Investment Climate and Efficiency of Vietnamese Manufacturing:
What matters most?

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List of Abbreviations

CIEM: The Central Institute for Economic Management

FDI: Foreign Direct Investment

PCA: Principle Component Analysis

SFA: Stochastic Frontier Analysis

SOEs: State Owned Enterprises

USD: The United States Dollar

VCCI: Vietnam Chamber of Commerce and Industry

VND: Vietnam dong (the Vietnamese currency)

WTO: World Trade Organization

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CHAPTER 1

INTRODUCTION

Most developing countries are confronting with competitive pressures from globalization and openness of the economy. In this context, they are struggling to consolidate national competitive underpinning based on both micro and macro reform programs. The key factor of national competitiveness is to have a friendly investment climate or business environment defined by the World Bank (2004) as “the set of location-specific factors shaping the opportunities and incentives for firms to invest productively, create jobs and expand.” The magnitude of the investment climate has been placing on the center of economic activities by accumulating the valid evidences that the investment climate has a pivotal role in stimulating economic growth (Bosworth & Collins, 2003; Hall & Jones, 1999; Rodrik et al., 2004), firm development (World Bank, 2004; Batra et al., 2003; Dollar et al., 2005; Escribano Saez & Guasch, 2005; Kinda et al., 2011), and Foreign Direct Investment (FDI) (Breen & Gillanders, 2012; Djankov et al., 2010; Djankov et al., 2008; Jayasuriya, 2011; Sekkat & Veganzones-Varoudakis, 2007)

After implementing economy reform *“Doimoi”* in 1986, with transitioning from a centrally planned economic regime to a socialism-oriented market economy, Vietnam has gained many achievements in its social-economic development thanked to vital contributions of manufacturing sector. The manufacturing sector has quickly become an engine of economic growth and the most dynamic sector in job creation. From almost nothing before 1989, the Vietnamese manufacturing accounted for nearly 21% of GDP in 2009 and about 31.3% of new employments for the whole 2001-2008 period (GSO, 2008, 2009). Recognizing the importance of manufacturing sector, the Vietnam government has attempted to establish a proper investment climate for enterprise growth based on the macro and micro reforms. From 2005, the government has implemented 21 reform programs– the highest number in East Asia Pacific – to improve the business environment. In addition, Provincial Competitiveness Index[1] project is established with the aim of assisting local government to improve the business environment, economic governance, and administrative reform. Unfortunately, in contrast to government's efforts, the investment climate is not improved and even became worse off in recent years. The doing business report, released by World Bank (World Bank, 2013, 2014), ranked the eases of the doing business of Vietnam at 90 in 2011, gradually regressed to 98 in 2012, and 99 in 2013[2]. These rankings reflect the fact that the attempts of the government toward improving the investment climate seem to be inefficient. This inefficiency is explained by the shortfall of empirical researches to encourage and guide the reform effectively. Therefore, the main purpose of this paper is to provide the well-founded evidence about the importance of the investment climate in determining firm technical efficiency, particularly emphasizing on guiding the policy to improve the business environment. This paper is, therefore, significant for the government in policy-making to create the national competitiveness advantages as well as to exploit the efficiency of internal and external forces for fast and sustainable development in the future

We contribute to the literature by several ways. The first merit of this paper is that unlike most previous paper, we analyze the relationship between the investment climate and the firm technical efficiency by using a panel data of a specific country, thus exploring this causal linkage much better. Most previous study in this field investigated this relation by

[1]Provincial Competitiveness Index is national project established since 2005 by collaborating between Vietnam Chamber of Commerce (VCCI) and the U.S Agency for International Development (USAID).

[2] The Doing Business Project measures and compares the business regulations across 189 economies around the world based on the perspective of domestic, primarily smaller companies. The lower ranking is better

utilizing a pooled data from a group of developing countries, which has the wide differences in culture and economic characteristics. These discrepancies inevitably produce a large proportion of the unmeasured heterogeneity in the data, and therefore cannot distinguish between cross individual heterogeneity and inefficiency (W. Greene, 2004). Second, we utilize both the individual indicator and the composite indicator of the investment climate to cope with collinearity and omitted variable bias in practical estimate. Employing the composite indicator of the investment climate is pioneered by Bastos & Nasir (2004) and Kinda et al. (2011). However, these papers used the data from a group of developing countries, which has the wide heterogeneities in culture and economic characteristics. Consequently, the composite indicator of the investment climate is inconsistent and severe fragile in practical estimate. This paper is distinct by employing the data from a particular country, thereby obtaining the more reliable and consistent results. Drawing from the Investment Climate Assessment Survey of World Bank (World Bank, 2005), this paper first shows that the investment climate is significant in explaining the firm technical inefficiency discrepancies. Particularly, improving the investment climate in terms of infrastructure-service, access to finance, and human capital could increase the firm technical efficiency, thus enhancing firm competitiveness. Second, using a composite indicator to capture for the diverse dimensions of the government affecting on the firm's business activities, our paper reveals that the government regulation is distorting the market, creating monopolies and inequalities in competitiveness. This situation is greatly harmful to the economy because of eroding the belief and the motivation of expanding private investment and technological innovation. This finding, therefore, suggests that the Vietnam government needs more effort than in institutional reform, especially in fighting against corruption and providing the efficiency of public services. Third, over the years, the private firms have emerged as an engine of economic growth and employment creation; however, the results from estimating the separate ownership types show that the private firms are crowded out by the foreign firms and the state ownership enterprises (SOEs) caused by the privilege policies of the government. Therefore, reorienting the policy to create a level playing field for the private firm growth is a key strategy for long-term development of Vietnam. Fourth, employing a state ownership variable to evaluate the government policy in stimulating the economy based on the SOEs, this paper points out that this policy is completely ineffective. It is unquestionable that the SOEs are squandering the national resource, distorting the market and creating the monopolies, which trigger the unstable macroeconomy and the stagnation of economic growth in recent years. Accordingly, the government needs to intensively privatize and restructure the SOEs, particularly prioritizing to strengthen transparency, improve the quality of management, and increase responsibility. Fifth, we find the limited evidences of the technological spillover effect from the FDI inflow in the Vietnamese industry, even negative effect in some industries. This finding suggests that the government needs to reorient the policies toward the attraction of the FDI, particularly emphasizing on attracting the high-tech industries to exploit the advantages of the FDI inflow. Finally, and sixth, employing the partial correlation analysis, our paper shows that the human capital deficiencies impair most to the firm technical efficiency. Accordingly, improving the quality of national human resource is a long-term strategy, not just because it can increase the firm efficiency and competition but also because it can create the national competitive advantages and sustainable development of Vietnam in the future.

This paper is organized following chapters. Chapter 2 will discuss the literature in this field to make underpinning for this study. We will show the brief literature from macroeconomic to microeconomic approach and concentrate on the specific dimensions of the investment climate related to this study. Chapter 3 will present the empirical methodology and investment climate measurement used in this paper. We commence this section by introducing to the Stochastic Frontier Analysis (SFA), focusing on explaining its concepts and principles, as well as key assumptions. From overall discussion of the SFA method, we will jump to the empirical model to test for the hypotheses of interest. Finally, we will argue the challenges in the measurement of the investment climate and practical estimate, of course accompanying with the solution to these challenges. Chapter 4 will discuss and explain the key findings emerged from empirical analysis. We begin this section by providing the background of the Vietnamese investment climate based on firm perception. We, then, come up to the main purpose of this paper that is to evaluate the impacts of the investment climate on the firm technical efficiency based on the individual indicator model and the composite indicators model. Basing on empirical results of the chapter 4, chapter 5 will present the conclusions and the policy implications for Vietnam to improve the investment climate.

CHAPTER 2

THE LITERATURE OF INVESTMENT CLIMATE AND FIRM ECONOMIC PERFORMANCE

There has been increasing interest in assessing the effects of the set of factors as policy, institutional, and regulatory environment, commonly known as the business environment or the investment climate, on economic activities. At macroeconomic level, a considerable number of empirical studies, relied on cross-country analysis, show that a good investment climate could promote country-level economic growth, productivity (Bosworth & Collins, 2003; Djankov et al., 2006; Hall & Jones, 1999; Lucas Jr, 1988; Romer, 1994) and FDI inflow (Breen & Gillanders, 2012; Djankov et al., 2010, 2008; Jayasuriya, 2011; Sekkat & Veganzones-Varoudakis, 2007). The macroeconomic approach suggests the importance of the investment climate in determining economic activities; however, it does not allow evaluating the comprehensive influences of the investment climate, and even suffers from omitted variable bias or endogeneity concerns.

The adjusted tactic of recent studies is to concentrate on exploring this linkage from microeconomic level. This approach is quite new but more advantageous, not just because it allows assessing the role of the investment climate more comprehensively but also because it formulates the policy more efficiently. From the firm perspective, an appropriate investment climate could reduce costs, risks and timing for doing business, thereby promoting productivity, enhancing competitive competence, and creating new opportunity, e.g. through trade or technological innovation. Following this perspective, an enormous number of studies have evaluated the role of the investment climate in firm economic performance, measured by various outcomes such as sales growth, productivity, and job creation (World Bank, 2004; Batra et al., 2003; Dollar et al., 2005; Escribano Saez & Guasch, 2005; Kinda et al., 2011). For instance, World Bank (2004), drawing on the data of 30,000 firms around the world, states that the poor investment climate creates unjustified risks, costs, and barriers to competition. Similarity, Batra et al. (2003), employing econometric analysis from the firm-level of 80 countries, find a strongly negative association between the poor investment climate and firm economic performance. Furthermore, building a fixed effect model for the four Asian economies, Dollar et al. (2005) show that the impediments of the investment climate considerably demolish the investment expansion, the revenue growth, as well as the employment creation of the firm. Alternative approach, Escribano & Guasch (2005) investigate the magnitude of the investment climate in association with firm's total factor productivity by utilizing a panel data of the three central American countries: Honduras; Guatemala; and Nicaragua. They investigate that the investment climate constraints are significantly harmful to the firm's total factor productivity. Nevertheless, the drawback of this paper is that the efficiency measured by total factor productivity technique is absorbed both the influences of random shock and measurement errors that are unrelated to efficiency (T. J. Coelli et al., 2005). This disadvantage is adapted in the interesting paper of Kinda et al. (2011), in which they employ the SFA technique to eight manufacturing industries in the five Middle East and North African economies. Kinda et al. (2011) highlight that the investment climate bottlenecks with respect to infrastructure-service, access to finance, human capital and government business relation, are substantially destructive to the firm technical efficiency. The most fascinating in the paper of Kinda et al. (2011) is that they utilize the composite indicators of the investment climate to deal with the collinearity and the omitted variable bias. However, because of using a pooled data of the five Middle East and North African countries which exists the extensive discrepancies in culture and economic characteristics, the composite indicators of the investment climate appear to be severe fragile and inconsistent in estimation.

Most studies under the microeconomic approach are often relied on the Investment Climate Assessment Surveys of World Bank (World Bank, 2005), which consists of the data of inputs and outputs, and various aspects of the investment climate at the firm level. In this survey, World Bank (2005) classifies the investment climate by seven dimensions[3]. However, only four main dimensions received the great care in the literature are: (1) infrastructures-services; (2) access to finance; (3) government business relations; (4) human capital.

2.1. Infrastructure-Service and Firm Performance

Impoverished infrastructure-service is identified as the main problem for firm productivity and competition in most developing countries (World Bank, 1994). The infrastructure-service is considered as complementary production inputs because it directly influences to firm's business cost and profit. The central hypotheses of the infrastructure-service in the literature are that a unaffordable infrastructure-service induces an increase in business cost or revenue loss, thereby destroying firm efficiency (Aschauer, 1989; Barro, 1990; Bastos & Nasir, 2004; Blejer & Khan, 1984; Escribano & Guasch, 2005; Kinda et al., 2011; Murphy et al., 1988). Alternatively, Holtz-Eakin & Schwartz (1995) believe that a developed and efficient infrastructure-service system allows firm to enhance efficiency by interconnections and externalities across firms, industries, and regions.

In the literature, power outage and impoverished quality of transportation are recognized as main severe problems for firm economic performance in developing countries (Bastos &

[3] The world Bank classifies the investment climate into seven components, including (1) Infrastructures and public services; (2) access to finance; (3) government business relations; (4) conflict resolution-legal environment; (5) crime; (6) learning, capacity, and innovation; (7) labor relation

Nasir, 2004; Carlin et al., 2006; Escribano & Guasch, 2005; Gelb et al., 2007; Kinda et al., 2011). Additionally, some authors also stress that the more firms depend on public service, the more they are affected by the infrastructure-service deficiencies (Anas et al., 1996; Dollar et al., 2005; Escribano & Guasch, 2005; Kinda et al., 2011; Reinikka & Svensson, 2002). These findings lead to the argument of Clarke & Xu (2004) that the country with poor infrastructure-service, firm is likely to pay bribery and corruption to get the basic needs such as electricity, water, telecommunication service, etc.

On the other hand, Commander & Svejnar (2007) and Fisman & Svensson (2007) do not find the evidence of infrastructure-service affecting on the firm economic performance. It is unquestionable that these papers are flawed due to poor sample or inefficient methodology.

2.2. Access to Finance and Firm Performance.

The second component of the investment climate, received the great care in the literature, is the access to external finance. The effects of financial development on economic growth and firm performance have been analyzing both by the theoretical and empirical literature. The literature shows that the efficient and developed financial market could boost economic growth and firm efficiency through diverse channels, including: improving information of production and efficiency of allocating capital (Boyd & Prescott, 1985; Greenwood & Jovanovic, 1990; Levine, 2005; Mishkin, 2007); boosting technological innovation (Acemoglu et al., 2002; Levine, 2005; Morales, 2003); monitoring firm and exerting corporate governance (Bencivenga & Smith, 1993; Diamond, 1984; Jensen & Meckling, 1976; Levine, 2005; Stiglitz & Weiss, 1983); mitigating risks of credit and liquidity (Acemoglu & Zilibotti, 1997; Greenwood & Jovanovic, 1990; Gurley & Shaw, 1955; King & Levine, 1993; Levine, 2005); pooling of saving and exploiting economies of scale (Acemoglu & Zilibotti, 1997; Carosso et al., 1970; Levine, 2005), increasing human capital (De Gregorio, 1996; Galor & Zeira, 1993; Jacoby, 1994; Levine, 2005).

