			
<b>Access to Finance</b>	-0.060	0.124*	1.000		
<b>Labor problem</b>	-0.029	0.020	0.075	1.000	
<b>Governance</b>	-0.067	0.123*	0.027	-0.032	1.000

*Note: \* indicates significance at the 5% level or lower*

### 3.5 Econometric Results

The empirical results are summarized in tables 3.5 and 3.6. Table 3.5 presents OLS results for three different models. The simple model is without the technological and institutional variables, the extended model includes all and the reduced one excludes insignificant technological variables.

In the simple model, all predictors are highly significant. Increasing returns to scale is a characteristic of production function in the manufacturing industries. The marginal product of capital is 0.279 and an elasticity of scale is 1.095. However, these parameters drop further once technological and institutional variables are in the extended model. Then we cannot reject constant return to scale and we obtain lower coefficients of capital and scale elasticities.

In the extended model, technological variables have signs as expected except *License* and *Training* (which are, however, both insignificant). This seems surprising, but may be the case of manufacturing industries in Vietnam. Labor training activity is necessary to improve the productivity but not in the short run because it might reduce the amount of labor involved in the production process while firms have to face the deadline in completing their production contracts. Moreover, most of the Vietnamese manufacturing enterprises are processors with cheap labor, they are not under pressure to have the new but costly technology through licensing. Furthermore, some technological variables, such as *Patent* and *Education of Top manager*, do not have statistically significant coefficients. By contrast, *Foreign*, *Education of employee*, *ISO certification* and *Internet* are positive and significant. This suggests that knowledge through R&D and the educational level of top manager may not improve the firm productivity at least in the short run. The regression results confirm the case that foreign owned firms have a significantly higher productivity than firms without foreign ownership.<sup>37</sup> We also show a positive impact of having internationally-recognized quality certificates on firm performance. Not surprisingly, the average educational level of workers and owning a website have positively significant effects on firm performance.

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<sup>37</sup>Long (2011) gives an empirical evidence that foreign firms increase their technical efficiency over time compared to domestic firms in Vietnam.

**Table 3.5: Results of OLS regressions**

<b>Dependent variable:</b>	<b>OLS Regressions</b>		
	<b>Simple model</b>	<b>Extended model</b>	<b>Reduced model</b>
Log value added per employee			
<b>Traditional variables</b>			
Log Labor	0.140 (0.039) ***	-0.056 (0.050)	-0.054 (0.047)
Log (Capital/Labor)	0.279 (0.043) ***	0.229 (0.044) ***	0.215 (0.043) ***
Capital Utilization	1.095(0.318) ***	1.023 (0.344) ***	0.972 (0.346) ***
<b>Technological variables</b>			
Patent		0.177 (0.218)	
Foreign		0.643 (0.155) ***	0.601 (0.152) ***
License		-0.125 (0.197)	
Education of employee		0.228 (0.110) **	0.206 (0.109) *
Education of top manager		0.151 (0.132)	
Training		-0.106 (0.123)	
ISO certification		0.317 (0.146) **	0.322 (0.139) **
Internet		0.377 (0.119) ***	0.376 (0.117) ***
<b>Institutional variables</b>			
Informal compete		-0.189 (0.110) *	-0.175 (0.106) *
Access to Finance		0.001 (0.114)	-0.014 (0.113)
Labor problem		-0.451 (0.236) **	-0.360 (0.185) *
Governance		-0.043 (0.160)	-0.048 (0.161)
Constant	11.736 (.866) ***	13.059 (0.973) ***	13.436 (0.950) ***
<b>R-squared</b>	0.22	0.29	0.28
<b>Number of observations</b>	378	361	366

*Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.*

*(2) Robust standard errors in parentheses.*

*(3) All regressions include industry and region fixed-effects.*

Institutional variables, on the contrary, have less influence on variations in firm productivity.<sup>38</sup> Although all variables get expected signs, *Accesses to Finance* from formal financial institutions (i.e., banking system) and *Governance* do not have any significant impact on firm productivity. The common knowledge that external financing in Vietnam is mostly

<sup>38</sup>This judgment is also confirmed by Long (2011) that medium and large manufacturing enterprises are less sensitive to investment climate obstacles in Vietnam.

limited to state-owned firms and is hard to obtain for the others.<sup>39</sup> Furthermore, high collateral requirements as a percentage of the loan as well as complicated and long-lasting procedures prevent private enterprises from relying on bank to finance for working capital and investment purposes. These firms prefer informal financial systems to overcome their financing constraints. Also they try to reduce the need for loans through more efficient management. These reasons explain for the insignificant coefficient of the *Accesses to Finance* variable. The statistically insignificant coefficient of *Governance* variable is, however, still in doubt. Tran, Grafton, and Kompas (2009) find that improvement in government practice could increase the daily value-added of an average firm in Vietnam. By contrast, the coefficients of *Informal compete* and *Labor problem* are negative and significant. These results, to some extent, are similar to the study of Hallward-Driemeier and Xu (2006) for Chinese manufacturing firms.<sup>40</sup> It can be said that due to accelerating integration into the world economy and becoming an official member of WTO in early 2007, the investment climate and business environment of Vietnam have been improved to meet the new requirements (see Dordi et al., 2008; MPI, 2010). However, these improvements are not enough and synchronous (Dang, 2009). Hence, the impact of institutional factors on firm productivity should be considered carefully.

Firms can face different conditions and cope with different problems at different levels of productivity. Technological activities may be organized differently in low- and high-productivity firms. Institutional problems affect firms in different ways depending on firm level productivity. Because the results from OLS regressions just give the average relationship between technology, institutions and productivity, we further apply the quantile regressions. This allows us to examine the differential impact of technology and institutions on firm productivity across three quartiles (25th, 50th, 75th) of the productivity distribution. Quantile methods are also preferred to least square estimation due to the higher degree of robustness in estimation as they are less sensitive to outlying observations. To detect and correct for heteroscedasticity, we combine quantile regressions with bootstrap methods.

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<sup>39</sup>This issue is especially relevant in socialism-oriented nations, which have strong policies that favor the state sector.

<sup>40</sup>Hallward-Driemeier, Scott and Xu (2006) show that labor market flexibility weakly significant while there is no evidence that average access to finance affects firm performance.

**Table 3.6: Results of Quantile Regressions**

<b>Dependent variable:</b>	<b>Quantile Regressions</b>		
	<b>Lower quartile</b>	<b>Median</b>	<b>Upper quartile</b>
Log value added per employee			
<b>Traditional variables</b>			
Log Labor	-0.084 (0.055)	-0.057 (0.054)	-0.116 (0.079)
Log (Capital/Labor)	0.210 (0.059) ***	0.174 (0.051) ***	0.225 (0.056) ***
Capital Utilization	0.659 (0.384) *	0.714 (0.397) *	0.716 (0.423) *
<b>Technological variables</b>			
Foreign	0.490 (0.177) ***	0.532 (0.202) ***	0.910 (0.237) ***
Education of employee	0.181 (0.128)	0.237 (0.129) *	0.195 (0.172)
ISO certification	0.458 (0.156) ***	0.417 (0.156) ***	0.445 (0.189) **
Internet	0.428 (0.159) ***	0.406 (0.144) ***	0.368 (0.167) **
<b>Institutional variables</b>			
Informal compete	-0.001 (0.145)	-0.139 (0.134)	-0.299 (0.164) *
Access to Finance	-0.115 (0.119)	-0.039 (0.144)	-0.093 (0.145)
Labor problem	0.306 (0.254)	-0.375 (0.216) *	-0.923 (0.502) *
Governance	-0.290 (0.171) *	-0.099 (0.262)	0.086 (0.204)
Constant	13.132 (1.236) ***	14.358 (1.065) ***	14.323 (1.169) ***
<b>Pseudo R-squared</b>	0.16	0.18	0.21
<b>Number of observations</b>	366	366	366

*Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.  
(2) All regressions include industry and region fixed-effects.  
(3) Bootstrap standard errors (with 100 replications) in parentheses.*

Table 3.6 presents results for the different quartiles of the distribution of firm productivity, namely the median regression, the lower and upper quartiles. Comparing the average and median firms, the size, sign and statistical significance of coefficients do not differ considerably.<sup>41</sup> However, the more interesting picture emerges by the different results for low- and high-productivity firms. Both types of firms share the characteristic of constant returns to scale but the low-productivity firms have a lower marginal productivity of capital. Looking at the

<sup>41</sup>We note that the above institutional variables may be endogenous as they could be affected by firm performance. We lack good instruments for these variables, however, the similar results of OLS and median regressions after controlling for industry and region fixed-effects and correcting for heteroscedasticity give evidence that our estimations might not be affected by endogeneity problem.

technological variables, the roles of foreign ownership, ISO certificate and owning a website are robust in different kinds of specifications, although the coefficient sizes differ. The differences between the low- and high-productivity firms are most prominently revealed through institutional variables. Practices of competitors in the informal sectors and the inadequately educated workforce hamper high-productivity firms while the obstacles caused by business licensing and permits, customs and trade regulation, tax rates and tax administration (i.e., governance) hurdle the performance of low-productivity firms.

### **3.6 Conclusion**

Using a cross-section data set of Vietnamese manufacturing industries we investigate the productivity effects of technology and institutions. Our results show that the positive impacts of indirect technological factors such as foreign ownership, ISO certificate, owning a website and educational level of employee on firm productivity are robust to different types of specifications. Furthermore, there is no evidence that access to finance appears to affect firm performance and other institutional variables such as practices of competitors in the informal sectors, labor market issue (i.e., inadequately educated workforce), obstacles in policy and administration have different impacts depending on firm level productivity. The results also point out the problem of constant returns to scale in Vietnamese manufacturing industries and the limitations of innovative activities and training labor in firms. These findings are in line with the research of Goedhuys, Janz and Mohnen (2006), who argue that firm productivity differences are not only explained by differences in production factors or in technology, but also by the role of institutions.

The main policy conclusion from this analysis is that the effects of institutions on firm productivity can differ substantially across firm level productivity. We suggest that improvements in public governance quality, education reform oriented to practical knowledge and working skills that suit firm labor demand and effective competition in the marketplace can help to increase firm productive performance.



## Appendix to Chapter 3

### Appendix 3.1: Results of OLS and Median Regressions

Dependent variable:	OLS Regressions		Median Regressions	
Log value added per employee	1	2	3	4
<b>Traditional variables</b>				
Log Labor	-0.029 (0.045)	-0.054 (0.047)	-0.044 (0.059)	-0.057 (0.054)
Log (Capital/Labor)	0.222 (0.042) ***	0.215 (0.043) ***	0.178 (0.056) ***	0.174 (0.051) ***
Capital Utilization	0.955 (0.321) ***	0.972 (0.346) ***	0.883 (0.343) **	0.714 (0.397) *
<b>Technological variables</b>				
Foreign	0.621 (0.145) ***	0.601 (0.152) ***	0.568 (0.221) **	0.532 (0.202) ***
Education of employee	0.185 (0.109) *	0.206 (0.109) *	0.217 (0.134) *	0.237 (0.129) *
ISO certification	0.328 (0.136) **	0.322 (0.139) **	0.469 (0.147) ***	0.417 (0.156) ***
Internet	0.346 (0.114) ***	0.376 (0.117) ***	0.377 (0.148) **	0.406 (0.144) ***
<b>Institutional variables</b>				
Informal compete		-0.175 (0.106) *		-0.139 (0.134)
Access to Finance		-0.014 (0.113)		-0.039 (0.144)
Labor problem		-0.360 (0.185) *		-0.375 (0.216) *
Governance		-0.048 (0.161)		-0.099 (0.262)
Constant		13.436 (0.950) ***		14.358 (1.065) ***
<b>R-squared</b>	0.28	0.28		
<b>R-squared Pseudo</b>			0.18	0.18
<b>Number of observations</b>	376	366	376	366

*Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.*

*(2) All regressions include industry and region fixed-effects.*

*(3) Robust standard errors in parentheses for OLS.*

*(4) Bootstrap standard errors (with 100 replications) in parentheses for median regressions.*

## 4 Investment Climate and Technical Efficiency in Vietnamese Manufacturing

**ABSTRACT.**<sup>42</sup> This chapter identifies the constraints of the investment climate on Vietnamese manufacturing technical efficiency. The empirical results show that a good quality of infrastructure and finance, an investment-friendly and transparent environment, a safe society encourage firm technical efficiency. The impacts of the investment climate on firm technical inefficiency are robust to various kinds of specifications. The results highlight that foreign firms attain improvements in production efficiency over time compared to domestic firms. Also large firms as well as foreign firms get benefits from their exports in terms of technical efficiency. However, no strong evidence supports technical efficiency improvement in Vietnamese manufacturing firms after this country became an official WTO member in early 2007.

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<sup>42</sup>Long, P. D. (2011). Investment Climate and Technical Efficiency: Evidence from Vietnamese Manufacturing. *Proceedings of the University of Mauritius and WTO Chairs Programme International Conference on International Trade and Investment*, ISSN: 16941225, Mauritius.

## 4.1 Introduction

In the literature, it is now well accepted that investment climate can significantly and adversely impact productivity, growth and economic activity. The investment climate is defined by the World Bank (2005) as “the set of location-specific factors shaping the opportunities and incentives for firms to invest productively, create jobs and expand.” Key factors affecting the investment climate are physical infrastructure, security, regulatory framework, access to finance, human capital, technological and innovation support, competition and property rights.

A better investment climate improves bureaucratic performances and predictability, and contributes to the effective delivery of public goods that are necessary for productive business (The World Bank, 2004). Using the World Bank enterprise surveys data, Escribano and Guasch, (2005) for Guatemala, Honduras and Nicaragua; Kinda, Plane, and Véganzonès-Varoudakis (2009) for the Middle East and North Africa find clear evidence that the investment climate matters for firm performance.<sup>43</sup> Interestingly, their findings come from different approaches. Escribano and Guasch study the influence of investment climate on productivity of the whole manufacturing in the three countries and then breakdown the data by country, size and age of firms, while Kinda, Plane, and Véganzonès-Varoudakis are in favour of industry specific technical efficiency impact of investment climate.

There is a somewhat poorer literature on firm productive performance effects of investment climate in transition economies. Vietnam is an interesting case to analyze in this context. After a short period of over-excitement in the first time of WTO membership from the early 2007, Vietnam has worried about the overall economic situation. Recent achievements are lower than state's potentials and capability. Economic growth quality, productivity, efficiency and competitiveness are low and improved slowly (Ninth Central Committee Conference, 2009). In fact, this country has suffered from negative impacts of global financial crisis and recession. GDP growth of the whole economy and GDP growth by economic sectors decreased, especially there was a tremendous decline of manufacturing.

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<sup>43</sup>Another related study is by Kinda (2010), who focuses on the relationship between investment climate and Foreign Direct Investment (FDI) in developing countries. She shows that constraints related to investment climate such as physical infrastructure problems, financing constraints, and institutional problem discourage FDI.

It has come to be widely agreed that the weaknesses of the economy and the manufacturing sector that became more serious in the context of global economic crisis could be overcome to large extents if the investment climate had not created obstacles to economic development (Vietnamese Business Forum Report, 2011). However, the empirical evidence on the constraints of the investment climate on the efficiency of Vietnamese enterprises is rather limited. For example, Nguyen and Nishijima (2009), using firm-level cross-section data set surveyed by the World Bank in Vietnam in 2005, find that obstacles in policy, administration and social environment hinder firms from increasing their intensity of exports, but not the cases of constraints from physical infrastructure and factor markets.

Long (2012) investigates the productivity effects of technology and institutions, using a cross-sectional manufacturing firm-level data set derived from the World Bank survey in Vietnam in 2009. He documents that firm productivity differences are not only explained by differences in production factors or in technology, but also by the role of institutions. He finds no evidence of access to finance appears to affect firm performance and other institutional variables such as practices of competitors in the informal sectors, labor market issue (i.e., inadequately educated workforce), obstacles in policy and administration have different impacts depending on firm level productivity.

As for studying the effects of the investment climate on firm efficiency, that to some extent, directly related to Vietnam, Kinda (2009) shows that foreign firms benefit from better investment climate, they are more efficient than domestic firms and firms (particularly small local firms) that sell more of their production to multinationals are more efficient.<sup>44</sup>

Unlike the earlier studies use one-step stochastic frontier analysis with pooled data from developing countries, this paper applies a different econometric approach for a specific country to be able to identify the causal effects of investment climate on technical efficiency. We show that, for a particular country, time-varying inefficiency model for panel data is better than pooling data one-step stochastic frontier analysis in considering the whole manufacturing or industry specific technical efficiency impact of investment climate. Additionally, using the unique and latest data from the investment climate surveys of the World Bank in Vietnam in

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<sup>44</sup>This paper uses manufacturing firm data from the World Bank surveys in five developing countries (Brazil, Morocco, Pakistan South Africa, and Vietnam) in the mid-2000s.

2005 and 2009, it is possible to link our empirical work to the recent literature that has put the investment climate at the center of economic performance (see Kinda, Plane, and Véganzonès-Varoudakis, 2011)) by providing more specific evidence.

The suitable models and the quality of the data allow us to investigate the improvement of technical efficiency by industry and the whole Vietnamese manufacturing after three years deeper integration to the world economy. Moreover, we identify whether the effect of investment climate on firm efficiency is different depending on firm size, export status and ownership. To our knowledge, these have not been investigated in earlier studies.

Previewing the empirical results we find, after controlling for the possible endogeneity of the investment climate variables and also controlling for firm specific characteristics, that the investment climate matters for firm performance. A good quality of infrastructure and finance, an investment-friendly and transparent environment, a safe society encourage firm technical efficiency. Some industries, more exposed to international competition, are more sensitive than others to investment climate deficiencies. Furthermore, the impacts of investment climate on firm technical inefficiency are robust to various kinds of specifications.