Additionally, using the Investment Climate Assessment Surveys of World Bank (World Bank, 2005), a substantial number of studies have been putting the access to external finance in the center of firm economic performance. Some authors stress that financial constraints are harmful to firm revenue and profit (Beck et al., 2005; Carlin et al., 2006; Dollar et al., 2005). For instance, Carlin et al. (2006) find out a negative impact of financial cost on firm revenue when they run a regression equation for both between- and within-country. At a different perspective, some studies underscore that financial restraints are significantly detrimental to the firm technical efficiency (Escribano & Guasch, 2005; Kinda et al., 2011). Kinda et al. (2011), for instance, argue that the firms restricted in accessing to external finance tend to be less efficient. Besides, few studies attempt to determine the magnitude of external finance source in job creation, and they reveal that a higher share of investment financed externally is associated with greater employment creation (Aterido et al., 2011; Hallward-Driemeier et al., 2006). In the literature, small firms are impacted more by credit-constrained than large ones (Aterido et al., 2011; Beck et al., 2005; Bigsten & Söderbom, 2006; Galindo & Micco, 2007).

On the contrary, Commander & Svejnar (2007) do not show the causality between financial constraints and firm revenue in Eastern and Central Asian countries. Similarity, Hallward-Driemeier et al. (2006) do not find an association between access to external finance and firm economic performance in China.

2.3. Government Business Relation and Firm Performance.

The role of the regulatory regime in bolstering economic growth and development has received considerable interest among practitioners in recent years. Economic growth and development are recognized, not simply as a matter of accumulating of physical and human capital, but as a matter of efficient institution (Bosworth & Collins, 2003; Hall & Jones, 1999; Rodrik et al., 2004). North, (1990) states that institutions are the rules of the game, and their entrepreneurs are the players. By setting the rules of the game, institutions are able to influence to economic performance (World Bank, 2002; North, 1990; Rodrik et al., 2004). North (1990) interprets the role of institution in association with economic performance that an efficient institution creates appropriate incentives and reduces transaction costs, thereby encouraging individuals to engage in productive activities as well as maximizing economic welfare. By contrast, a bad institution diminishes individual incentives and chances to invest, innovate, and gain foreign technology. Accordingly, it is uncontroversial that establishing an effective regulatory regime could promote economic performance. However, it is the most challenge for almost all developing countries (Kirkpatrick & Parker, 2004). Hasan et al. (2007) and North (1990) stress the institutional frameworks in developing countries that "overwhelmingly favor activities that promote redistributive rather than productive activity, that create monopolies rather than competitive conditions, and that restrict opportunities rather than expand them."

Theoretically, there are many channels through which institutions might influence to firm economic performance as Political Change, Political Stability, Legal System, Judiciary, Bureaucracy, Corruption, etc. However, we will limit to two aspects related to this paper, including corruption and cumbersome business regulation.

Corruption is conventionally defined as "the misuse or the abuse of public office for private gain" (World Bank, 1997). To combat against corruption, a considerable number of researchers investigate its impact on economic activities under both macroeconomic and microeconomic level. However, it is controversial whether corruption has a negative or a positive effect to economic activities. At macroeconomic level, few papers find out the negative effect of corruption on economic growth, investment, technological innovation, as well as human capital. For instance, Mo (2001) provides three channels through which corruption impairs to economic growth, including: reducing investment, destroying human capital and political instability. Romer (1994) interprets that corruption might be referred to as a tax levied on productive producer, thus suffocating the entry of new goods and technological innovation. Murphy et al. (1991) underline that when corruption is widespread, talented people are allocated to rent-seeking activities instead of productive investment as accumulating capital, knowledge, and skills, thereby destroying economic growth, technological innovation and human capital.

Because of the weak evidences from the macroeconomic level, some authors have attempted to explore this linkage from microeconomic approach based on firm-level data. The main hypotheses of these studies are that corruption raises operational cost, timing and uncertainty for enterprise to doing business, thus deterring firm economic performance. By tremendous and detailed information from firm-level, a substantial number of studies find that corruption robustly devastates firm performance, measured by various aspects as expanding investment, profit growth, technical advance, productivity, as well as job creation (Aterido et al., 2011; World Bank, 2004; Beck et al., 2005; Fisman & Svensson, 2007; Hallward-Driemeier et al., 2006; Kinda et al., 2011; Shleifer & Vishny, 1993).

On other the hand, some researchers suggest that corruption might be favorable for firm economic performance by including the efficient provision of public services, or by providing a leeway for entrepreneurs to bypass the inefficient regulations, especially in the context of developing countries, where red tape and cumbersome business regulations are widespread (Acemoglu & Verdier, 1998; Leff, 1964). In this situation, corruption acts as a lubricant which smooths the business, thus raising firm efficiency. Moreover, some authors stress that the negative impact of corruption might be neutralized or offset in situations where corruption acts as catalyst and greases for the wheels of business, or creates chances for private illicit gains such as paying cash for governmental contracts, winning the project auctioning from government (Rand & Tarp, 2012; Rose-Ackerman, 1999). Rose-Ackerman (1999), for instance, explain this issue that “when the government is a buyer or a contractor,...a corrupt firm might pay to be included in the list of qualified bidders, to have officials structure the bidding specifications so that it is the only qualified supplier, or to be selected as the winning contractor. And the firm selected, it might pay for the opportunity to charge inflated prices or to skimp on quality.” Therefore, all things being equal, corrupt firms benefit from corruption by expanding their investment and profit. Regarding the Vietnam context, recently empirical study of World Bank (2013) and Rand & Tarp (2012) investigates that the firms paying more for corruption tend to be more profitable. This result suggests that corruption appears to be an efficient way for entrepreneurs to bypass the inefficient regulations or a catalyst and greases for the wheels of business. This argument is reconfirmed by VCCI (2013), but they stresses that firms–which prefer paying for corruption–often join the government’s restricted business fields, and these restricted fields often have more profits and benefits by easily becoming the monopoly in business. Consequently, corruption might promote the efficiency of corrupt firms but deteriorate the belief and motivation of other firms due to inequality in competitiveness. On the other hand, Nguyen & van Dijk (2012), in an empirical study of corruption affecting on SOEs versus private firms in Vietnam, show that corruption prohibits the growth of private sector, but neutralizes for the SOEs. Furthermore, employing a logistic model to determine the principle causes of corruption, they find that corruption is widespread in approaching to land certificate. Rand & Tarp (2012) devote their attention in exploring the principle causes of bribe in Vietnam. Employing a logistic model, they also investigate that the firm is the high probability of paying for bribes in the case of dealing with the inspections from the government and when the government is supplier or customer of the firm.

The substantial steps of opening or closing a business activity unavoidably involve regulations and permits from authorities. In general, it has been widely acknowledged that an effective regulatory regime will provide appropriate incentives for productive investment, technological advance. Therefore, the country with effective regulatory regime will improve economic growth; on the contrary, cumbersome regulations and red tape might adversely impact on economic development (World Bank, 2002). Mauro (1995) highlights the cumbersome and dishonest bureaucracies might postpone the provision of permits, thereby deteriorating technological advances embodied in new equipment or new productive processes of firm. Using enterprise data, a number of studies show that the burdens of governmental regulations trigger the increase in business costs, risks and barriers to competition, thus prohibiting technological advance, profits, employment creation as well as productivity (Aterido et al., 2011; World Bank, 2004; Batra et al., 2003; Beck et al., 2005; Djankov et al., 2002; Djankov et al., 2006; Escribano & Guasch, 2005; Hallward-Driemeier et al., 2006; Kinda et al., 2011; North, 1990). Additionally, Escribano & Guasch (2005) stress that if there are high transaction costs or cumbersome regulations in registering properties, the assets are not qualified as collateral to obtain the loans from the bank, thereby becoming “dead” capital.

In the literature, it is widely accepted that the government regulations are relevant to widespread corruption (Beck et al., 2005; Djankov et al., 2002; Kinda et al., 2011; Mauro, 1995; Myrdal, 1968; Shleifer & Vishny, 1993). For instance, Shleifer & Vishny (1993) explain why many permits and regulations exist is that it is probably to give officials the power and collect bribe in return for providing the permits. Mauro (1995) argues that corruption might be expected to be more widespread in the countries where red tape slows down the process of providing bureaucratic procedures. Additionally, in an empirical study of eight industries in the five Middle East and North African economies, Kinda et al. (2011) discover that it has no impact of corruption on the firm technical efficiency when using single variable. However, when they employ a composite indicator which allows interacting between corruption and cumbersome regulations such as tax administration, business license, customs and trade regulations, operating permit, they find the negative correlation with the firm technical efficiency in some industries.

2.4. Human capital and Firm performance.

Theory at both microeconomic and macroeconomic level predicts that human capital is a crucial determinant of economic activities. At macroeconomic level, it is unquestionable that human capital is also an original resource of economic growth and productivity (Bosworth & Collins, 2003; Hall & Jones, 1999; Lucas Jr, 1988; Mankiw et al., 1992; Psacharopoulos, 1988; Rodrik et al., 2004). For instance, Hall & Jones (1999) believe that the discrepancies in human capital are responsible for the variation of country productivity and economic growth. Similarity, Bosworth & Collins (2003), in a study of the growth experiences across 84 countries over past 40 years, investigate that the educational quality has a strongly positive correlation with growth rate and productivity. However, they stress that using years of schooling might not be a good proxy for human capital by error measurements or failure to account for variations in the quality of education between countries.

At microeconomic approach, the role of human capital in association with firm development is investigated by diverse aspects. It has been widely acknowledged that human capital has a pivotal importance to the creation of competitive advantages of organizations (Colbert, 2004; Laursen & Foss, 2003; Subramony et al., 2008). Furthermore, thank to human capital, firms are able to create competitive advantages by developing human resources in ways that create unique value difficult for competitors to imitate (Amit & Schoemaker, 1993; Barney, 2000). The existing papers under microeconomic approach have often concentrated on evaluating the effects of human capital on firm economic performance.

The principle hypotheses underlying these studies are that the human capital allows enterprise to increase profit and productivity through employee productivity, efficient usage of machine and technology (Acemoglu & Verdier, 1998; Bresnahan et al., 2002; Escribano & Guasch, 2005; Kinda et al., 2011; Subramony et al., 2008; Youndt et al., 1996). Kinda et al. (2011), for instance, employing the SFA technique for the five Middle East and North African countries, figure out that the firm with high quality of human resource is more efficient. In this paper, human capital is proxy by various variables as skill and education of available workers, experience of the top manager, and training of employees.

To sum up, the literature under both macroeconomic and microeconomic level suggests an important role of the investment climate in firm growth. We emphasize that the obstacles of the investment climate in terms of infrastructure-service, access to finance, and human capital will devastate the firm technical efficiency. By contrast, government business relation, especially in term of corruption, is emerging some debates. However, it is unquestionable that corruption and business regulation are highly correlated. Therefore, it raises the challenge of precisely evaluating the influences of government on firm business by high correlation among regressors. An attempt in selecting variables to impose into model will induce a persistent bias by omitted variable bias. We will discuss this issue further in the chapter 3

CHAPTER 3

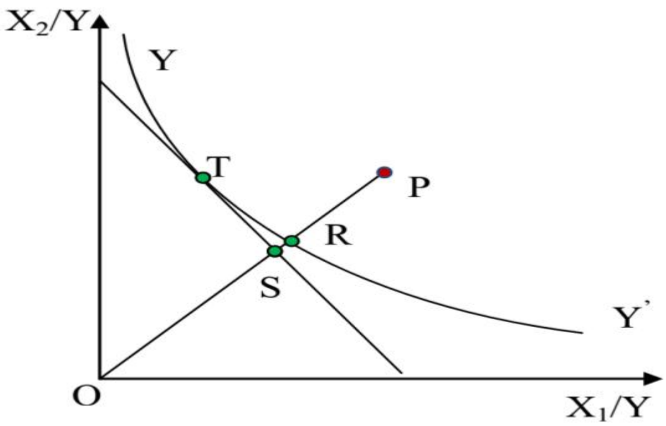
EMPIRICAL METHODOLOGY

AND INVESTMENT CLIMATE MEASUREMENT

3.1. Empirical Methodology

The literature of the SFA technique is extremely substantial; therefore, we will highlight some central features of this technique. Conventional definition of a production function is that it produces maximum feasible output from a given set of the inputs. The concept of measuring efficiency are pioneered by Farrell (1957), who proposed that firm efficiency could be categorized by technical efficiency and allocative efficiency. The technical efficiency is explained as producing the maximum level of the output from a given set of the inputs (output-oriented), while the allocative efficiency reflects the optimal combination of the inputs to produce a given output (input-oriented) (T. J. Coelli et al., 2005). The allocative efficiency occurs when marginal rate substitution between any of the inputs is equal to input price ratio. The combination of these two concepts gives the concept of total economic efficiency (T. J. Coelli et al., 2005). The technical efficiency and allocative efficiency could be depicted graphically by means of the unit isoquant curve as in figure 1. We assume that the firm uses two inputs X_1 and X_2 to produce a single output Y under assumption of constant return to scale. The knowledge of the unit isoquant of fully efficient firm is represented by the curve YY'. If the firm uses input quantities X_1 and X_2, denoted by point P, to produce one unit of output, it is inefficient since the same level of output could be obtained by consuming less of both inputs, which denoted by the point R. The technical efficiency is, therefore, defined by the ratio OR/OP, and the distance RP expresses inefficiency in resource utilization.

Figure 1. Technical and Allocative Inefficiency.



Furthermore, the firm could minimize production cost by choosing a different ratio of input combination. The minimum cost combination of inputs that produce one unit of output is portrayed by the point T, where the marginal rate substitution between two inputs is equal to the input price ratio. The allocative efficiency is, therefore, defined as ratio OS/OR.

There are several purposes of measuring efficiency. The initial aim is to compare economic performance across economic units as firms, countries. Secondly, perhaps more significantly is to interpret why some firms are far from "best practice" or more inefficient than others based on incorporating appropriately explanatory variables. Finally, firm efficiency discrepancies imply that there is scope for formulating and implementing policies to mitigate inefficiency and to improve efficiency.

The technical efficiency could be modeled by utilizing either the deterministic or the stochastic production frontier. One important assumption of the deterministic production frontier is that the entire deficit of observed outputs from maximum attainable output is attributed to technical inefficiency. Therefore, this model measures efficiency less precisely because of absorbing both the effects of random shock and measurement errors that are unrelated to efficiency (T. J. Coelli et al., 2005). On the other hand, the stochastic production frontier could overcome this shortcoming by authorizing to distinguish the error component into two parts: the technical inefficiency and the random shock, thereby estimating efficiency more accurately.