The rest of the chapter is organized as follows. Section 2 provides a context for the empirical analyses by reviewing the manufacturing and the impacts of investment climate on firm performance in this sector. Section 3 presents the literature review relating to the paper. Section 4 and 5 lay down the main model to be used as framework for the empirical analyses and the data, variables construction. Section 6 discusses the main econometric results. Finally, the conclusion is presented in section 7.

## **4.2 Manufacturing Sector and Investment Climate in Vietnam**

### **4.2.1 Manufacturing Sector**

Vietnam has been in the early stage of industrialization and modernization process with increasing importance of production activities in the economy. The manufacturing industries have occupied the largest share in the GDP growth compared with others. They made around 32% of GDP growth for the periods 2001 – 2005 and 2006 – 2009.

**Table 4.1: Contribution of Economic Sectors and Manufacturing to GDP Growth**

*(in percentage of overall GDP growth)*

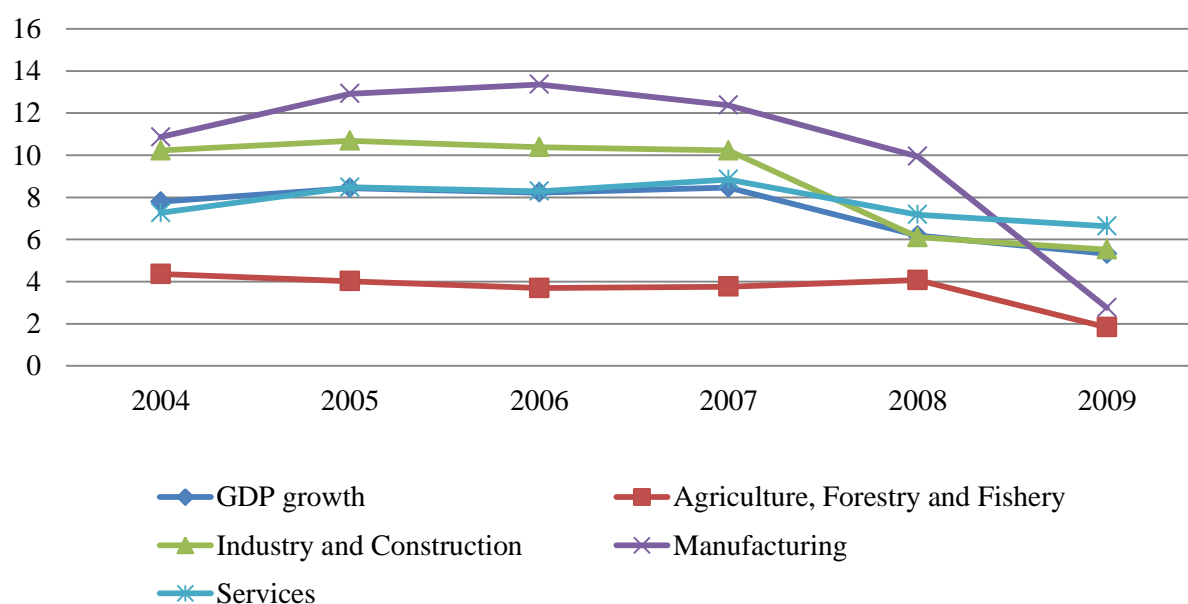
	1996 – 2000	2001 – 2005	2006 – 2009
Agriculture, Forestry and Fishery	15.9	11.0	8.8
Services	35.0	37.9	44.7
Industry and Construction	49.1	51.1	46.5
<b>+ Manufacturing industries</b>	<b>27.2</b>	<b>31.7</b>	<b>31.9</b>

*Source: Nguyen and Pham, 2010*

However, the stagnancy in recent economic growth and the prolonged weak competitiveness of the economy indicates the limitations of manufacturing. They are low capital efficiency, labor productivity and value added, low employment creation relative to employment destruction in agriculture, heavy dependence on external markets for outputs and major inputs (Nguyen and Pham, 2010; MPI, 2010).

**Figure 4.1: GDP Growth by Economic Sectors and Manufacturing**

*(in percentages 2004 - 2009)*



*Source: Ministry of Planning and Investment – MPI (2010).*

The years 2007 – 2009 witnessed remarkable changes in Vietnam’s economic performance, from social issues to economic institutions. In the first three years of WTO membership and deeper integration to the world economy, the vulnerability to negative external shocks of the economy is more apparent. GDP growth of the whole economy and GDP growth by economic sectors decreased, especially there was an enormous decline of manufacturing from 12.37% in 2007 to 2.76% in 2009 because of the global financial crisis and rising energy price.

Different from other industries, Vietnamese manufacturing is mostly affected by international integration owing to its export-oriented characteristics. Manufacturing for domestic market was fiercely competed by foreign goods with decreasing import tax under WTO and others’ commitments. Meanwhile, manufacturing for export faced declined demands from foreign markets in the period. For example, compared to 2008, agriculture intensive industries (Food and Beverage) were influenced most seriously with the growth rate in 2009 declined 63%. The growth rate of capital intensive industries (Paper, Chemical, Plastics and Rubber, Non metallic mineral, Machinery and Equipment) was around a half and of labor intensive (Apparel and Leather, Textiles) was 40% decreased.

The improvement in production effectiveness of manufacturing industries has not been as expected when Vietnam has engaged into regional and world economy. In general, manufacturing industries have not clearly improved the technology, diversified and raised value added for Vietnamese products despite increasingly competitive pressures from globalization (MPI, 2010).

#### **4.2.2 Investment Climate in Vietnam**

The weaknesses of the manufacturing sector that became more serious in the context of global economic crisis could be overcome to large extents if the investment climate had not created obstacles to economic development. The Table 4.2 presents the scores of main indicators of Vietnam’s investment climate and shows up the limitations of its business environment. It highlines cases with rankings lower than the median of the sample countries.

**Table 4.2: Ranking of Ease of Doing Business for Vietnam versus the Regional Average**

	2005		2009		
	Vietnam (Out of 181)	Average (6)	Vietnam (Out of 175)	Average (9)	Average (6)
Overall ranking	<b>98</b>	66	<b>92</b>	87	66
Ranking for 10 factors					
Starting a business	<b>89</b>	75	<b>108</b>	106	94
Dealing with licenses	28	70	67	78	62
Employing workers	<b>137</b>	81	90	78	80
Registering property	30	56	37	87	57
Getting credit	76	50	43	75	58
Protecting investors	<b>170</b>	70	<b>170</b>	81	61
Paying taxes	<b>116</b>	75	<b>140</b>	74	82
Trading across borders	68	54	67	59	34
Enforcing contracts	<b>90</b>	71	42	89	66
Closing a business	<b>105</b>	77	124	101	86

*Source: Doing Business Database of World Bank, 2009 and Urata and Ando, 2009.*

*Notes: Average ranking is calculated for a comparison among 10 factors. Average (9) shows average ranking for nine ASEAN economies (Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand, and Vietnam). Average (6) shows average ranking for six ASEAN economies that appear in both year (Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam).*

The position of Vietnam in overall ranking is not improved in 2009 compared with that in 2005. In particular, some items tend to be better such as getting credit, enforcing contracts while others are even worse. The most serious problems are in the areas of starting and closing a business, protecting investors, and paying taxes. Relating to trade activities, relative evaluations for trading across borders are improved from 54<sup>th</sup> to 34<sup>th</sup> on average in ASEAN 6 but seem not to be the case of Vietnam, 68<sup>th</sup> out of 175 in 2005 and 67<sup>th</sup> out of 181 in 2009. These may reveal the fact that Vietnam has not made use of the facilitation of international integration and trade liberalization in this period.

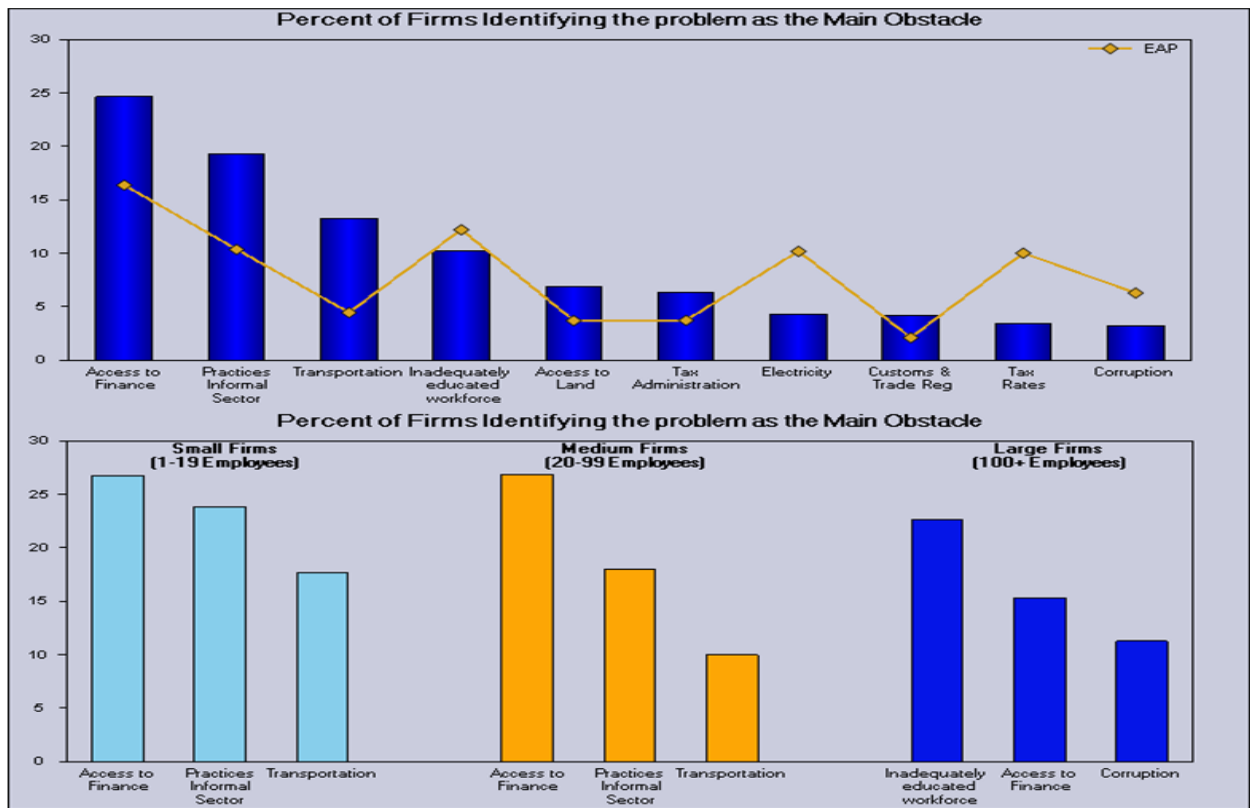
Urata and Ando (2009) emphasize main striking problems of Vietnamese investment climate:



- Underdeveloped infrastructure, shortages of human resources, and insufficient investment incentives.
- Non-transparency in policies and regulations relating to investment which are sudden and/or frequent changes without notification in advance.
- Complicated and/or delayed procedures concerning doing business in the fields of implementing on establishment, taxation, custom clearance, firm entry and exit as well as inconsistent interpretation and implementation of various regulations.

The following figure presents the biggest business environment obstacles as perceived by firms from the Enterprise Survey in Vietnam 2009. The first graph shows the top ten constraints in Vietnam versus the regional average (East Asia Pacific - EAP), the second presents the top three constraints broken down by different firm sizes.

**Figure 4.2: Business Environment Obstacles in Vietnam**



Source: The World Bank Enterprise Survey – Vietnam Country Profile 2009

The result from the survey indicates the main problems for firm performance such as getting credit, practices of competitors in the informal sector, infrastructure, workforce and economic

governance. These bottlenecks are reported as hindering manufacturing firms to operate efficiently.

### **4.3 Technical In/Efficiency and Stochastic Frontier Analysis**

Productivity and efficiency are economic aspects of firm performance and have been frequently used interchangeably in the media. Coelli et al. (2005) present that productivity can be decomposed into three components: technical efficiency, scale economies, and technical level. The technical efficiency refers to the ability to avoid wastes, either by producing as much output as technology and input usage or by using as little input as required by technology and output production. Hence, the analysis of technical efficiency can be output-oriented or input-oriented. The output-oriented technical efficiency refers to a firm's ability to obtain maximum output from a given amount of inputs, given the technology (Fried, Lovell, and Schmidt, 2008). According to this definition, the output-oriented technical inefficiency could be defined as a situation where it is possible for a firm, given the know-how, to produce a larger output from the same inputs without increasing the amount of other inputs.<sup>45</sup>

Kumbhakar and Lovell (2000) provide the main reason for using technical efficiency as opposed to other types of efficiency. Different from cost, revenue and profit efficiency, technical efficiency is a purely physical notion that can be measured without the information of price and the position of an appropriate behavioral objective on producers.

Formally, the level of technical efficiency is measured by estimating the best practice efficient frontier based on a relevant sample of firms. Thus, the firms on the frontier are considered the best practice firms in the market and the efficiencies of others are measured in comparison to the efficient frontier.

Kalijaran and Shand (1999) explain a basic approach to calculate technical efficiency

$$TE = \text{Actual output} / \text{Maximum possible output} \quad (4.1)$$

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<sup>45</sup>Unless otherwise stated, the output-oriented technical inefficiency will be referred to as technical inefficiency for the remainder of the paper.

In this equation, the actual output is observable but maximum possible output is not and must be estimated. A ratio of one in the above equation means that the firm is technically efficient and operates on the production frontier.

Farrell (1957) is the pioneer who firstly develops the technique to empirically measure the production frontier. He uses a linear programming method to obtain the production frontier that is called deterministic frontier. This method forms the basis of the Data Envelopment Analysis (DEA) method by Charnes, Cooper and Rhodes (1978). In this deterministic approach, no account is taken of measurement errors and other sources of random noise. All deviations from the frontier are assumed to be the result of technical inefficiency (Coelli et al., 2005).

The alternative to the DEA, the stochastic frontier analysis (SFA), originated by Meeusen and van den Broeck (1977) and Aigner, Lovell and Schmidt (1977), uses econometric methods to estimate the frontier. The SFA uses econometric techniques to estimate the error term of the production function that is split into two uncorrelated components, providing the basis for statistical inference. One is typical statistical noise which is a double-sided random error, which presents the external shocks to the firm. The other represents the technical inefficiency which is assumed to follow a one-sided distribution. In this approach, the factors that are beyond the control of management such as business environment or investment climate, socio-economic and demographic factors and other effects can be distinguished from inefficiency. This is the key reason why stochastic frontier approach is more relevant in the context of this study.

#### **4.4 Empirical Specifications**

Firm technical inefficiency can be explained by exogenous factors which affect either the technology of production or the firm ability to transform inputs into outputs (Kinda, Plane, and Véganzonès-Varoudakis, 2011). In the literature, these factors can be estimated in two different ways. A two-step procedure firstly estimates the stochastic production frontier and inefficiency without exogenous variables, and then the estimated inefficiency is regressed against exogenous variables in the second step. However, Kumbhakar and Lovell (2000) explain that there is inconsistency in the two-step approach because the second step regression is based on the biased estimated inefficiency from the first step. If the regression in the second step is not leant on true inefficiency then it is not meaningful to understand the determinants of variation in inefficiency.

There is another way suggesting to estimate using maximum likelihood techniques the production function frontier and the factors that explain technical inefficiency at the same time, called one-step stochastic frontier analysis. For this study, we follow one-step approach means that the parameters of the technical inefficiency and stochastic frontier model are jointly estimated but extend to the case of panel data assuming technical efficiency is time-varying.

#### 4.4.1 Time-varying Inefficiency Models for Panel Data

According to Schmidt and Sickles (1984), there are three main difficulties concerning maximum likelihood methods and consistency of estimates from using cross-sectional data. First, firm technical inefficiency can be estimated inconsistently. Second, distributional assumptions of technical inefficiency are required. Third, it may be incorrect to assume that inefficiency is independent of the regressors. Each of these difficulties is potentially avoidable if a ‘satisfactory’ panel data set is available (Henderson, 2003).

Coelli et al. (2005) present the three potential gains from using panel data to measure technical inefficiency. First, relaxing some of the strong distributional assumptions that are necessary to disentangle the separate effects of inefficiency and noise. Next, getting consistent predictions of technical efficiency. Finally, showing changes in technical efficiencies over time.

For panel data models, it is common to classify different structures due to whether technical inefficiency is time-invariant or time-varying. For many industries the independence assumption is unrealistic, it is expected efficient firms to remain reasonably efficient from period to period, and that inefficient firms improve their efficient levels over time (Coelli et al., 2005). Therefore, we estimate the Time-varying Inefficiency Models and check whether the technical efficiency is improved after Vietnam joined in WTO.

Consider a stochastic frontier analysis of panel data:

SFA assumes that each firm potentially produces less than it might due to a degree of inefficiency.

$$Y_{rsit} = f(L_{rsit}, K_{rsit}, D_r, D_s, D_t, \beta) f(Z_{rsit}, \delta) \exp(V_{rsit}) \quad (4.2)$$

Where  $f(Z_{rsit}, \delta)$  is the degree of efficiency for firm  $i$  and in the interval  $(0,1]$  and  $Z_{rsit}$  presents factors explaining technical inefficiency such as investment climate (IC) and firm-specific characteristics (C).