In the literature, there are two alternative approaches to estimating the frontier models: non-parameter and parameter. The non-parametric approach relies on linear program technique, which is also called as Data Envelopment Analysis (DEA)[4]. The advantage of this approach is simply since it does not require the explicitly functional form of the production frontier imposed into the data. However, because of simplicity, it is unable to rule out the effects of random shock and measurement errors in efficiency measurement. In addition, this method is extremely sensitive with outliers in sample, thereby leading to misleading information in computing efficiency (Timmer, 1971). Furthermore, by directly calculating efficiency from data, this approach is, therefore, impossible to make statistical inference and to construct standard error or confidence interval.

By contrast, the parametric or statistical approach imposes a specification on the production frontier; therefore, it of course could overcome the restrictions of the DEA method. Moreover, this approach allows constructing standard error and confidence interval as well as making statistical inference. Hence, we could test the different hypotheses on efficiency term and all other parameters of the production frontier for further aims. The parametric technique could be utilized with both cross-section and panel data. In practical application, using panel data are more advantageous than cross-section data. With cross-section data, we cannot eliminate the firm's specific effects that are unrelated to the technical efficiency (G. E. Battese & Coelli, 1995), whereas using panel data could decompose the error into the firm's specific effects, the time specific effects, the white noise and the technical inefficiency (Kumbhakar, 1991). Moreover, the benefit of

[4] See T. J. Coelli et al. (2005) for more detailed discussion of this technique.

panel data is that it enables to relax some strong assumptions imposed in the case of cross-section data, thus producing estimators with more desirable statistical properties.

As discussed above, the technical efficiency estimated by the deterministic production frontier induces to a persistent bias due to firm's specific effects. Aigner et al. (1977) and Meeusen & van Den Broeck (1977) independently proposed a stochastic frontier model, which could split the error term into the random shock and the technical efficiency:

$$y_i = f(x_i;\beta)\exp(v_i)TE_i \quad (1)$$

Where,$f(x_i;\beta)\exp(v_i)$is the stochastic frontier, which consists of two elements: one is deterministic part $f(x_i;\beta)$, which is common to all firms; the other is a firm-specific part exp (v_i), which captures the effect of random shock to each firm. Let TE_i be the technical efficiency of firm i, which is defined as the ratio of the real output y_i to the maximum feasible output$f(x_i;\beta)\exp(v_i)$. Therefore, the TE is in the form:

$$TE_i = \frac{y_i}{f(x_i;\beta)\exp(v_i)} \quad (2)$$

The TE always takes a value between zero and one; therefore it provides an indicator of the degree of the technical efficiency of firm i. If TE_i = 1, this implies that firm i is fully efficient by obtaining its maximum feasible output $f(xi;\beta)$ exp (v_i) (e.g. the point R in the figure 1). The $\exp(v_i)$ are the random shocks, which could take any value. This means that these shocks are allowed to vary across firms.

Under econometric standpoint, the equation (1) could be formulated in linearity of log of the variables as:

$$\ln y_i = \ln f(x_i;\beta) + v_i - u_i \quad (3)$$

Where $u_i \geq 0$ measures the technical inefficiency since $u_i = -\ln TE_i$=1-TE_i. Therefore, the TE_i will be in the form: $TE_i = \exp(u_i)$. In equation (3), the errors v_i are the random shocks to specific firm. The v_i could take any values and has a symmetric distribution, which is usually assumed to be normal distribution.

Choosing econometric techniques to estimate the technical efficiency is depended on data type used. This difference is entirely accounted for by different assumptions imposed into each kind of data. In the context of cross-section data, it needs some compulsory assumptions on the characteristics of two economically distinguishable random disturbances: the statistical noise denoted by v_i and the technical inefficiency denoted by u_i. The errors v_i are assumed to have a symmetric distribution. More specific, they are independently and identically distributed as $N^+(0, \sigma_v^2)$. The u_i are assumed to be independently distributed of v_i and to satisfy that $u_i \geq 0$ (e.g. it follows a one-sided normal distribution$N^+(0, \sigma_u^2)$). It should be remarked that the total error term, $\varepsilon_i = v_i - u_i$, is asymmetric and non-normal. This implies that least squares estimator is biased. By contrast, with panel data, we could loosen some strong assumptions on distributional forms of the statistical noise and the technical inefficiency. Additionally, it does not require that the technical inefficiency is independent with the inputs in the production frontier. Furthermore, it could construct estimates of the efficiency levels of each firm that are consistent as the number of observations per firm increases. This means that the technical efficiency could be estimated more accurately.

The main aim of this paper is to interpret why some firms perform more efficient than others based on incorporating appropriate explanatory variables. In the literature, one way to do this, which is commonly known as “two step” procedure, is to estimate the technical inefficiency of the stochastic production frontier in the first step and the obtained technical inefficiency is run regression with a vector of explanatory variables in the second step. This approach is adopted by Kalirajan (1981) and Pitt & Lee (1981). However, the “two step” procedure is totally flawed as pointed out by G. E. Battese & Coelli (1995) that this approach totally conflicts with the assumption that the technical inefficiency is independently distributed in the first step. Additionally, H. Wang & Schmidt (2002) straightforwardly showed that without accounting for the impacts of the exogenous variables in the first step will induces a persistent bias in the estimate of the technical efficiency, and this bias is transferred into the result of the second step. Kumbhakar (1991) and Reifschneider & Stevenson (1991) proposed a single-stage maximum likelihood procedure to address to the bias of the "two step" procedure. G. E. Battese & Coelli (1995) expanded the model of Kumbhakar (1991) to use with panel data. Therefore, we will adopt the following model suggested by G. E. Battese & Coelli (1995) as below:

Writing a production function in log-linear form of the Cobb-Douglas function, we obtain

$$\ln y_{it} = \ln x'_{it}\beta + v_{it} - u_{it} \quad (4)$$

Where, Y_{it} is actual added value of total sale of firm i at time t and X_{it} is a matrix of inputs, including labor force (L) and capital (K) of firm i at time t. It should be remarked that this model is a pooled estimator since it treats the multiple observations of the same unit as being obtained from independent samples (G. E. Battese & Coelli, 1995). Therefore, this model must satisfy the all assumptions of the cross-section data. More particularly, the componentv_{it} is the disturbances, which are assumed to be independent and identically distributed with zero mean and variance σ_v^2 and independently distributed with u_{it}. The u_{it} is the technical inefficiency and non-negative number in the stochastic frontier model, which is assumed to be independently distributed, such that u_{it} obtained by truncation (at zero) of the normal distribution with mean $\mu = z_{it}\delta$ and variance $\sigma_u{}^2$. The equation (5) specifies the stochastic production frontier in terms of original inputs. However, the technical inefficiency u_{it} is a functional form of appropriate explanatory variables (z' variables) and unknown parameter δ. The impacts of the explanatory variables (z' variables) on the technical inefficiency, u_{it}, in the stochastic frontier model (4) will be expressed explicitly in the equation (5) as:

$$u_{it} = \delta_{z_{it}} + \omega_{it} \quad (5)$$

The z_{it} is the vector of the explanatory variables including investment climate and firm characteristics, which influences on the technical inefficiencies of the firm, and δ is the vector of coefficients need to be estimated. The ω_{it} is a random variable defined by the truncation of the normal distribution with zero mean and variance σ_u^2 . The requirement that $u_{it} \geq 0$ is ensured by truncating ω_{it} from below such that $\omega_{it} \geq -\delta z_{it}$. G. E. Battese & Coelli (1995) underlined that these assumptions are consistent with the assumption of the inefficiency terms being distributed as truncated normal distribution $N^+(\delta z_{it}, \sigma_u^2)$.

The asymmetry of the distribution of the error term $\varepsilon_{it} = v_{it} - u_{it}$ is a central feature of the model. The formulation to compute the degree of asymmetry could be represented by the following parameter:

$$\lambda = \frac{\delta_u}{\delta_v}. (6)$$

The larger λ means that it contains a large ratio of the technical inefficiency (u_{it}) in error term ε_{it}. By contrast, if $\lambda = 0$, then the symmetric error component (v_{it}) are overwhelming in the determination of the ε_i. Therefore, the complete error term ε_i is contributed by the random shock v_{it}, which follows a normal distribution. The ε_i therefore has a normal distribution. To test for the hypothesis that $\lambda = 0$, we could use wald statistic or likelihood ratio test both based on the maximum likelihood estimator of λ. T. Coelli (1995) used the test with the null hypothesis $\gamma = 0$ against the alternative $\gamma > 0$, where:

$$\gamma = \frac{\sigma_u}{\sigma_v + \sigma_u} \ (7)$$

T. Coelli (1995) stressed that the parameter γ does not view as the contribution of the inefficiency effect on the total variance of ε_i since the variance of inefficiency does not equal to σ_u^2, but to $[(\pi - 2)/\pi]$ σ_u^2. Therefore, calculated the contribution of inefficiency effects on the total variance of ε_i is equal to $\gamma/[\gamma + (1 - \gamma)\, \pi/(\pi - 2)]$

The Wald statistic value is constructed as

$$W = \frac{\hat{\gamma}}{\hat{\sigma}_{\hat{\gamma}}} \quad (8)$$

Where, $\hat{\gamma}$ is maximum likelihood estimator of γ and $\hat{\sigma}_{\hat{\gamma}}$ is the estimator of its standard error. This test is performed as a one-sided test due to γ is non negative.

The likelihood test statistic for hypothesis $\gamma = 0$ is:

$$LR = -2\,[\log(L_O) - \log(L_1)] \quad (9)$$

In which $\log(L_O)$ is the log-likelihood value under the null hypothesis and $\log(L_1)$ is the log-likelihood value under the alternative. This test statistic is asymptotically distributed as chi-square random variable with degrees of freedom equal to the number of restrictions (T. Coelli, 1995). Based on a Monte Carlo study, T. Coelli (1995) argues that the Wald test performs very poor size, while the likelihood ratio test has the correct size and superior power. Therefore, he suggested that likelihood ratio test should be used with maximum likelihood estimation and testing hypothesis.

The method of maximum likelihood is suggested estimating simultaneously the parameters in equation (4) and (5)[5]. Related to distributed assumption, W. H. Greene (1980, 1990) argued that the only distribution which provisions the maximum likelihood estimator with all desirable properties is the Gamma distribution. However, van den Broeck et al. (1994) stated that the truncated distribution function is preferred by allowing to distinguishes better between statistical noise v_{it} and inefficiency terms u_{it}.

The technical efficiency of firm i at time t is defined by:

$$TE_{it} = \exp(-u_{it}) = \exp(-\delta z_{it} - \omega_{it}), \quad (10)$$

Jondrow et al. (1982) argued that the distribution of ε_{it} contains all information of u_{it}; therefore, he proposed that it should measure the efficiency based on the distribution of inefficiency conditional to the composite error term, $u_{it} \mid \varepsilon_{it}$. This implies that $E(u_{it} \mid \varepsilon_{it})$

[5] See George E. Battese & Coelli (1993) for more detail discussion of the maximum likelihood procedure, including the likelihood function and its partial derivatives with respect to the parameters of the model

could be considered as a point estimate of u_{it}. When the distribution of the inefficiencycomponent is a truncated distribution, a point estimate of the technical efficiency TE_{it} is given by:

$$E(TE_{it}) = E[\exp(-u_{it})|\varepsilon_{it}] = \frac{[\Phi(-\sigma_* + \mu_{it}^*/\sigma_*)]}{[\Phi(\mu_{it}^*/\sigma_*)]} \exp\left[-\mu_{it}^* + \frac{1}{2}\sigma_*^2\right] (11)$$

Where:

$$\mu_{it}^* = (\sigma_v^2 \delta z_{it} - \sigma_u^2 \varepsilon_{it})(\sigma_u^2 + \sigma_v^2)^{-1} \text{ and } \sigma_*^2 = \sigma_u^2 \sigma_v^2 (\sigma_u^2 + \sigma_v^2)^{-1}.$$

Φ (.) is the standard normal cumulative density function.

The technical inefficiency effect model measures the efficiency by including a linear function of the appropriate explanatory variables. The equation (5) consists of a shift parameter δ_0, which is constant across production units. This model treats multiple observations of the same unit as being obtained from independent samples. Therefore, this model is a pooled estimator. To exploit the benefits from the panel data, Kumbhakar & Hjalmarsson (1995) and H.-J. Wang (2003) suggested interacting with individual specific effects in the inefficiency model. It is because, the truncated distribution does not allow to take first differences or to subtract means from the data in order to eliminate the individual specific effects because of resulting in unknown distribution (H.-J. Wang, 2003). In addition, Kumbhakar (1991) suggested including dummy variables to account for specific characteristics.

3.2. Investment Climate Measurement.

The World Bank Investment Climate Survey consists of the data of inputs and outputs, and various aspects of the investment climate at firm-level. Therefore, it allows measuring efficiency across firms as well as assessing the extent to which the investment climate influences firm efficiency. In this survey, World Bank classifies the investment climate by seven dimensions; however, we only concentrate on four dimensions of the investment climate that are: Infrastructure-service; Government Business Relation; Access to finance; Human Capital.

The data of Vietnam is collected in 2004 and 2005. It is remarkable that the data of 2004 only includes outputs and inputs of the production function. However, following the Law of Large Number and the empirical results of Escribano & Guasch (2005), it is rational to assume that unless there is a structural break, the investment climate does not alter much for one consecutive year. By this assumption, we will have a panel data of 2004 and 2005 to increase the sample size as well as to test for the hypotheses of interest.

In this paper, we always expect to treat the investment climate variables as the exogenous determinant of firm economic performance. However, it is not always as we desire due to the fact that some productive firms might be willing to reduce their own investment climate constraints, thereby resulting in a simultaneity bias of practical estimation. For instance, a productive firm might have a close relationship with authorities, and they might exploit this relationship to minimize the inspections from authorities or to achieve some economic benefits. This situation was widespread in Vietnam case (VCCI, 2009, 2010, 2011). To address the endogeneity concern, we will utilize average investment climate indicators taken across firms in the same city and sector. This approach is similarly adopted by Bastos & Nasir (2004); Escribano & Guasch (2005); and Kinda et al. (2011). Using the average value of the investment climate is a valid instrument variable to mitigate the endogeneity bias and to maximize the sample size, thus obtaining valid and reliable results.