Taking the natural log of both sides of (4.2), the general empirical equation in linear form that the parameters of the technical inefficiency and stochastic frontier model are jointly estimated can be written as follows:

$$\ln Y_{rsit} = \ln f(L_{rsit}, K_{rsit}, \beta) + D_r + D_s + D_t + V_{rsit} - U_{rsit} \quad (4.3)$$

$$\text{where } \mathbf{U}_{rsit} = \mathbf{Inf}(\mathbf{Z}_{rsit}, \boldsymbol{\delta}) = \boldsymbol{\delta}_{IC} \ln \bar{IC} + \boldsymbol{\delta}_C \ln C_{rsit} + \boldsymbol{\delta}_o + \boldsymbol{\varepsilon}_{rsit}$$

with

$Y_{rsit}$ : Value added of the firm  $i$  in region  $r$  and sector  $s$  during year  $t$

$\beta, \delta$ : Parameters of the equation

$L_{rsit}, K_{rsit}$ : Production factors – Labor, Capital

$D_r, D_s, D_t$ : dummies for region, sector and year

$V_{rsit}$ : External shocks and assumed to be independently  $N(0, \sigma_v^2)$  distributed

$\boldsymbol{\varepsilon}_{rsit}$ : error term defined by the truncation of normal distribution with zero mean and  $\sigma^2$  variance

Two different specifications of the technical inefficiency  $U_{it}$  (for simplicity,  $U_{it}$  is used instead of  $U_{rsit}$ ) term represent for time-invariant and time-varying technical inefficiency. In the time-invariant models,  $U_{it} = U_i$  with  $U_i \stackrel{iid}{\sim} N^+(\mu, \sigma_u^2), V_{it} \stackrel{iid}{\sim} N(0, \sigma_v^2)$  and  $U_i, V_{it}$  are distributed independently of each other and the covariates in the model.

The time-varying decay specifications allow the technical efficiency levels to change systematically over time. These type of models take the form:

$$U_{it} = f(t) \cdot U_i \text{ where } f(t) = \exp[-\eta(t - T_i)] \text{ (see Battese and Coelli, 1992)} \quad (4.4)$$

Where  $T_i$  is the last period in the  $i$ -th panel,  $\eta$  is the decay parameter. When  $\eta = 0$ , the time-varying model reduces to time-invariant; if  $\eta > 0$ , the degree of inefficiency decreases over time and vice versa for  $\eta < 0$ .

A predictor of the technical efficiency for the  $i$ -th firm is defined as:

$$TE_i = E\{\exp(-U_i) | (V_i - U_i)\} = \left\{ \frac{1 - \Phi(\sigma_* - \mu_{*i}/\sigma_*)}{1 - \Phi(-\mu_{*i}/\sigma_*)} \right\} \exp\left(-\mu_{*i} + \frac{1}{2}\sigma_*^2\right) \quad (4.5)$$

with  $\mu_{*i} = -(V_i - U_i) - \frac{\sigma_v^2}{\sigma_u}$  and  $\sigma_* = \sigma_v$

and  $\Phi(\cdot)$  represents the distribution function of the standard Gaussian random variable.

## **4.5 Data Descriptions and Variables**

### **4.5.1 Descriptions of Data**

The data are drawn from the enterprise surveys in Vietnam conducted by the World Bank in 2005 and the period 2009 – 2010.<sup>46</sup> These surveys collect the data on inputs and outputs, firm characteristics in the last fiscal year with retrospective basis (one to three years before), and as well as quantitative and qualitative indicators of the investment climate. They provide subjective evaluations of obstacles and other objective information of cost and productivity on the themes of infrastructure, human capital, governance, and finance.

The database for estimating is an unbalanced panel of Vietnam in the period 2003 – 2004 and 2008/2009. For the investment climate (IC) variables, observations are available for the years 2004, 2008 and 2009 but not for 2003. In order to use as many observations as possible to benefit from the law of large numbers, it is able to assume that, unless there is a structural break, the IC variables do not change much from one year to the next. In fact, what can change from one year to the next is the reaction of the firm facing a certain investment climate, but that depends on the firm's perceptions of the impact of investment climate and on the time required for firm to implement the corresponding adjustments (see Escribano and Guasch, 2005; Kinda, 2009). Under these hypotheses, it is possible to allow the coefficients of certain IC variables to change from one year to the next while maintaining the values of the IC variables constant during 2003 and 2004. For analysis, we get 2,809 observations available. In this sample, enterprises come from 13 manufacturing industries in five regions Red River Delta, Central North, Mekong River Delta, Southern Central Coast, and South East.

### **4.5.2 Variables Descriptions**

All variables are expressed in logarithms, except the ones that are expressed as a percent, and all nominal variables are deflated by the producer price index (PPI). The dependent variable

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<sup>46</sup>The Second World Bank Enterprise Surveys took place in Vietnam from June 2009 to January 2010.

(*Value added*) and two production function variables (*Labor, Capital*) are in Vietnam Dong (VND) and adjusted by PPI base year 2000. In accordance with the theory, firm characteristics such as *Export, Foreign ownership, ISO certificate, Training employee, Manager's experience, Capacity utilization, Internet access, and Working hours* are included. The explanatory variables of interest – investment climate variables are distinguished into four categories: Infrastructure, Business-Government Relations, Crime and Legal Environment, Finance and Labor, depend on the context of Vietnam and available data from the two enterprise surveys. The quality of Infrastructure consists of four variables: Obstacle for the operation of the enterprise caused by *Duration of power outages, Losses due to power outages, Electricity problem and Days to clear customs for imports*. In fact, infrastructure deficiencies are considered as a burden for enterprise operations and investment (World Bank, 2004). Business-Government Relations are defined by six variables: Obstacle for the operation of the enterprise caused by *Payments to deal with bureaucracy faster, Percentage of time spent dealing with regulations, Tax administration problem, Customs and Trade regulation problem, Permit problem and Corruption problem*. Crime and Legal Environment are represented by three variables: Obstacle for the operation of the enterprise caused by *Security cost, Crime problem, and Practices of competitors in informal sectors*. These above reveal the capacity of the government to provide an investment-friendly and transparent environment and a safe society to the business sector. Finance and Labor include four variables: Obstacle for the operation of the enterprise caused by *Access to finance, Loan, Labor regulation problem and Worker problem*. Finance and human capital constitute essential factors of firm performance. Access to finance and the quality of educated workforce are always the main concerns of manufacturing in emerging economies.<sup>47</sup>

### **4.5.3 Endogeneity of the Investment Climate Variables**

One of the econometric problems that we have to face in estimating models above is the possible endogeneity of the IC variables due to the qualitative nature of investment climate factors (Kinda, Plane, and Véganzonès-Varoudakis, 2009). Following the methods presented by Escribano and Guasch (2005), the two complementary procedures are used to correct for the

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<sup>47</sup>See the Appendix for definition and construction of all variables used in this chapter.

endogeneity of the IC variables.<sup>48</sup> First, the region-industry average of the firm level investment climate variables ( $\bar{IC}$ ) instead of the crude IC variables is created to reduce the degree of endogeneity of the IC variables. This also helps to mitigate the effect of missing IC observations for some firms. Then the investment climate perception variables are used together with IC variables.<sup>49</sup> Furthermore, in some cases, we restrict the sample to the firms that are less likely to choose their location by excluding large firms or foreign ownership firms.

#### **4.5.4 Investment Climate Variables Selection**

The econometric methodology applied for the selection of the IC variables goes from the general to the specific (e.g., Escribano and Guasch, 2005). Starting from a general model with all variables (in *Appendix 4.1 - Appendix 4.4*) included at once, we then reduce this general model to a simple one with relevant (significant) variables. In the reduction process, we do not delete all insignificant variables at once. In detail, the less significant variables are eliminated one by one but to ensure the existence of at least one IC variable from each broad category (Infrastructure, Business-Government Relations, Crime and Legal Environment, Finance and Labor) for interpretive purposes. Then the final estimated model is efficiently estimated once insignificant or irrelevant variables are deleted. The estimated explanatory variables of the regression models of Table 4.4 to 4.7 are selected in this way. These regression results are consistent and allow interpreting the estimated coefficients and their signs with confidence.

## **4.6 Empirical Results and Discussion**

We firstly estimate the stochastic production frontiers by industry to discover which sectors have technical inefficiency component. Next, using time-varying inefficiency models we

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<sup>48</sup>Enterprise surveys contain production function data for the last year and one to three years before. However, investment climate indicators refer to only one year. Hence, it is not possible to use the natural instruments like lagged IC variables as traditional instrumental variable approach.

<sup>49</sup>The investment climate perception variables present firms' feedbacks on obstacles they face for operation and growth, ranked from 'no problem' through 'minor', 'moderate', 'major' and 'very severe' problems. Endogeneity of the perception variables is also taken into account using region-sector average. These variables are weak instruments for IC variables in the best case. They are not highly correlated to IC variables.



consider what the impacts of investment climate are on these inefficiency sectors, and finally we provide further analyses and robustness checks.

Table 4.3 presents the estimation results of the production frontier by industry. Unlike other manufacturing industries, the sum of the coefficients relative to labor and capital is just equal or less than one in Plastics and Rubber, Textiles. The two industries are probably the most exposed to the competition in the developing country like Vietnam.