Another problem related to measurement of the investment climate is that the investment climate is a vast concept and is covered by multiple indicators that address a similar major issue. Therefore, practically estimating the effects of the investment climate on firm efficiency is to respond to the question of whether we achieve the best results from selecting the variables of the investment climate imposed into the model. To do this, most authors frequently employ multiple individual variables to capture for different dimensions of the investment climate. However, by utilizing multiple variables that cover the same theme could lead to the high correlation among regressors. For example, the government business relation comprises the multiple variables such as corruption, land certificate obstacles, tax administration obstacles, etc. As showed in the literature of chapter 2, corruption might be masked in dealing with the governmental regulations; therefore, these variables are highly correlated. To avoid collinearity problem, most authors often endeavor to select the investment climate variables imposed into the model. However, this approach might induce to the omitted variables bias, which is more severe than multicollinearity problem. To solve this, Bastos & Nasir (2004) and Kinda et al. (2011) proposed using the composite indicators of the investment climate to substitute for the individual variables. The composite indicators of the investment climate are constructed by Principle Component Analysis (PCA). This procedure authorizes to combine the individual variables in the same theme to extract only one aggregate variable, which envelops more dimension of the investment climate. The principle of PCA method is to reduce the dimension of observed variables to a smaller number of principal components, which account for most of the variance of the observed variables. Therefore, the PCA technique allows synthesizing the data with least loss of information. The number of components is proportional to the number of initial variables used in the PCA. Usually, we will retain only the first component because it accounts for the maximal amount of the total variances in the initial variables. The aggregate indicators of the investment climate in the PCA are constructed as a linear combination of optimally-weighted observed variables. Therefore, we will have four aggregate indicators of the investment climate that are: infrastructure-service, government business relation, access to finance, and human capital. The initial individual variables selected to produce the composite indicators of the investment climate are chosen based on maximizing the number of observations and capturing as many dimensions of the investment climate as possible. More detailed discussion of the PCA method is presented in the appendix 1.

CHAPTER 4

INVESTMENT CLIMATE AND

EFFICIENNCY OF THE VIETNAMESE MANUFACTURING

4.1. Vietnamese Manufacturing and investment climate.

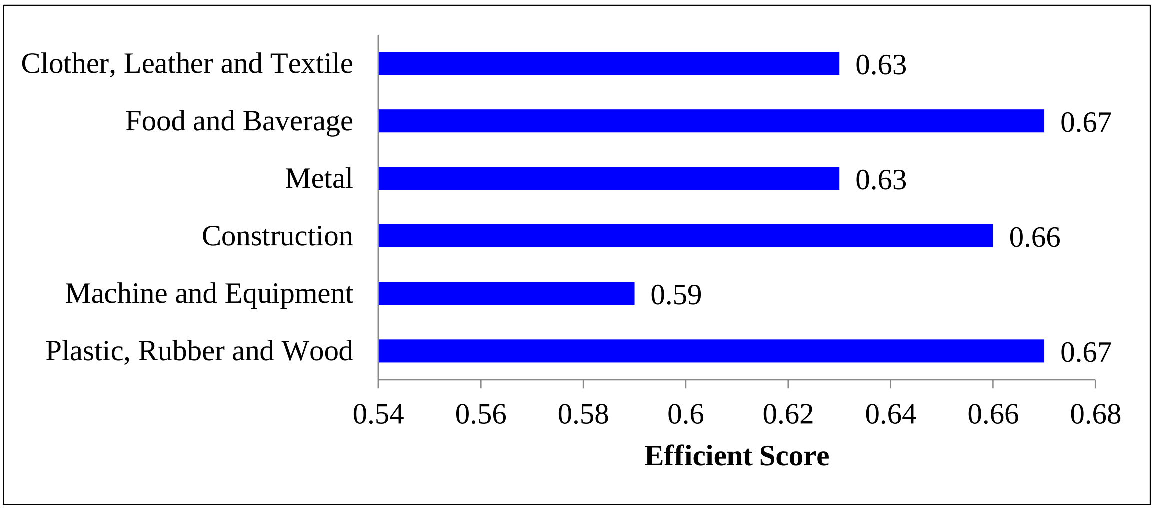
Before 1986, Vietnam followed the centrally planned economic regime with only collective ownership, and therefore the SOEs are exclusively dominant in the industry. The centrally planned economic regime with the collective ownership triggered the burial of produced motivation, innovation, and national productivity. As a consequence, the economy was sunk deeply in crisis and surrounded by poverty. These challenges compelled the government to implement the economy reform *"Doimoi"* in 1986. The *"Doimoi"* is an important milestone in altering the structure of the economy with officially allowing the development of private sector in a socialism-oriented market economy. The perspicacity of the *"Doimoi"* was soon demonstrated by an unprecedented raise in national productivity. Over the years, the Vietnamese manufacturing has become the engine of economic growth with impressive contributions. From almost nothing before 1989, the manufacturing sector accounted for nearly 15% of GDP in 1995 and dramatically enhanced to 21% in 2009. Additionally, it quickly became the most dynamic sector in job creation with 31.3% of new employments for the whole 2001-2008 period. After the revision of Enterprise Law in 2000 and 2005, it recorded a rapid growth of private enterprise from approximately 35,000 firms in 2000 to around 84,000 firms in 2004 and about 312,416 firms in 2011 (GSO, 2005, 2011). Notwithstanding, the majority of the Vietnamese enterprises are small and medium sized, with around 90% in 2005 and 97.6% in 2011 (GSO, 2005, 2011). Regarding the SOEs, it had about 5900 SOEs in during the 1990s and slightly declined to 4500 SOEs in 2004 by the process of privatizing and restructuring of the government (Nguyen & van Dijk, 2012). However, after 20 years of *"Doimoi"* from 1986, the government still preserved a great proportion of the SOEs with the aim of boosting the economy. Therefore, it is no surprise that the process of restructuring the SOEs is sluggish with only 9% of the total state capital privatized until 2005 (Nguyen & van Dijk, 2012). In contrast to the government target, the SOEs are greatly concerned by the vast amount of bad debts, inefficiency, insufficient transparency and widespread corruption. For example, by the end of 2011, the Vietnam Electricity Corporate lost approximately VND 11.5 trillion, equivalently USD 555 million. Additionally, until 2013, total debts of the 127 largest SOEs recorded at USD 62 billion, approximately 50% of entire GDP[6]. With widely preferential treatments of the government such as access to land, soft loan, and technology innovation, the SOEs continue overwhelmingly and put more pressure on the development of private enterprise by inequality in competitiveness. Therefore, it widely believes that there is not yet a level playing field for the private firm in the Vietnam market. It derives from the fact that the managers of the SOEs often have an intimate relationship with state ownership bank or State Bank of Vietnam; therefore, they could relax the rigorous procedures, project evaluation, collateral properties in the process of approaching to external finance, and even the pressures of governmental authority force bank to lend to the SOEs in spite of high risk of proposed projects. Hence, it is no surprise when over 76% of the SOEs made a loan from the State Bank of Vietnam in 2011 (GSO, 2011).

By globalization, the Vietnam economy is confronting with many challenges from competitive pressures, especially after joining the World Trade Organization. The vulnerability by external shocks to the economy is early exposed, and it triggers for the

[6]In general, information of the SOEs is confidential, but debt and loss are partly known by the public. To substantiate this, we have reviewed the newspaper articles as *VNeconomy* available at http://vneconomy.vn; Vietnam *New* available at http://vietnamnet.vn.

stagnation of economic growth in recent years. As a typical illustration, the GDP growth by the whole economy and economic sectors declined suddenly, especially tremendous slump of the manufacturing from 12.37% in 2007 to 2.76% in 2009 due to the financial crisis in 2009. In this context, the poor investment climate is forcing this situation to be more severe and sluggish in the progress of economy recovery. The fragility of the Vietnam manufacturing is early exposed, in part because of the pressures of competitiveness, in vast part because of their weak capacity in all aspects (Nguyen and Pham, 2010; MPI, 2010). The figure 2 shows the inefficiency of the Vietnam manufacturing from estimating the production frontier in the period of 2005 and 2009. The efficiency of the Vietnamese manufacturing quite restricts and falls in the interval of 0.59 to 0.67.

Figure 2. The efficiency of the Vietnamese manufacturing in 2005-2009



Source: Author's estimation

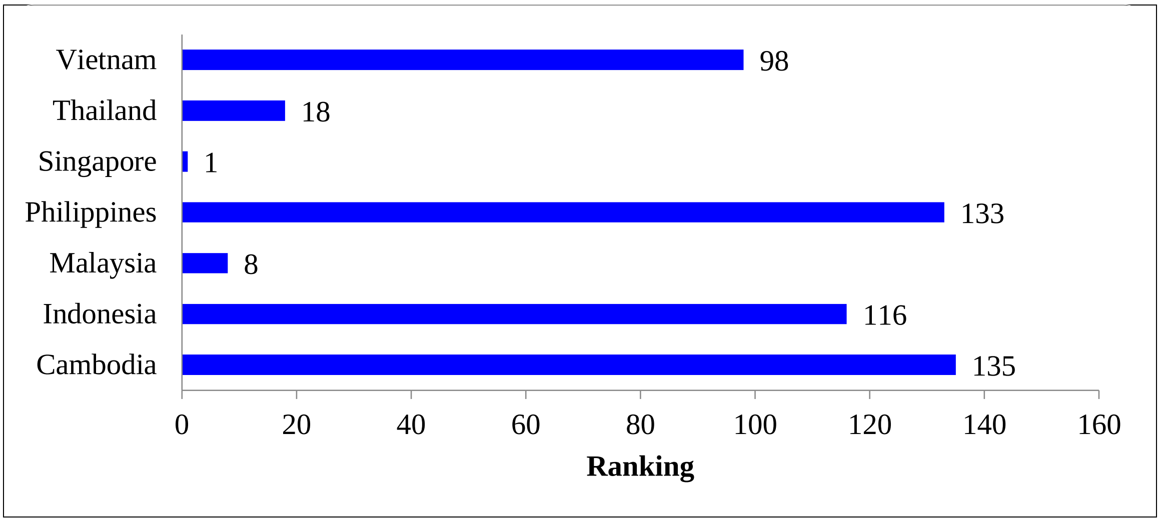
Over the years, manufacturing sector has emerged as an engine of economic growth by vital contributions in increasing income, creating employment, alleviating poverty, and paying tax for public expenditures. Therefore, creating a friendly business environment for enterprise to grow and increase its contributions is received great care from the government in recent years. As a typical illustration, the Vietnam government has conducted 21 reforms- the highest number of East Asia Pacific region- since 2005. Simultaneously, Provincial Competitiveness Index project[7] is established since 2005 with the aim of assisting local government to improve the business environment, economic governance, and administrative reform. Unfortunately, the Vietnamese investment climate is not improved and even lagged behind other countries in South East Asia region. According to the Doing Business Report[8] released by World Bank (2011, 2012, 2013, 2014), it ranked the overall eases of the doing business of Viet Nam at 90 in 2011, gradually regressed to 98 in 2012, and 99 in 2013. These rankings reflect the fact that the government policies toward improving the investment climate seem to be inefficient

The Vietnamese investment climate in comparison with other countries in South-East Asia region is illustrated in the figure 3.

[7] *Provincial Competitiveness Index is national project, which is established since 2005 by collaborating between* Vietnam Chamber of Commerce (VCCI) and the U.S Agency for International Development (USAID). The aim of this project is to assessing the ease of doing business, economic governance, and administrative reform across 63 provinces and cities of Vietnam. Therefore, it is an important tool for local governments to improve economic governance, and thus promoting socio-economic development. This project evaluates the local business environment based on the firm perspective. The doing business is evaluated by 10 indicators, including Entry Costs, Land Access and Security of Tenure, Transparency and Access to Information, Time Costs and Regulatory Compliance, Informal Charges, Policy Bias, Proactivity of Provincial Leadership, Business Support Services, Labor and Training, Legal Institutions. The detailed information and the results of this project are variable in English at http://eng.pcivietnam.org

[8] The *Doing Business Report* measures and compares the business regulations across 189 economies around the world based on the perspective of domestic, primarily smaller companies. The business regulation of each country is measured by 9 indicators affecting on firm through their life cycle —for starting a business, dealing with construction permits, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts and closing a business. The ranking of each country is constructed by average percentile of all 9 indicators. Further information and the results of this project can be found at http://www.doingbusiness.org.

Figure 3. The ranking of the Vietnamese Investment Climate in comparison with other South-East Asia countries in 2012

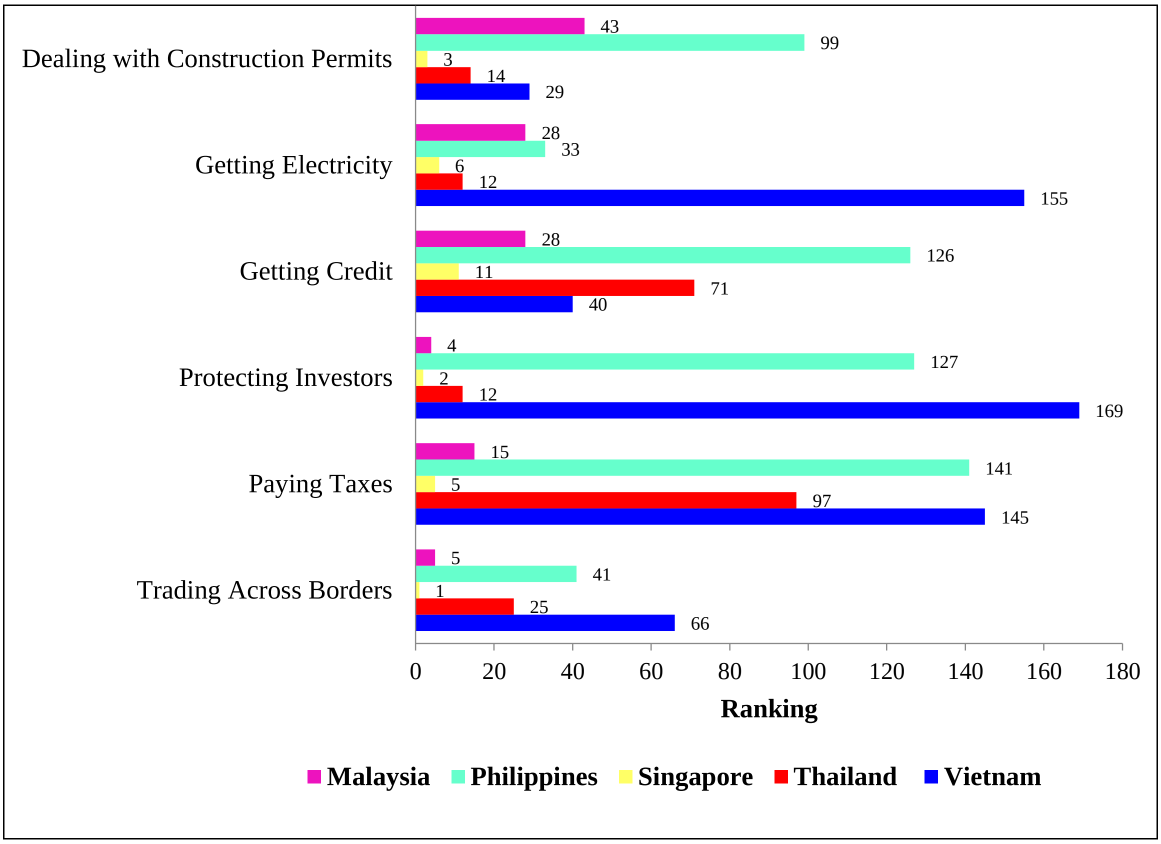


Resource: Doing Business Report, World Bank (2012)

As be seen in the figure 3, the ranking of overall eases of the business environment of Singapore, Malaysia, and Thailand is improved considerably with the positions of 1, 8, and 18 respectively. On the contrary, Vietnam is lagged behind at 90 in 2011 and is regressed to 98 in 2012.

The deep insight into main bottlenecks of the Vietnamese investment climate is expressed following the figure 4, in which paying tax, protecting investor and getting electricity are identified as the biggest obstructions. By contrast, others countries have an impressive improvement, for example, Singapore, Malaysia and Thailand. The business environment hindrances are the fundamental cause of inflating cost and timing for doing business, creating uncertainty, thereby intensively devastating investment, technological innovation, national prosperity and potential of the FDI inflow. The figure 5 shows the impacts of the poor investment climate on the FDI of Vietnam from 2009 to 2012. Regrettably, the volume of the FDI penetrating into the Vietnam economy is eroded dramatically.

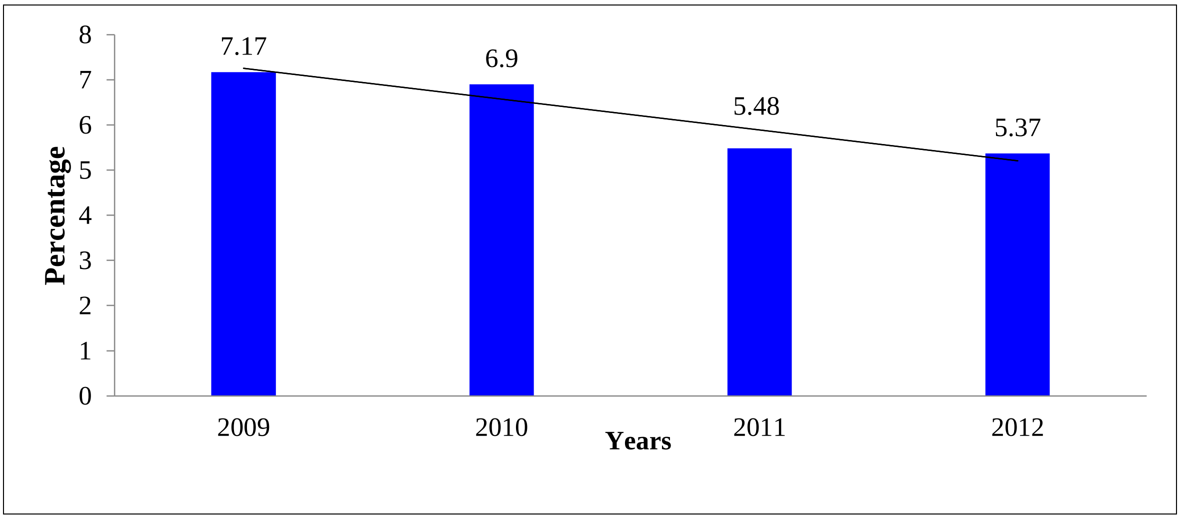
Figure 4. The main hindrances of the Vietnamese Investment Climate in comparison with other South-East Asia countries in 2012



Resource: Doing Business Report, World Bank (2012)

More specific, after becoming the World Trade Organization membership in 2007, the FDI of Vietnam was recorded impressively with about 7.17% of GDP in 2009, but gradually diminished parallel with the impoverished business environment to 5.37% in 2012.

Figure 5. The FDI volume inflow of Vietnam in the period of 2009-2012.



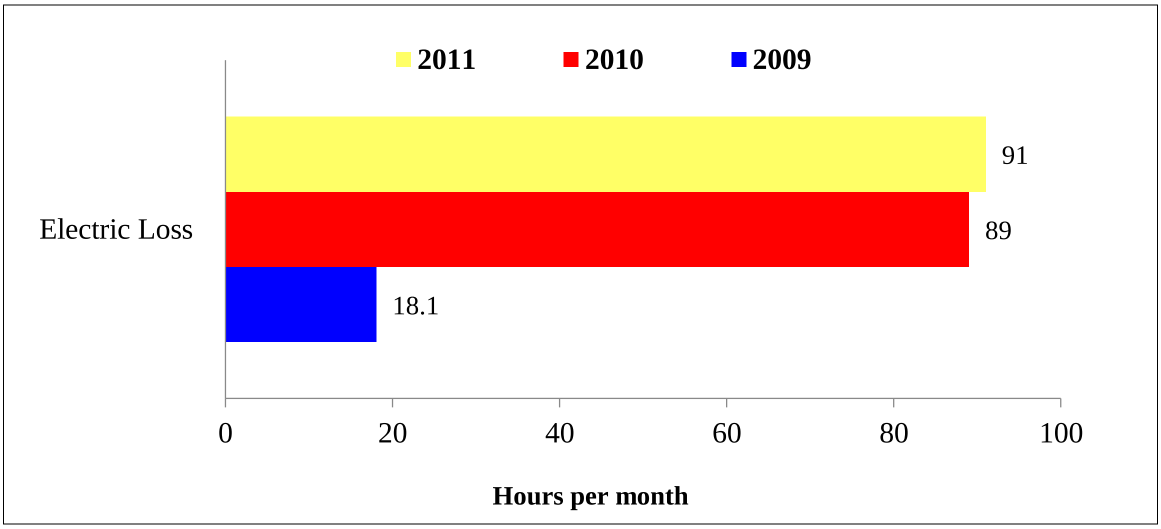
Resource: World Development Indicator, World Bank Database.

To clarify the main bottlenecks of the Vietnamese investment climate, following the subsections will help us to have a deep insight this issue based on firm perception. We will concentrate on the four components of the investment climate that are related to this paper, including infrastructure-service, government business relation, access to finance, and human capital.

4.1.1. Infrastructure – Service

The infrastructures-service is extremely crucial for firm performance since it is considered as the complementary production inputs. Therefore, the poor infrastructure-service will directly influence to firm's business cost and profit. The figure 6 and 7 elaborate the quality of the infrastructure-service of Vietnam from firm perception, classifying into three elements: getting electricity, the quality of transportation and industrial zone. The figure 6 shows the obstacle of firm in getting electricity for doing business. Unfortunately, the electric obstacle, represented by power outage per month, tends to be more severe. Particularly, in 2009, the average hours of electric loss per month were approximate 18 hours and tremendously increased to 89 and 91 hours in 2010 and 2011, respectively.

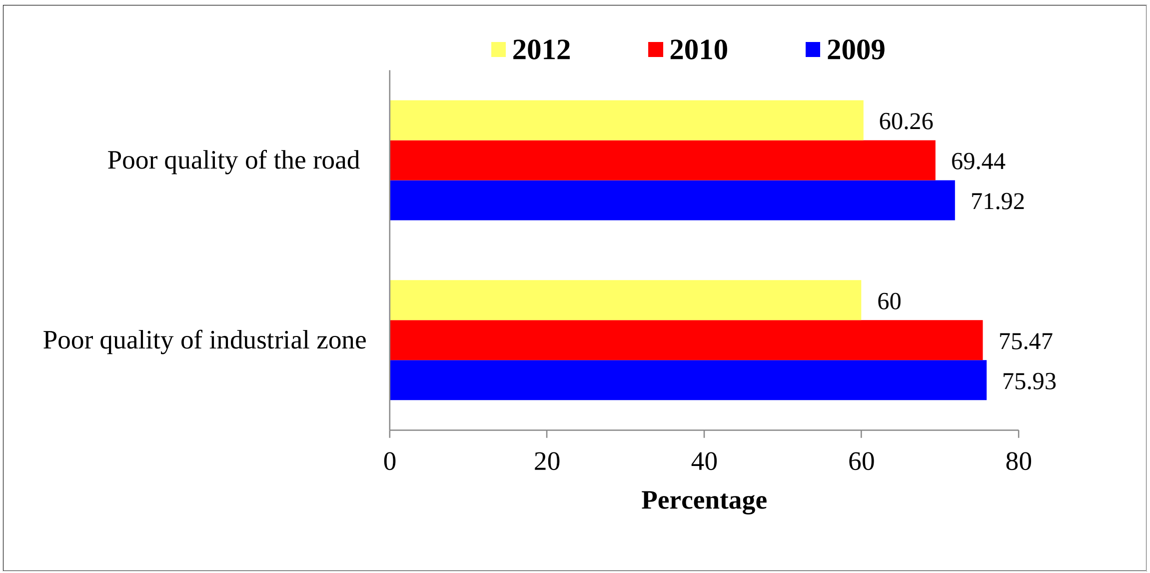
Figure 6. Electric obstacles for doing business



Resource: VCCI (2009, 2010, 2011)

The transportation is important for firm to effectively establish the chain of delivering their products to market as well as mitigating the cost of transportation and the damage of goods. Although, the Vietnam government has many efforts in improving the quality of infrastructure system, the quality of infrastructure system is not improved much. The figure 7 indicates that nearly 60.26% of the firms assessed the poor quality of road, and 60% evaluated the poor quality of industrial zone in 2011.

Figure 7. The percentage of the firms identifying the obstacles in infrastructure

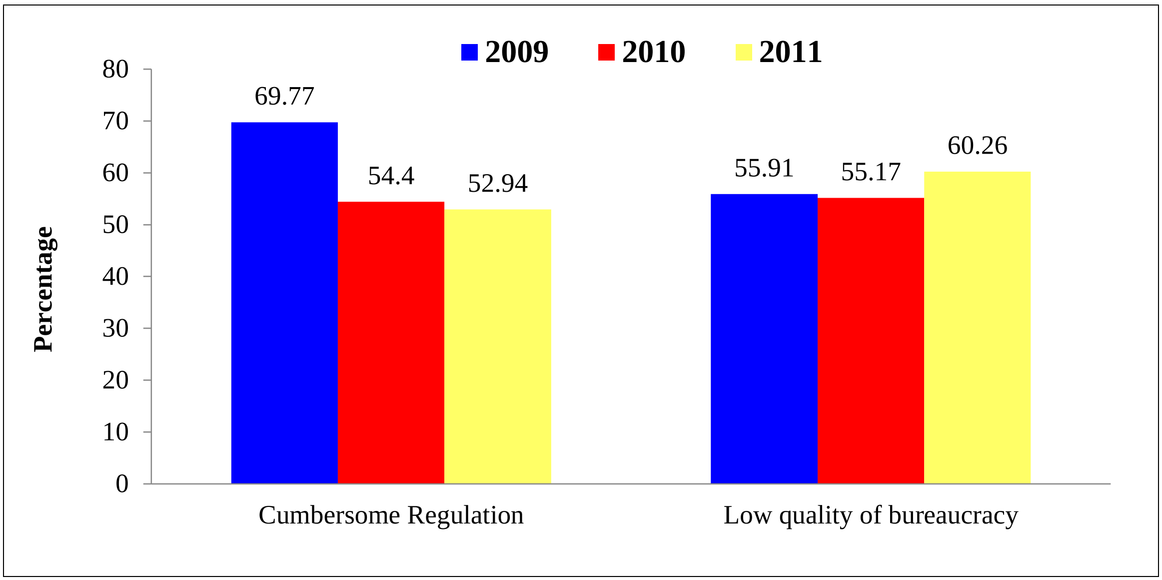


Resource: VCCI (2009, 2010, 2011)

4.1.2. Government Business Relation

The role of government regulation has been putting in the center of firm economic performance, not just because it directly influences on firm's cost and timing for doing business but also because it dramatically impacts on the incentives of individual and organization in innovating technology and expanding investment. The government business relation, covered by the variety of dimensions, is exposed in the figure 8 and 9. The figure 8 exposes the percentage of the firms identifying the main obstacles in dealing with the government regulations. Unfortunately, the burdens of administrative procedure on firm operation remained heavily with 52.94 % of the firms facing with the difficulties of administrative procedures in 2011. The result, given in the figure 8, also shows that the attempt of the government in enhancing the quality of officers is inefficient with 55.91% of the firms identifying the poor quality of bureaucracy in 2011. Furthermore, the hindrances of accessing to land certificate did not show improvement with remaining average 30 days to get land certificate across 2009-2011.