Furthermore, stochastic frontier analysis displays that eight out of thirteen industries get technical inefficiency. They are Apparel and Leather (A & L), Paper, Food, Textiles, Plastics and Rubber (P & R), Non Metallic Mineral Products (N M M), Machinery and Equipment (M & M), and Construction Materials (C M).

The manufacturing sector is heterogeneous so that firms in the various industries could be affected differently by the same factors. Table 4.4 and 4.5 present the impacts of firm characteristics and investment climate on firm technical efficiency per each of eight inefficient industries that are indicated from Table 4.3. The parameters of the production functions are estimated jointly with the parameters of the investment climate and firm characteristic variables. However, to make the empirical results more readable we present them in separate tables.

Table 4.4 shows that elasticities of capital and labor are different from each industry. Construction Material, Machinery and Equipment seem to be capital intensive industries. Meanwhile, Apparel and Leather, Paper, Food, Textiles, Non Metallic Mineral Products look like more intensive in labor. The results furthermore indicate that firm characteristics such as export activities, training employee, getting ISO certification and manager's experience positively and significantly affect on firm technical efficiency. Apparel and Leather, the most labor intensive industry in the sample, improve its performance by training its workforce. Paper industry gets benefit from exporting and training its labor. Technical inefficiency in Textiles is decreased in enterprises that having ISO certificate and their managers get more years of working experience in the industry. Surprisingly, the experience of managers in Construction Material industry can hinder the improvement of firm efficiency.

**Table 4.3: Technical Inefficiency by Industry**

Dependent variable: Value added													
	Others	Apparel & Leather	Wood & Furniture	Paper	Food	Textiles	Garment	Chemical	Plastics & rubber	Non metallic mineral	Machinery & equipment	Electronics	Construction materials
Capital	.449*** (0.000)	.446*** (0.000)	.391*** (0.000)	.409*** (0.000)	.529*** (0.000)	.484*** (0.000)	.415*** (0.000)	.388*** (0.000)	.575*** (0.000)	.408*** (0.000)	.573*** (0.000)	.556*** (0.000)	.631*** (0.000)
Labor	.610*** (0.000)	.667*** (0.000)	.634*** (0.000)	.610*** (0.000)	.596*** (0.000)	.528*** (0.000)	.652*** (0.000)	.854*** (0.000)	.223*** (0.000)	.756*** (0.000)	.505*** (0.000)	.739** (0.001)	.706*** (0.000)
Intercept	8.24***	8.17***	9.45***	10.76***	7.82***	8.77***	8.63***	9.15***	9.81***	9.41***	7.26***	6.41*	4.63***
H0: No inefficiency component	.021 (1.000)	1.29*** (0.000)	.009 (1.000)	1.421*** (0.005)	1.66*** (0.000)	1.50*** (0.006)	.0203 (1.000)	.0354 (1.000)	3.03*** (0.000)	2.64*** (0.017)	.980*** (0.066)	.863 (0.368)	1.340*** (0.025)
Observations	230	188	254	121	433	204	74	137	148	88	192	46	174

Notes: (1) Estimated equation for Stochastic Production Frontiers by industry is as follows:

$$\ln Y_{rit} = \beta_L \ln L_{rit} + \beta_K \ln K_{rit} + D_r + D_t + \beta_o + V_{rit} - U_{rit}$$

(2) p-value is reported in parentheses. \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.

**Table 4.4: Time-varying Inefficiency Models by Industry**

Dependent variable: Value added								
	C M	A & L	Paper	Food	Textiles	P & R	N M M	M & E
Capital	0.609***	0.247***	0.358***	0.360***	0.647***	0.411***	0.324**	0.506***
Labor	0.385**	0.830***	0.546***	0.633***	0.571***	0.480**	0.694***	0.470***
<b><u>Firm characteristic variables</u></b> (regressed on firm technical inefficiency)								
Export	-0.005		<b>-0.02***</b>			0.007	0.007	-0.001
Training	0.020	<b>-0.371*</b>	<b>-0.530*</b>	0.314		-0.332	0.270	-0.265
Foreign	-0.005			-0.005				
ISO			-0.116	-0.541	<b>-0.982**</b>	-0.018	0.779	
Manager's exp	<b>0.420***</b>	-0.066		-0.029	<b>-0.249*</b>			
Hours		0.847				0.856	0.563	-1.055
Mu	0.557	-1.114	-5.811	-10.003	-10.714	-12.549	-2.535	3.124*
Eta	0.059	<b>-0.118*</b>	0.009	-0.049	-0.022	<b>0.416***</b>	-0.024	-0.096
Observations	131	152	62	113	113	72	65	135

Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.

(2) Intercept included

The results from Table 4.5 confirm that investment climate deficiencies harm firm performance. Unfortunately, these are true for all aspects of the investment climate but quite different from each industry. All of the inefficient industries face obstacles from security cost and crime problem except Non Metallic Mineral Products. In some industries, for example: Construction Material, Food, Textiles, most constraints of investment climate just come from these issues. Machinery and Equipments, Plastics and Rubber are more sensitive to investment climate constraints than the others. The obstacles from duration of power outages, security cost

and especially the problem of corruption hurdle the firm performance in Machinery and Equipment industry. The business efficiency of Plastics and Rubber is reduced by constraints from payments to speed up bureaucratic issues, cost of security and inadequately educated workforce. Meanwhile, Paper and Non Metallic Mineral Products are mainly influenced by deficiencies in the quality of infrastructure (losses due to the power outages and days to clear customs for imports).

Comparing with the econometric results from pooling data SFA, evidences from time-varying inefficiency models for panel data are better in terms of expected signs and statistical significance of coefficients.<sup>50</sup> Furthermore, information on the change of technical efficiency from time-varying inefficiency model could tell something about the concerned problem: there is a little improvement or evenly decreased in technical efficiency in some manufacturing industries after three years WTO membership.

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<sup>50</sup>We have considered the pooled SFA. However, the results are not reliable despite bootstrapping and controlling for heteroskedasticity. The results are reported in *Appendix 4.6*.

**Table 4.5: Investment Climate and Technical Inefficiency by Industry**

	C M	A & L	Paper	Food	Textiles	P & R	N M M	M & E
<b><u>Infrastructure</u></b>								
Losses power	-0.303	-0.003	-2.714	0.026		-0.221	<b>0.536*</b>	0.164
Power outages			<b>1.984**</b>					<b>0.976*</b>
Electricity problem					5.088			
Custom clearance	1.458	-0.077	<b>2.407**</b>	-0.549	-5.690		<b>1.213*</b>	-1.175
<b><u>Business-Government</u></b>								
Regulation dealing		-0.131	-0.067	-0.146	0.034	0.141	-0.416	
Bureaucracy faster	-1.010	<b>0.545**</b>	0.392		-0.488	<b>1.209**</b>	-5.761	0.524
Corruption problem					3.410			<b>4.512*</b>
<b><u>Crime and Legal</u></b>								
Crime			0.056	<b>1.471**</b>	<b>0.834*</b>	0.847	0.098	0.347
Security	<b>0.185**</b>	<b>0.167**</b>	<b>0.431***</b>	<b>0.240***</b>	-0.038	<b>0.331***</b>		<b>0.202*</b>
Informal practices				0.353				
<b><u>Finance and Labor</u></b>								
Finance access pro				-0.453		-0.744		
Worker problem						<b>2.187**</b>		

Notes: (1) Investment climate variables are regressed on firm technical inefficiency.  
(2) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively  
(3) Excluding large firms in Food industry.

### **Further analyses**

Our former regressions confirm the choice of estimating the time-varying inefficiency models by industry. They are random effects time-varying inefficiency models because our estimates may be unreliable if fixed-effects models are used when the number of enterprises in each industry is small (Coelli et al., 2005). For further analyses and robustness checks of firm technical efficiency impact of investment climate, we estimate these models for the whole manufacturing with sector, time, and region fixed-effects. The fixed-effects models can be estimated in a standard regression framework using dummy variables.

For all firms in the manufacturing industries, in general, it seems that investment climate obstacles but not firm characteristics affect on firm technical efficiency. The results from pooled SFA and unbalanced panel are not so different but less statistically significant information provided than from balanced panel. They show up the obstacles caused by security cost and access to finance. Interestingly, most constraints of investment climate appear significantly in the observations of balanced panel model, except finance access. These might be come from the fact that the firms have more time operating in the industry so are easier to get access to credit. Their main concerns are number of days to clear customs for imports, payments to speed up bureaucracy issues and especially the practices of competitors in the informal sectors.