Figure 8. The percentage of the firms identifying the main obstacles in government regulations



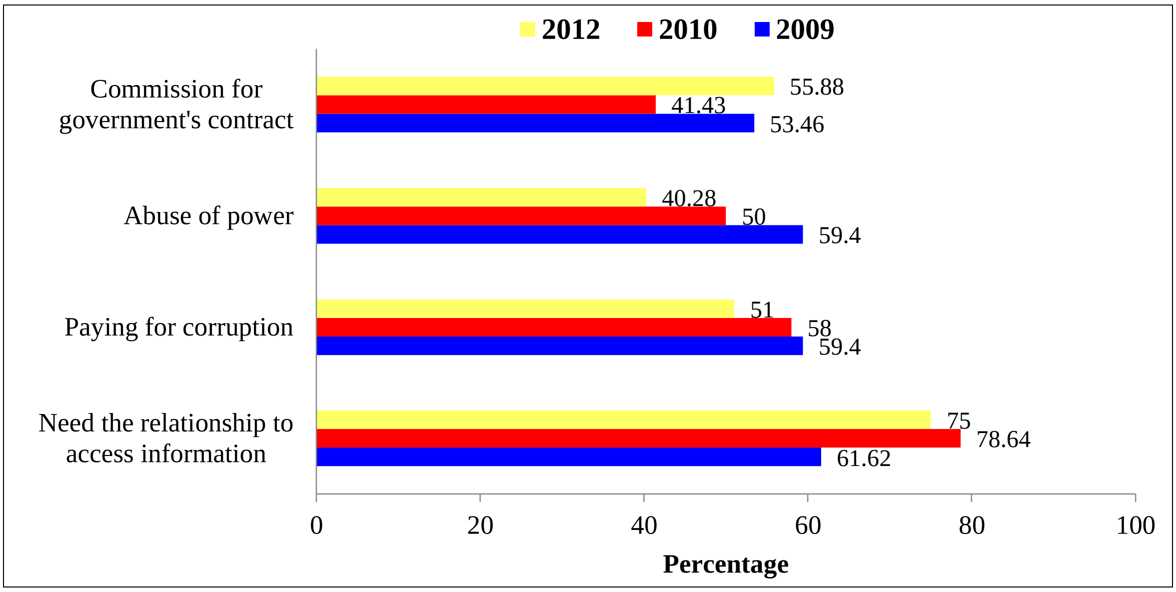
Resource: VCCI (2009, 2010, 2011)

Struggling against corruption seems to be a persistent challenge to the Vietnam government since it is widespread and rooted in the governmental system. As the typical evidence, the International Transparency Organization[9] ranked the corruption level of Vietnam at 123[10] out of total 177 countries measured in 2012 and somewhat improved to 116 in 2013. The burdens of corruption on firm business are manifested profoundly in the figure 9. Unluckily, the level of corruption is still prevalent in the public service system. More particular, paying commission for government's contract had an increasing trend between 2009 and 2011 and remarked at 55.88% of the firms that had to give the illegal money or the gift to acquire the government's contract in 2011. Additionally, around 51%

[9] http://www.transparency.org
[10] With higher ranking is higher corruption

of the firms paid for corruption, and roughly 75% of the firms needed the relationships to approach the information from the government in 2011.

Figure 9. The level of the corruption in Vietnam across 2009-2011.

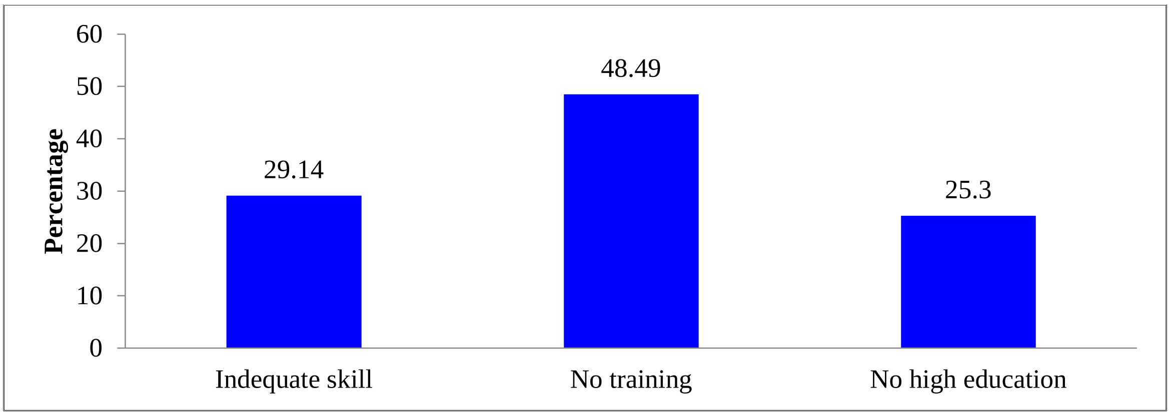


Resource: VCCI (2009, 2010, 2011)

4.1.3. Human capital.

Human capital is crucial for firm productivity since it allows achieving the efficiency in resource utilization. Furthermore, the human capital has a pivotal importance to the creation of competitive advantages of organizations. The role of firm human capital is emphasized in both the quality of worker and manager. The figure 10 shows the poor quality of the Vietnamese labor force.

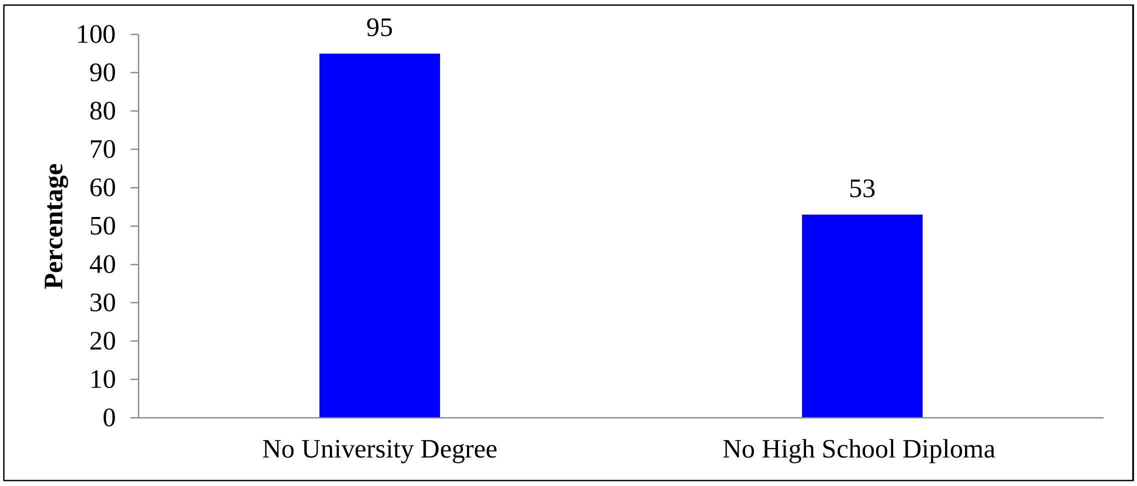
Figure 10. The quality of the Vietnamese labor force in 2004-2005.



Resource: Author's calculation from the data of World Bank (2005)

Particularly, the ratio of unskilled worker was reported approximately 29.14%, while the untrained worker proportion was recorded highly at 48.49%. The quality of top manager is revealed in the figure 11. It is remarkable that 53.6% of the top managers had no high school degree, and 94.5% had no university degree.

Figure 11. The quality of firm managers in 2004-2005

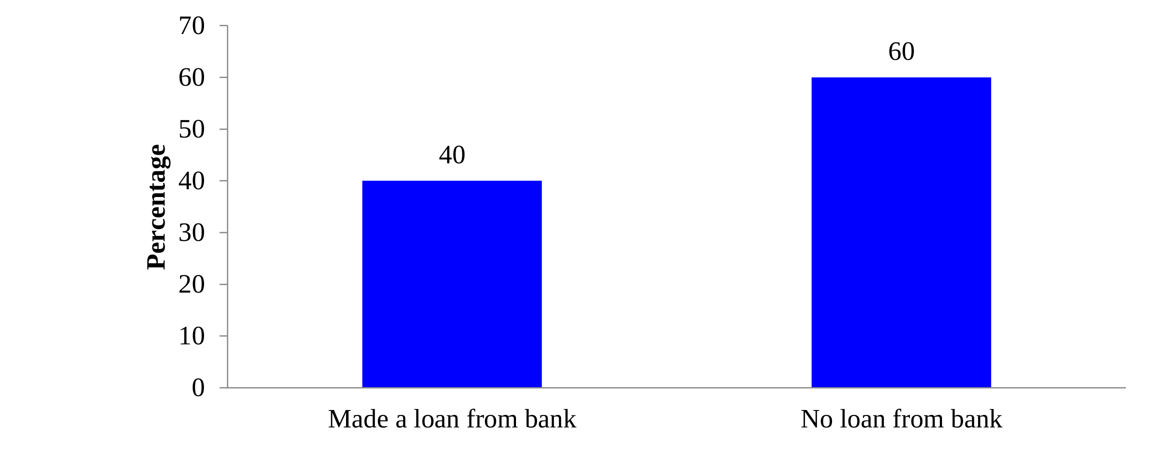


Resource: CIEM (2004, 2005)

4.1.4. Access to finance

External finance could promote firm efficiency through diverse channels such as improving information of production and efficiency of allocating capital, boosting technological innovation, improving corporate governance, exploiting economies of scale, as well as increasing human capital. The access to external finance of the Vietnamese firm is exposed in the figure 12. It is noticeable that notably 60% of the firms did not make a loan from the bank in 2005. This result infers that they might not need a loan for doing business, or they might be constrained in approaching to finance. To clarify whether the firm faces with the constraints in accessing to external finance in 2005, we show principle reasons why the firm did not need a loan from the bank for business in figure 13 below.

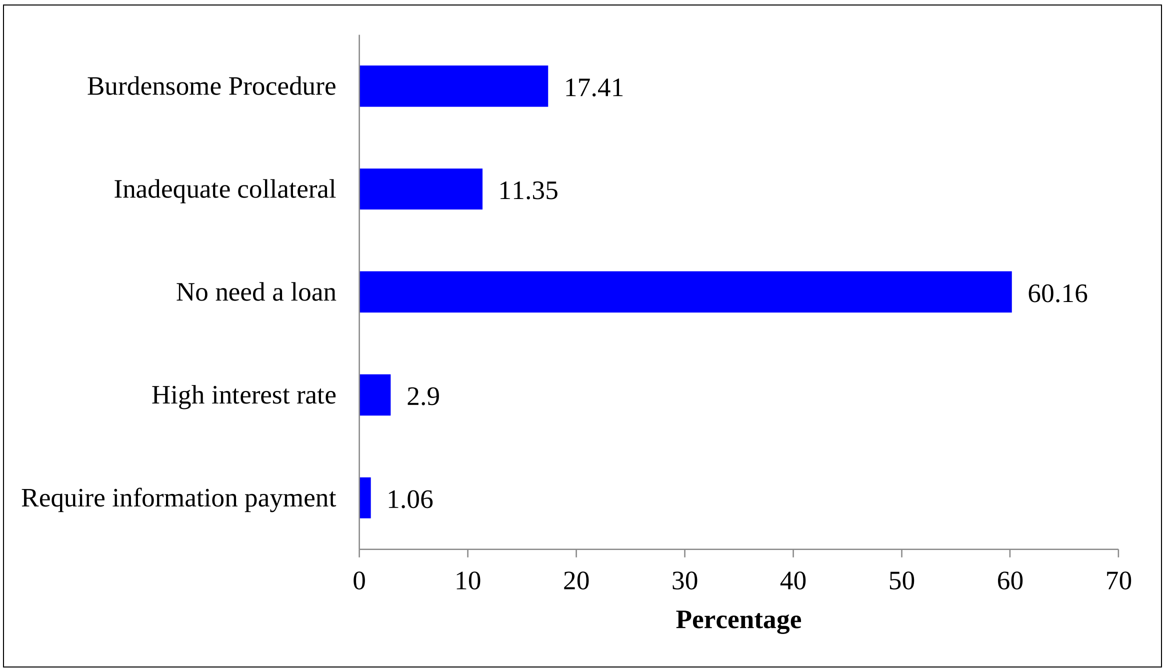
Figure 12. The access to finance of the Vietnamese firm in 2004-2005.



Resource: CIEM (2004, 2005)

The results, given in the figure 13, imply that approaching to finance seems to be not severe to firm operation because around 60% of the firms did not need a loan for business. In contrast, approximately 17.41% of the firms faced with the administrative burdensome in getting external finance, and only 11.35% had the burden of collateral properties.

Figure 13. Why the firm did not need a loan in 2004- 2005



Resource: CIEM

To sum up, the Vietnamese investment climate consist of numerous bottlenecks toward firm development, in which the impoverished infrastructure, the burdens of the government regulation, and human capital deficiencies are emerging as main barriers. Accordingly, comprehensively evaluating the impacts of the investment climate on firm performance is essential and significant to encourage more effort in reform. Furthermore, this evaluation is valuable for policy-making in order to fill the gap in national competitiveness competence with other countries as well as to exploit efficiency of internal and external forces for fast and sustainable development in the future.

4.2. The Vietnamese manufacturing and the explanation of the technical inefficiency

The aim of this section is to test for the hypothesis of whether the investment climate plays an important role in determining the firm technical efficiency by employing the empirical methodology developed in the chapter 3. In addition, we will endeavor to identify what the dimensions of the investment climate matter most for firm economic performance.

We commence this section by discussing the challenge in practical estimate. As discussed in the chapter 3, we incorporate the firm characteristics and the investment climate in determining the firm technical inefficiency by the equation (5), in which the error component is assumed to be truncated normal distribution. This assumption, therefore, does not allow taking first difference or subtracting mean from data to eliminate the firm's specific effects because of resulting in unknown distribution of the error term. To address this challenge, Kumbhakar & Hjalmarsson (1995) and H.-J. Wang (2003) suggested imposing the firm's specific effects in the technical inefficiency equation. Similarly, Kumbhakar (1991) proposed including dummy variables to capture for the firm's specific effects. Following these approaches, we concisely discuss the main explanatory variables to capture for firm heterogeneities as well as to test for the hypotheses of interest. Instead, fully statistical description of the Vietnamese manufacturing is attached in appendix 2.

We first note that, in our sample, foreign ownership occupies a small ratio with only 10% of the total sample and only 7.82% in terms of percent capital. It is uncontroversial that foreign ownership might lead to an increase in the firm technical efficiency if oversea investor brings new high technologies and manageable techniques to host country. Therefore, our regression will include the foreign ownership variable to test for the technological spillover effect from the FDI inflow in Vietnam. Second, the SOEs have a high proportion with approximately 35% of the total sample and 23.71% in terms of percent capital. This overwhelming tendency is coincidental with the policy target of the government to boost the economy through the SOEs, which has been conducting so far. Although the SOEs have received great privilege policies from the government, they are constantly censured by inefficiency and waste of the national resource. We, therefore, employ the SOEs variable as an attempt to evaluate the effectiveness policy of the Vietnam government in stimulating the economy based on the SOEs. Third, it should be noted that the Vietnamese firms have the high proportion of exporting in terms of the percentage of total sales (approximately 24%). Therefore, our estimation should be involved the export variable because the export is a learning process through which enterprise could gradually improve technology and productivity by learning from overseas customers or by the momentum of technological innovation from encountering with global competitors. Fourth, the ratio of the small-medium firm is quite equal to large firm in the total sample (around 50%), and thus we will employ a dummy variable of firm size to test for the hypothesis of scale economies as well as to mitigate heteroscedasticity. Fifth, in panel data context, it cannot avoid the heterogeneity of the investment climate among regions; therefore, we will utilize a region dummy variable representing for mega cities to reflect for the regional heterogeneities. Sixth, a dummy variable of International Organization for Standardization certificate (ISO) is included to capture for the technological innovation of the firm. Finally, and seventh, we will impose a time dummy variable to test for the hypothesis of whether the firm technical efficiency is improved across time.

4.2.1. The individual indicator model in explaining the technical inefficiency of the Vietnamese manufacturing.

In this paper, we will use both the individual indicators and the composite indicators of the investment climate to get the best picture of the relationship between the firm technical inefficiency and the investment climate. We start by explaining the technical inefficiency of the Vietnamese manufacturing based on the individual indicators of the investment climate (henceforth referred to as individual indicator model). The equation (4) and (5) will be simultaneously estimated in “one step” procedure as discussed in the chapter 3. The equation (4) is the production frontier model in which we also control for the region, time and sectors in order to capture for both the firm heterogeneity and the macroeconomic environment effects. The equation (5) is to explain the firm efficiency discrepancies based on incorporating appropriately explanatory variables, including the firm characteristic and the investment climate. For the firm characteristics, as previously discussed, we will include the variables of time, region, size, ISO certificate, foreign ownership, state ownership, age and export to control for the firms’ specific effects and to test for the hypotheses of concern. For the investment climate, it raises a challenge in practical estimate by high correlation among regressors. To avoid the multicollinearity, we will restrict the amount of explanatory variables imposed into the model but rigorously ensure that these variables included will capture as many dimensions of the investment climate as possible to obtain the consistent and unbiased estimators. In addition, we will choose the variables of the investment climate that matters most for firm productive performance as exposed in the literature, especially in the case of Vietnam. Specifically, the infrastructure-service will be enveloped by two variables: transportation obstacle and electric loss, while the government business relation is proxy by two variables: land certificate obstacle, corruption obstacles. Likewise, the access to finance is represented by two variables: no finance from bank and collateral ratio. The human capital will be substituted by two variables: unskilled worker and manager education obstacle. Furthermore, to address the endogeneity concern, the city-sector averages are considered for the variable of transportation obstacle, land certificate obstacle, corruption obstacles. On the contrary, the other individual variables are regarded as specific to each firm.

Turning to our empirical results, the equation (4) and (5) are jointly estimated on the balanced panel data of the Vietnamese manufacturing in the period of 2004-2005. The result is presented following the table 1, in which the production frontier is well determined. Our interest is the technical inefficiency model in which the firm technical inefficiency is determined by the firm characteristics and the investment climate. We first look at the firm characteristics. The results of the table 1 show that the firm characteristics are significant in accounting for the firm technical inefficiency discrepancies. All coefficients of the firm characteristics indicate an expected sign and report highly statistically significant. We first note that the heterogeneous investment climate among regions triggers the firm technical inefficiency discrepancies. More specific, the firms, running the business in mega cities, are more efficient than that of others in small cities. This finding is no surprise since the business environment of mega cities are often better than that of small cities, for example, quality of the infrastructure, education system, market potential, etc. Second, the time dummy variable is negative but insignificant. In other word, the technical efficiency of the Vietnamese manufacturing is not improved across time. Third, surprisingly, in spite of being received the greatly preferential treatment from the government, the SOEs are still inefficient. This finding, therefore, implies that the policy objective of the government to boost the economy through the SOEs is totally flawed.

Table 1. The individual indicator model in the explanation of the technical inefficiency of the Vietnamese manufacturing

Dependent Variables: Log (Added value of total sale)	
Variables	Individual Indicator Model
Constant	1.04***
Log (Labor)	0.46***
Log (Capital)	0.58***
Firm characteristics (regressed on technical inefficiency)	
Constant	-7.47***
Time	-0.04
Region	-1.1***
Size	-1.97***
Foreign Ownership	-0.004
SOEs	0.023***
Export	-0.01***
Age	-0.02***
ISO certification	-2.56***
Investment Climate (regressed on technical inefficiency)	
Infrastructure-Service	
Transportation Obstacle	0.02***
Time lost outage	0.001*
Access to Finance	
No finance from bank	0.024***
Collateral ratio	0.0014**
Government Business Relation	
Land certificate obstacle	-0.77***
Corruption obstacles	-0.14
Human Capital	
Unskilled worker	0.04***
Manager Education obstacle	-0.17**
σ^2	2.98 ***
γ	0.88 ***
LR test	138.77***
Observations	1938

Notes:

1. ****, **, and * represent statistically significance at the 1%, 5%, and 10% level, respectively.*
2. *Production Frontier Regression is controlled for region, time and sector dummies.*

It is widely accepted that the SOEs are wasting the national resources. For example, in 2009, the SOEs used roughly 37.2% of the national total capital and 44.8% of the national total fixed asset; however, they only created about 25% of the national total revenue and 20% of the national total industry product (GSO, 2009). The dominance but inefficacy of the SOEs provoke to the unstable macroeconomy and the stagnation of economic growth in recent years (ECNA, 2013; World Bank, 2011). The weak management, widespread corruption and complex governance structure are identified as radical causes for the inefficient investment of the SOEs (ECNA, 2013; World Bank, 2011).

Fourth, the foreign ownership variable shows a negative sign as our expectation but reports insignificance. This finding, therefore, implies that there is no technological spillover effect from the FDI inflow in the Vietnamese industry. This finding is more surprising but in line with the survey of VCCI (2010). In this survey, they investigate that the foreign firms are less to choose the domestic firms as their subcontractor with 54% of their intermediary goods and services bought outside Vietnam. Additionally, only 13.5% of the foreign firms bring high technology and modern equipment to Vietnam. These results explain why we do not find the horizontal and vertical spillovers of the FDI inflow. Finally, and fifth, the export, considered as a learning process through which firm might improve efficiency, is strongly confirmed in the Vietnamese industry.

Regarding the investment climate, our estimation reveals that the investment climate plays an important magnitude in determining the firm technical efficiency discrepancies. Our finding validates that the investment climate constraints are dramatically harmful to the firm technical efficiency. It seems to be true for almost all aspects of the investment climate and highly statistically significant at 1% level. Specifically, the poor infrastructure-service, the financial constraint and the deficient human capital trigger a dramatic reduction in the firm technical efficiency. This finding is also consistent with the empirical literatures exposed in the chapter 2. For the government business relation, astonishingly, the land certificate obstacle variable is negative and statistically significant at 1% level, whereas the corruption obstacle variable shows a similar sign but reports insignificantly. To make a reliable inference from these findings, the great attention needs to be exercised here. Firstly, as exposed by Nguyen & van Dijk (2012), the access to land is relevant to widespread corruption in Vietnam. Therefore, the land certificate obstacle could absorb both effects of corruption, however, corruption seem to be favorable for the firm economic performance by providing as a leeway for entrepreneurs to bypass the inefficient regulations or by acting as catalyst and greases for the wheels of business. This explains why the land certificate obstacle shows a negative influence to the firm technical inefficiency. Secondly, the land certificate obstacle might incur from multicollinearity. However, we tend to be more believable in the case of land certificate obstacle absorbing both effects of corruption because this phenomenon is strongly confirmed in Vietnam (World Bank, 2013; Nguyen & van Dijk, 2012; Rand & Tarp, 2012; VCCI, 2013). Although the corruption acts as a leeway for entrepreneurs to bypass the inefficient regulations or as catalyst and greases for the wheels of business, however, in general, this situation is greatly harmful to the economy in the long-run by distorting the market, creating monopoly and inequality in competitiveness. As a consequence, it will erode the belief and motivation of expanding investment and technological innovation. The corruption can be masked or transferred into the government regulations and permits, thereby posing the challenge of evaluating the role of the government in the firm business because of the collinearity of the regressors. An attempt in selecting the appropriately explanatory variables imposed into the model could induce to a persistent bias by omitted variables bias.

Regarding the human capital, the manager education obstacle is negative and statistically significant at 5% levels. This finding, therefore, might suggest two possible comments. Firstly, the role of manager might be sunk or neutralized since the manager education seems to be not important in explaining the firm economic performance, especially in the context of Vietnam where the education system is usually criticized by miserable quality

(World Bank, 2006, 2012). Secondly, this result might slightly suffer from collinearity problem. However, we tend to believe that the role of the manager might be sunk or neutralized since the unskilled worker variable shows an expected sign and consistency with the literature.

Finally, as noted in the chapter 3, the degree of asymmetry (γ) is the central feature of our model. The larger γ implies that it consists of the great ratio of the technical inefficiency (u_{it}) in the error component. To test the hypothesis: $\gamma = 0$ can be constructed by likelihood ratio test based on the maximum likelihood estimator of γ. Nevertheless, it should emphasize that the parameter γ could not consider as the contribution of technical inefficiency to the total variance of the error term (T. Coelli, 1995). In our model, LR test =138.87 is highly statistically significant at 1% level, which substantiates that our empirical results are valid and reliable in making the inferences and testing for the hypotheses of interest.

It is unquestionable that the impact of the investment climate on the firm technical efficiency is completely different among industries. Therefore, a profound insight into separate industries is significant and valuable for policy-making to improve the business environment. We continue to estimate the influence of the investment climate by specific industries. Similarity, the parameters of the production frontier model and the technical inefficiency model are adopted in “one step” estimate. However, we prefer presenting them in separate tables for more readable (table 2 and 3). The table 2 manifests the impact of the firm characteristics in determining the firm technical inefficiency. Our result demonstrates an accurate choice to estimate the production frontier by separate industries. The elasticities of labor and capital are highly statistically significant but different from one sector to another. The most industries appear to be more intense in capital accumulation. Interestingly, Food and Beverage (F&B) and Apparel-Leather-Textile

(ALT) are more dominant in capital accumulation, despite the fact that these industries are usually more intensive in labor accumulation. This result, therefore, implies that the poor quality of the labor prohibits its potential contribution to the firm technological change.

Turning to the technical inefficiency model, we commence by underlining some key features of the firm characteristics. The results, given in the table 2, verify that the firm characteristics are valid in interpreting the firm technical efficiency discrepancies but quite distinct among industries. Firstly, for the region dummy variable, the finding by industry reconfirms that the firms, doing business in mega city, are more productive than that of other in small city but statistically significant in only Food and Beverage (F&B); Wood and Furniture (W&F) industry.

Table 2. The individual indicator model in the explanation of the technical inefficiency by separate industries

Dependent variable: Log (Added value of total sale)						
Variables	CM	F&B	ALT	ME&M	W&F	R&P
Constant	0.6	0.84***	0.62**	0.73	1.60***	4.40***
Log (Labor)	0.17**	0.41***	0.42***	0.56***	0.42***	0.60***
Log (Capital)	0.80***	0.67***	0.63***	0.60***	0.54***	0.20***
Firm characteristics (regressed on technical inefficiency**)**						
Constant	10.18	-8.67***	-2.52	0.21	-0.82	0.79
Time	-0.004	0.69	0.04	0.13	-0.29	-0.13
Region	-0.29	-1.71***	0.25	-0.21	-0.67**	-0.001
Size	-1.40***	-2.75***	-0.63*	0.1	-0.05	-0.34
Foreign Ownership	0.015*	0.025***	0.001	-0.01**	-0.026*	-0.01***
State Ownership	0.0005	0.01	0.02***	0.001	-0.002	-0.01
Export	-0.01	0.003	-0.01***	-0.01**	0.001	-0.0003
Age	-0.0004	-0.05***	-0.01	0.02*	0.002	-0.025
ISO certification	-0.13	-0.92	-0.50*	-0.17	0.09	0.20
σ^2	0.38	2.55	0.51	0.43	0.54	0.50
γ	0.36	0.91	0.39	0.26	0.37	0.33
LR test	52.32***	124.03***	49.65***	41.70***	29.60**	36.22***
Observations	164	334	288	260	254	124

Notes:

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

Secondly, the technological spillover effect from the FDI inflow is only found in Machine-Equipment- Metal (ME&M), Wood and Furniture (W&F) and Rubber and Plastic (R&P) industry, whereas the FDI shows a negative effect in Construction Material (CM) and Food and Beverage (F&B) industry. To clarify these results, we require some explanations to be exercised here. These results are surprising but compatible with the survey of VCCI (2010). Additionally, for Construction Material (CM) industry, this sector is highly competitive with the overwhelming market share of the domestic firm through the long history of existence (average 15 years), whereas the foreign ownership firms just projected in this field less than six years. Therefore, it requires a long time to establish foundations before having a stable position in the market or gaining more profit. Similarly, for Food and Beverage (F&B) industry, approximately 45% of the foreign ownership firms just projected this field less than five years. Besides, roughly 40% of the foreign ownership firms invested in the SOE, which are substantially criticized by inefficiency and corruption. Accordingly, it is unsurprising when we find a negative effect of the FDI inflow in these two sectors. Thirdly, the SOEs are found inefficiently in Apparel-Leather-Textile (ALT) industry, which concentrates the high density of the SOEs (roughly 17%).

The impact of the investment climate on the firm technical inefficiency is presented in the table 3. Our regression reconfirm that the investment climate deficiencies are exceedingly detrimental to the firm productive performance. Unluckily, it is true for most dimensions of the investment climate but quite distinct from one industry to another. The results of the table 3 show that all industries seem to be vulnerable to the investment climate deficiencies. We will briefly highlight the key findings emerged from the table 3. We first show that the poor infrastructure-service significantly hinders to the firm productive performance in only Apparel-Leather-Textile (ALT) industry. Second, the financial constraints are harmful to the firm technical efficiency but significant in only the Food and Beverage (F&B) and Apparel-Leather-Textile (ALT) industry

Table 3. The individual indicator model in the explanation of the technical inefficiency by separate industries

Variables	CM	F&B	ALT	M&ME	W&F	R&P
Transportation Obstacle	-1.12***	-0.03	0.15	0.05	0.17	0.47
Electric Loss	0.01	0.013	0.004***	-0.01	-0.01	-0.01*
Land certificate obstacle	0.01	-1.28**	-0.63***	0.14	-0.41**	-0.63**
Corruption obstacles	-0.52*	1.10	-0.25	-0.11	0.63*	-0.52
Financing obstacles	-0.06***	0.07**	0.03*	-0.004	0.01	0.003
Collateral ratio	-0.007***	0.003	0.0005	-0.002***	0.0004	0.003
Unskilled worker	-0.01**	0.03***	-0.002	0.014*	-0.002	0.01**
Education of manager	0.08	-1.11***	-0.05	0.16	0.26**	-0.09

Notes:

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

Third, government business relation works as catalyst or greases for the wheels of business in most industries, except for Machine-Equipment-Metal (ME&M) industry. Finally, and fourth, the human capital demonstrates a crucial role in the firm productive performance. The poor quality of both labor force and top manager is substantially harmful to the firm technical efficiency in almost all industries, except for Apparel-Leather-Textile (ALT) and Construction Material (CM) industry.