**Table 4.6: Pooled and Panel Data Models for Manufacturing Industries**

<b>Dependent variable: Value added</b>			
	<b><u>Pooled SFA</u></b>	<b><u>Unbalanced panel</u></b>	<b><u>Balanced panel</u></b>
Capital	0.356***	0.350***	0.469***
Labor	0.532***	0.572***	0.529***
<b><u>Firm characteristics</u></b>			
Export	<b>0.004*</b>	0.003	-0.002
Training	-0.080	-0.047	-0.235
Manager's Exp	-0.046	-0.057	0.077
Hours	-0.359	-0.252	-0.245
<b><u>Investment climate</u></b>			
Losses power	-0.029	-0.024	-0.020
Power outages	0.010	0.099	-0.052
Electricity problem	0.115	0.113	<b>-0.532*</b>
Custom clearance	0.185	0.209	<b>0.521**</b>
Regulation dealing	0.012	0.022	0.074
Bureaucracy faster	0.072	-0.016	<b>0.306**</b>
Crime	0.122	0.115	-0.128
Security	<b>0.184***</b>	<b>0.192***</b>	<b>0.192***</b>
Informal practices pro	-0.203	-0.184	<b>0.628***</b>
Finance access problem	<b>0.511**</b>	<b>0.560*</b>	-0.228
Mu		5.002	-4.397
Eta		-0.040	0.054
Observations	588	589	387

Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.  
(2) Regressions include intercept, region, sector and year dummies  
(3) Excluding large foreign firms in Pooled SFA and Unbalanced Panel due to heteroskedasticity

### **Breakdown by size and ownership**

The breakdown by size and ownership allow testing for the robustness of impacts of firm characteristics and investment climate constraints on firm efficiency.

Considering the breakdown by firm size, the results in Table 4.7 show that most coefficients with expected signs are statistically significant. Large firms get benefits from exporting, meanwhile the practices of competitors in informal sectors, the security cost, and the days to clear customs for imports hinder their performance. The investment climate obstacles from business-government relations seem not to significantly hurdle them. However, the pictures of small firms are very different. Their business efficiency is harmed by government regulations, power outages, and finance access. However, it is useful in terms of public governance, to take into account that the operations of informal sectors increase their technical efficiency. It might come from the fact that business law has still not functioned properly (Vo and Nguyen, 2009). Interestingly, compared to small and large firms, medium enterprises are the least sensitive to investment climate obstacles. Their technical efficiency is negatively affected by security cost and power outages.

The Table 4.7 also presents the classification by firm ownership. Foreign ownership firms are less influenced by investment climate constraints than local firms. Their performance is only affected by security problems (crime, expenditure on security), while investment climate obstacles caused by Business-Government relations (proxied by payments to deal with bureaucracy ‘faster’) and security cost significantly worsen domestic firms in term of technical efficiency. In fact, foreign firms have more power in lobbying policy makers and attracting high qualified workers.

Moreover, from the empirical results, exporting of foreign firms significantly improves their technical efficiency and especially, foreign firms increase their technical efficiency over time of period study.



**Table 4.7: Time-varying Inefficiency Models by Size and Ownership**

Dependent variable: Value added					
	<u>Size</u>			<u>Ownership</u>	
	Small	Medium	Large	Foreign	Domestic
Capital	0.336***	0.377***	0.402***	0.343***	0.373***
Labor	0.587	0.638***	0.520***	0.521***	0.664***
<b><u>Firm characteristics</u></b>					
Export	0.002	0.004	<b>-0.003***</b>	<b>-0.007***</b>	-0.002
Hours	<b>-1.778***</b>	0.002	-0.181	0.404	<b>-0.327*</b>
<b><u>Investment climate</u></b>					
Losses power	0.047	-0.058	-0.036	-0.079	-0.035
Power outages	<b>0.673**</b>	<b>0.274**</b>	-0.079	-0.234	0.009
Electricity problem	<b>1.526**</b>	0.454	-0.091	-0.315	0.118
Custom clearance	0.330	0.182	<b>0.269*</b>	0.312	0.173
Regulation dealing	<b>0.235***</b>	-0.050	0.018	-0.048	-0.009
Bureaucracy faster	-0.474	-0.036	0.046	-0.174	<b>0.141*</b>
Crime	-0.247	0.154	-0.128	<b>0.464*</b>	0.106
Security	<b>0.236**</b>	<b>0.202***</b>	<b>0.188***</b>	<b>0.179***</b>	<b>0.193***</b>
Informal Practices	<b>-0.815**</b>	-0.167	<b>0.332***</b>	-0.220	0.049
Finance access pro	<b>1.404***</b>	0.370	<b>-0.595***</b>	0.083	-0.123
mu	0.329	2.784***	2.857***	-1.379	4.830
eta	0.121	0.029	0.033	<b>0.167***</b>	-0.047
Observations	89	504	887	185	1348

Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively.

(2) Regressions include intercept, region, sector and year dummies. For small firms, only sector dummy due to few observations.

## 4.7 Conclusion

Using time-varying inefficiency models for the World Bank Investment Climate surveys in 2005 and 2009, this is the first paper that identifies the constraints of investment climate on Vietnamese manufacturing firm technical efficiency. The results empirically show that a good quality of infrastructure and finance, an investment-friendly and transparent environment, a safe society encourage firm technical efficiency. The impacts of investment climate on firm technical inefficiency are robust to various kinds of specifications. Security problem emerges as the most popular constraint. Some industries such as Machinery and Equipments, Plastics and Rubber are more sensitive than others to investment climate deficiencies. These are also the cases of small firms and domestic-owned enterprises.

The results also highlight that foreign firms attain improvement in production efficiency over time compared to domestic firms. In addition, large firms as well as foreign firms get benefit from their export in term of technical efficiency. This finding is in line with the study of Le (2010), who evidences that exporting has no significant influence on the technical efficiency of Vietnamese domestic manufacturing SMEs. Remarkably, we find no strong evidence supports for technical efficiency improvement in Vietnamese firms after this country became an official WTO member in early 2007.

## Appendix to Chapter 4

### Appendix 4.1: General Information at Plant Level and Production Function Variables

<b>General Information at Plant Level</b>	Industrial classification	Other manufacturing, Apparel & Leather products, Wood & wood products, incl. furniture, Paper, Food, Textiles, Garments, Chemicals, Plastics & rubber, Non metallic mineral products, Basic metals & Fabricated metal products, Machinery and equipment, Electronics, Construction materials
	Regional classification	Red River Delta, Central North, Mekong River Delta, Southern Central Coastal, South East
<b>Production Function Variables</b>	Sales	Used as the measure of output for the production function estimation (in VND adjusted by PPI - base year 2000)
	Value added	Value of total sales minus costs of raw materials and energy (in VND adjusted by PPI - base year 2000)
	Employment	Total number of workers.
	Capital stock	Book value of all fixed assets (in VND adjusted by PPI - base year 2000)
	Labor cost	Total expenditures on personnel (in VND adjusted by PPI - base year 2000)

### Appendix 4.2: Firm Characteristic Variables

Training	dummy variable =1 if the plant provides training to its employees
Export	Percentage of the establishment's sales were exported directly
Foreign ownership	Percentage of firm is owned by foreign private
Manager's experience	Top Manager's years of working experience
Working hours	Hours per week normally operate
ISO certification	Firm has ISO Quality certification
Capacity utilization	percentage of capacity utilized
Internet access	dummy variable = 1 if the plant has used email or a website in its interactions with clients or suppliers.

### Appendix 4.3: Investment Climate Variables

	Duration of power outages	Average duration of power outages suffered by the plant in hours.
<b>Infrastructure</b>	Losses due to power outages	Value of the losses due to the power outages as a percentage of sales
	Days to clear customs for imports	Average number of days that it took from the time the plant's imports arrived to the point of entry until the time the plant could claim them from customs.
<b>Business-Government Relations</b>	Percentage of time spent dealing with regulation	Percentage of time in a typical week spent by management dealing with bureaucracy/regulation.
	Payments to deal with bureaucracy faster	Payments to "speed up" bureaucratic issues as a percentage of sales.
<b>Finance</b>	Loan	Dummy variable = 1 if the plant reports that it has a bank loan.
<b>Crime</b>	Security cost	Expenditure on security related items by the plant as percentage of sales.

### Appendix 4.4: Investment Climate Perception Variables

<b>Infrastructure</b>	Electricity problem	Ranking by the plant of electricity as a problem for its operations and growth.
	Tax administration	Ranking by the plant of tax administration as a problem for its operations.
<b>Business-Government Relations</b>	Customs and Trade regulation	Ranking by the plant of trade regulation as a problem for its operations.
	Permit problem	Ranking by the plant of permit and business registration as a problem for its operations and growth.
	Corruption problem	Ranking by the plant of corruption as a problem for its operations and growth.
<b>Crime and Legal Environment</b>	Crime problem	Ranking by the plant of crime a problem for its operations and growth.
	Competitor problem	Ranking by plant of practices of competitors in the informal sector as a problem for its operation and growth
	Finance problem	Ranking by the plant of access to finance as a problem for its operations and growth
<b>Finance and Labor</b>	Labor regulation problem	Ranking by the plant of labor regulation as a problem for its operations and growth.
	Worker problem	Ranking by plant of inadequately educated workforce as a problem for its operations and growth.

**Table 4.5: Summary Statistics**

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
Value Added	2658	21.38826	2.09466	3.019989	29.88232
Capital	2713	22.23961	1.803433	15.63505	28.55724
Labor	2804	4.77031	1.41935	1.386294	9.854665
Export	2792	23.534	37.77589	0	100
Training	2741	.557096	.49682	0	1
Foreign	2797	10.20096	28.67406	0	100
ISO	2796	.3040057	.4600673	0	1
Manager's Experience	2775	2.211941	.9374563	0	3.912023
Hours	2793	3.950063	.2963782	0	5.123964
Losses power	2743	2.462224	2.261494	0	20
Power outages	2785	1.866987	.5687915	0	3.178054
Electricity problem	2780	.1584188	.3224831	-1.386294	1.386294
Custom clearance	2644	1.545028	.6624939	0	4.317488
Regulation dealing	2801	5.878051	2.537081	0	15
Bureaucracy faster	2783	.8687847	.7756454	0	3.466667
Corruption problem	2701	-.3403969	.6352285	-2.302585	1.098612
Crime	2809	0.884656	.319493	0	1
Security	1881	17.34241	1.943248	13.68098	27.14878
Informal practices problem	2747	-.3352814	.5979747	-2.302585	1.098612
Finance access problem	2750	.4361072	.4345911	-1.386294	1.386294
Worker problem	2776	.1990673	.4015042	-1.94591	1.386294

### Appendix 4.6: Pooled Data SFA by Industry

Dependent variable: Value added								
	C M	A & L	Paper	Food	Textiles	P & R	N M M	M & E
Capital	0.650***	0.279***	0.246***	0.363***	0.690***	0.152	0.313**	0.606***
Labor	0.405**	0.859***	0.401***	0.531***	0.473***	0.245	0.692***	0.417***
<b>Firm characteristic variables</b>								
Export	-0.004		<b>-0.018***</b>			0.005	0.007	-0.004
Training	-0.009	-0.120	<b>-0.561***</b>	0.290		0.502	0.344	-0.301
Foreign	-0.004			-0.004				
ISO			<b>-0.045***</b>	-0.417	<b>-0.640**</b>	0.157	0.795	
Manager's Exp	<b>0.375**</b>	-0.031		0.011	<b>-0.244**</b>			
Hours		0.582	<b>1.745***</b>			0.101	0.553	<b>-0.998*</b>
<b>Investment climate variables</b>								
Losses power	-0.060	-0.076	<b>-1.494***</b>	0.101		-0.551	<b>0.509*</b>	0.008
Power outages			<b>0.193***</b>					0.299
Electricity problem					2.673			
Custom clearance	0.723	-0.017	<b>0.956***</b>	-0.590	-3.571		<b>1.152*</b>	0.001
Regulation dealing		-0.126	<b>-0.081***</b>	-0.112	0.015	-0.138	-0.417	
Bureaucracy faster	-0.452	<b>0.356*</b>	<b>-0.082***</b>		-0.153	2.540	-5.627	-0.191
Corruption problem					1.588			1.373
Crime			<b>-0.637***</b>	<b>1.164**</b>	0.475	0.741	0.107	0.319
Security	<b>0.139**</b>	<b>0.132*</b>	<b>0.389***</b>	<b>0.253***</b>	-0.016	<b>0.342**</b>		<b>0.162*</b>
Informal practices				0.192				
Finance access pro				-0.099		0.184		
Worker problem						<b>1.685**</b>		
Insig2v	-0.688	-0.97***	-35.252	-0.558**	-1.15***	-33.584	0.368	-0.585
Insig2u	-0.623	-0.604**	-0.340	-0.586	0.162	0.347	-0.226	-0.524
Observations	131	152	60	113	113	72	65	135

Notes: (1) \*\*\*, \*\*, and \* denote significance level of 1%, 5%, and 10% respectively

(2) Excluding large firms in Food industry. Considering Paper industry only in two years 03 – 04.

(3) Firm's characteristic and investment climate variables are regressed on firm technical inefficiency.

(4) Intercept included.

## **5 Conclusion**

### **5.1 Summary of Results**

In reality, what we can observe from the episode of trade liberalization is that Vietnam's vulnerability to negative shocks has become increasingly apparent (Vo and Nguyen, 2009). After a short period of over-excitement in early stages of WTO membership from early 2007, Vietnam has worried about the overall economic situation. GDP growth of the whole economy and by economic sectors has decreased from the time of global financial crisis in 2008. Therefore, the implementation of international and regional trade commitments has raised concerns associated with the labor market adjustments and firm productive performance effects of trade policy reforms in Vietnam.

This dissertation focuses on the impact of trade liberalization and institutions on labor market and firm productivity. The study commences (chapter 2) by highlighting the negative effect of trade liberalization on employment and wages in Vietnamese manufacturing, although this impact is moderate. In itself, this may have accounted for a 2.4% - 3.5% decline in real wages on average, and only a minor decline in employment. Furthermore, we find evidence of gender and skill earning inequalities in Vietnamese manufacturing, however these gaps decrease under trade liberalization. Additionally, trade unions and collective agreements seem to reduce the skill earning differentials, when taking into account the influence of unions by region.

In chapter 3, we investigate the effects of technology and institutions on firm productivity, using a cross-section dataset. Interestingly, rather than R&D activities, indirect technology factors such as foreign ownership, ISO certificate and owning a website have a positive impact on firm performance. Additionally, there is no evidence that access to finance appears to affect firm performance, and other institutional variables such as competitors' practices in the informal sectors, labor market issues (i.e. inadequately educated workforce), plus obstacles in policy and administration have different impacts, depending on firm level productivity. The results also indicate the problem of constant returns to scale in Vietnamese manufacturing industries and the limitations of innovative activities and training labor within firms.

Chapter 4 deepens the analysis of chapter 3 in considering the role of the investment climate (the quality of institutions) on firm productive performance. We try to identify the constraints of

investment climate on Vietnamese manufacturing firm technical efficiency, with the empirical results suggesting that a good quality of infrastructure and finance, an investment-friendly and transparent environment, and a safe society encourage firm technical efficiency, with the security problem emerging as the most popular constraint. Some industries, such as Machinery and Equipment, Plastics and Rubber or small firms and domestic-owned enterprises are more sensitive to investment climate deficiencies than others. The results further indicate that foreign firms attain improvement in production efficiency over time, compared to domestic firms. Furthermore, both large and foreign firms gain benefit from their exports in term of technical efficiency. Remarkably, we do not find strong evidence in support of technical efficiency improvement in Vietnamese firms after the country became an official WTO member in early 2007.

## **5.2 Policy Implications and Future Research**

Overall, we should not adopt a negative perspective on the response of the labor market to trade openness in the case of Vietnam. Rather than fearing the negative effect of trade liberalization on employment and wages, Vietnam should enhance policies to protect unskilled or female workers by upgrading education and training levels, strengthening the role of trade unions in firms, increasing the number of unionized private sector firms with collective agreements, or launching policies to help enterprises improve their productivity in order to share more rents to workers and create more jobs.

Additionally, this study finds that the effects of institutions and the investment climate on firm productivity substantially differ across firm level productivity and sectors. We further suggest that improvements in public governance quality, education reform oriented to practical knowledge and working skills suiting firm labor demand and effective competition in the marketplace can help to increase firm productive performance.

Openness to the world economy is the opportunity for Vietnam to look back upon its chosen way, hopefully bringing significant benefits to the majority of Vietnamese citizens. Institutional reforms oriented to the greater predictability, security and transparency of market access for all economic sectors (public and private) is a prerequisite to build the foundations of greater prosperity and consolidate the achievements to date.



There has recently been a promising stream of research on Vietnamese manufacturing uses matched employer-employee data that has allowed for disentangling worker and firm heterogeneity by controlling for firm and worker characteristics (e.g., Larsen, Rand, and Torm, 2011, and Torm, 2012). Thus, future research can apply this kind of data to analyze the economic and social impact assessment from Vietnam's deeper integration into the global economy on the labor market, firm performance and worker income inequalities.

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- 11/2001 – 11/2003: **Master in Development Economics**  
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- 12/2003 – 12/2008: Lecturer at Ton Duc Thang University
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- 14<sup>th</sup> International Student Conference on Economics, organized by Ege University, Izmir, Turkey, May 2011.

## **Eidesstattliche Erklärung**

Ich erkläre hiermit an Eides Statt, dass ich meine Doktorarbeit mit dem Titel “Impacts of Trade Liberalization and Institutions on Labor Market and Firm Productivity in Vietnamese Manufacturing” selbstständig und ohne fremde Hilfe angefertigt habe und dass ich alle von anderen Autoren wörtlich übernommenen Stellen, wie auch die sich an die Gedanken anderer Autoren eng anlehrenden Ausführungen meiner Arbeit, besonders gekennzeichnet und die Quellen nach den mir angegebenen Richtlinien zitiert habe.

Kiel, 19 November 2012

Pham Dinh Long