The policy-making raises the question of whether the impact of the investment climate is distinguishable by ownership types. The merit of estimating by different ownership types is showed in the table 4. We continue to confirm that the investment climate constraints and the firm characteristics are robust in determining the firm technical inefficiency discrepancies but quite different among the ownership types. The result exposed by the table 4 shows that the private ownership firm appears to be more susceptible to the investment climate deficiencies, whereas the foreign ownership firms are less affected.

This finding is unsurprising in the context of Vietnam, where the government tends to bolster the SOEs or formulate many privilege policies to attract the FDI inflow. For the firm characteristics, we first note that the age variable indicates a negative sign but reports statistically significant in only the foreign ownership firm. This finding infers that the longer foreign firms operate, the more efficient they are. Accordingly, this result explains why the foreign ownership firms with little time of operation are inefficient in the some industries as has already been discussed in the previous paragraph. Second, the learning process from exporting to improve technical efficiency is found in only the private ownership.

Turning to the investment climate, we first note that the foreign ownership firms seem to be immune from the infrastructure-service obstacles; on the contrary, the domestic firms are easily vulnerable by the infrastructure-service obstacles. This finding is no surprise by the fact that the oversea investor projecting in Vietnam is to gain the advantages of cheap labor and rich natural resources for aiming of exporting, less depending on the Vietnam market for consuming their products. By contrast, the domestic firms considerably depend on the domestic market demand. Accordingly, the infrastructure-service is extremely important in establishing the chain of delivering their products and services. This argument is verified by reference to our data in which the foreign ownership firms directly export about 60% of their total sales, while the domestic participants are only 21%. Therefore, they seem to be resistant to the poor infrastructure-service. Second, the human capital continues to demonstrate the pivotal role in the firm productive performance. The result of the table 4 shows that the human capital deficiencies substantially destroy the firm technical efficiency. Unluckily, it is true for all ownerships but more severe than for the foreign ownership. This result portrays the huge gap in the quality of human resource between the host country and requirements of the foreign investor. We stress that this conclusion is consistent with the investigation of VCCI (2010) that only 18% of the foreign firms are satisfactory with the quality of the labor force in Vietnam.

Table 4. The individual indicator model in the explanation of the technical inefficiency by ownership types

Dependent variable: Log (Added value of total sale)			
Variables	**FOREIGN**	**SOE**	**PRIVATE**
Constant	0.48	0.34	1.70***
Log (Labor)	0.35***	0.46***	0.45***
Log (Capital)	0.71***	0.63***	0.51***
Firm characteristics (regressed on technical inefficiency)			
Constant	1.29	-0.76	-4.42***
Time	-0.02	-0.04	-0.16
Region	-1.67**	0.48	-0.08
Size	-2.08**	-0.03	-1.85***
Export	0.004	0.003	-0.02***
Age	-0.21***	0.002	0.004
ISO certification	1.57*	-0.57***	-2.09***
Investment Climate (regressed on technical inefficiency)			
Transportation Obstacle	0.05	0.53***	0.03
Time loss of outage	-0.00	0.002	0.02***
Land certificate obstacle	-2.32***	0.11	-0.19**
Corruption obstacles	-0.18	-1.10***	0.41***
Financing obstacles	0.005	-0.001	0.03***
Collateral ratio	-0.01	0.0004	0.001
Unskilled worker	0.02***	0.007***	0.01***
Education of manager obstacle	-0.40	0.13	-0.09
σ^2	2.78	0.71	1.32
γ	0.93	0.49	0.73
LR test	82.34***	54.06***	63.19***
Observations	202	682	1104

Notes:

1. ****, **, and * represent statistically significance at the 1%, 5%, and 10% level, respectively.*
2. *Production Frontier regression is controlled for time, region and sector dummies.*

Third, financial constraints are greatly detrimental to the private ownership but neutral for the state ownership and the foreign ownership. This result is surprising but quite realistic by the fact that both the SOEs, which are received greatly financial supports from the government and the foreign firms, which often have stable financial resource are less affected by financial restriction. Fourth, the government business relation acting as catalyst or greases for the wheels of business are well determined in all ownerships but different story. For the oversea ownership, the land certificate obstacle is negative and highly statistically significant, while the corruption obstacle is insignificant. These results imply that the main bottleneck of the foreign firms is derived from accessing to land, and corruption might be masked or transferred into obtaining land certificate. By contrast, the domestic participants reveal an interesting story in terms of the corruption obstacle. The corruption works as catalyst or greases for the wheels of business in the state ownership but impairs to the private ownership. We stress again that this situation is greatly harmful to the economy because of distorting the market, creating monopoly and inequality in competitiveness.

Before finishing this part, we synthesize the key findings emerged from the individual indicator model. We first note that the results, exposed by the overall Vietnam manufacturing, the separate industries and the ownership types, verify that the investment climate is significant in determining the firm technical inefficiency discrepancies. The poor infrastructure-service, the financial constraint, and deficient human capital are extremely detrimental to the firm technical efficiency, whereas the government-business relation works as catalyst or greases for the wheels of business in the state ownership but impairs to the private ownership. Second, the private firms seem to be more sensitive and vulnerable to the investment climate impediments, while the oversea ownership firms are less affected. Third, the policy objective of the government to boost the economy through the SOEs is completely ineffective. Finally and fourth, we find the limited evidence of the technological spillover effect from the FDI inflow in the Vietnamese industry and even negative effect in the some industries.

4.2.2. The composite indicator model in the explanation of the technical inefficiency of Vietnamese manufacturing.

As mentioned in the chapter 3, the individual indicator model might suffer from the collinearity or the omitted variables bias. Therefore, the aggregate indicators of the investment climate are employed to address these troubles. The aggregate indicators of the investment climate are constructed by the PCA method. The principle of the PCA method is to reduce the dimension of observed variables to a smaller number of principal components, which account for maximum amount of the variances of observed variables. The PCA technique, therefore, allows synthesizing the data with little loss of information. The composite indicators of the investment climate are then extracted as a linear combination of optimally-weighted observed variables. Accordingly, we will have four aggregate indicators of the investment climate, including infrastructure-service, government business relation, access to finance, and human capital. The correlation between the aggregate indicators and the initial variables used in the PCA method is showed in the table 5. The PCA technique is quite compatible with high correlation between composite indicator and original variables, ranking from 0.2 to 0.88. Furthermore, as showed in the table 5, each aggregate indicator now captures various dimensions of the investment climate. For example, government business Relation is comprehended by the four initial variables: Business license obstacle, Tax administration obstacle, Land certificate obstacle, Corruption obstacle. Therefore, the aggregate indicator allows evaluating the role of the investment climate associating with to the firm technical inefficiency more comprehensively and accurately.

Table 5. Correlation between each composite variable and underlying variables

Infrastructure – Service	**Correlation**
Electric Loss	0.88
Transportation Obstacle	0.22
Water loss	0.89
Telecommunication obstacle	0.20
Government Business Relation	
Business license Obstacle	0.57
Tax administration Obstacle	0.81
Land certificate Obstacle	0.54
Corruption Obstacle	0.77
Access to Finance	
No finance from commercial bank	0.58
No finance from state bank	0.84
Collateral ratio	0.40
Human Capital	
Unskilled worker	0.77
Worker with no high education	0.75
Manager Experience Obstacle	0.2
Manager education Obstacle	0.52

Resource: Author's calculation

Employing these composite indicators of the investment climate, we reestimate the models as the previous section, in which we will retain all the firm characteristics (referred to as composite indicator model henceforth). The results of the technical inefficiency of the Vietnamese manufacturing are mentioned following the table 6. We will briefly discuss the main findings of the composite indicator model, emphasizing on comparing between two models in interpreting the firm technical inefficiency. We begin by looking at the firm characteristics. We reconfirm that the firm characteristics are significant in explaining the firm technical efficiency discrepancies. The almost all coefficients of the firm characteristics show an expected sign as in the individual indicator model. However, there is a minor difference related to the foreign ownership variable, which is now positive and significant at 5% levels. This result is surprising, but we stress that it is consistent with the empirical results of the individual indicator model, in which we find out the foreign ownership firm is inefficient in the some sectors, for example, Food and Beverage (F&B) and Construction Material (CM). As explained above, this finding is also in line with the investigation of VCCI (2010) that the foreign firms are less to choose domestic firms as their subcontractor, and only 13.5% of the foreign firms bring high technologies and modern equipment to Vietnam. Furthermore, as showed by the individual indicator model that the longer the foreign firms operate, the more efficient they are. Referencing to our data, we investigate that around 50% of the foreign ownership firms established the business in Vietnam less than five years; therefore, they need first long stage to build foundations for business before gaining profit or having a stable position in the market. Besides, there is the high proportion of the foreign investors projecting in the SOEs (approximately 25% of total foreign ownership firms), which are substantially concerned by inefficiency and corruption. These arguments explain why we do not find the evidence of horizontal and vertical spillover of the FDI inflow in the Vietnam case.

The benefits of using the composite indicators of the investment climate are robustly demonstrated following the table 6. We first highlight that our regression reconfirms that the investment climate constraints are greatly harmful to the firm productive performance. Unluckily, it is true and highly significant for almost all dimensions of the investment climate, including infrastructure-service, access to finance and human capital. This conclusion is in line with the individual indicator model. However, all coefficients of the investment climate now increase the magnitude impacting on the firm technical inefficiency, especially with the coefficient of the human capital. This means that the aggregate indicators of the investment climate allow evaluating the role of the investment climate more accurately and comprehensively than the individual indicator model. Second, as has already been discussed in the individual indicator model, corruption could be masked or transferred into government regulations and permits. This circumstance poses the challenge in practical estimate by the collinearity. An attempt in selecting the appropriately explanatory variables included into the model can induce to a persistent bias by the omitted variables bias. This challenge could be overcome by using the composite indicator of the government business relation, which allows the corruption to interact with the government's cumbersome regulations.

Table 6. The composite indicator model in the explanation of the technical inefficiency of the Vietnamese manufacturing

Dependent Variables: Log (Added value of total sale)	
Variables	Composite Indicators Model
Constant	1.07***
Log (Labor)	0.46***
Log (Capital)	0.58***
Firm characteristics (regressed on technical inefficiency)	
Constant	-5.54***
Time	-0.22
Region	-1.39***
Size	-1.87***
Foreign Ownership	0.01**
State Ownership	0.03***
Export	-0.01***
Age	-0.01*
ISO certification	-3.16***
Investment Climate (regressed on technical inefficiency)	
Infrastructure-Service	0.35***
Government Business Relation	-0.27***
Access to Finance	0.25***
Human Capital	0.72***
σ^2	3.59
γ	0.91
LR test	125.50***
Observations	1938

Notes:

1. ****, **, and * represent statistically significance at the 1%, 5%, and 10% level, respectively.*
2. *The Production Frontier regression is controlled for time and region and sector dummies.*

The table 6 substantiates the accurate choice of using aggregate indicator for the government business relation. As be seen from the table 6, we reinforces the conclusion of the individual indicator model that the government business relation acts as catalyst or greases for the wheels of business. It is widely acknowledged that corruption might be expected to be more widespread in the countries where red tape and cumbersome regulations slow down the process of providing bureaucratic procedures (Mauro, 1995). Therefore, paying for corruption and bribe will smooth firm business by including more efficient provision of public services or by providing a leeway for entrepreneurs to bypass the inefficient regulations or creating chance for private illicit gains to firm (Acemoglu & Verdier, 1998; Leff, 1964; Mauro, 1995; Rand & Tarp, 2012; Rose-Ackerman, 1999). Accordingly, in our model, the government business relation variable, interacted between corruption and the government's cumbersome regulations, shows a negative effect on the firm technical inefficiency. However, we stress that although the government business relation acts as catalyst or greases for the wheels of business, this situation is greatly harmful to the economy in long-run because it distorts the market, creates monopoly and inequality in competitiveness, thus leading to bury the belief and motivation of investment and technological innovation. This finding, therefore, provides the additional evidence for the discussions of Hasan et al. (2007) and North (1990) about the institutional frameworks in developing countries that "overwhelmingly favor activities that promote redistributive rather than productive activity, that create monopolies rather than competitive conditions, and that restrict opportunities rather than expand them".

We continue estimate the impact of the investment climate by specific industries, and its results are presented separately in the table 7 and 8. As previously argued, the parameters of the production frontier model and the technical inefficiency model are adopted in "one-step" procedure, but they are preferable to split them for readable aim. The table 7 reveals the impact of the firm characteristics. It is unsurprising when we achieve results better with many coefficients that are highly statistically significant. We reconfirm that the firm characteristics are significant in determining the firm technical efficiency but slightly different from the individual indicator model. We first remark that the negative effect of the FDI inflow is only found in Food and Beverage (F&B) and Construction Material

(CM), which is similar to the individual indicator model. However, the technological spillover effect of the FDI inflow is now found in only Machine - Equipment – Metal (ME&M) industry, in contrast to the individual indicator model, it is significant in both Wood and Furniture (W&F) and Rubber and Plastic (R&P) industry.

Table 7. The composite indicator model in the explanation of the technical inefficiency by separate industries

Dependent variable: Log (Added value of total sale)						
Variables	CM	F&B	ALT	M&ME	WP	R&P
Constant	0.80***	0.76***	0.38	1.29***	2.08***	3.01***
Log (Labor)	0.17**	0.36***	0.46***	0.49***	0.54***	0.69***
Log (Capital)	0.78***	0.71***	0.63***	0.58***	0.41***	0.29***
Firm characteristics (regressed on technical inefficiency)						
Constant	0.66	-2.63***	-1.91	0.59**	0.12	0.54
Time	-0.18	0.69	-0.04	0.11	-0.28	0.18
Region	0.08	-1.54***	0.40	-0.37**	-0.70*	0.12
Size	-2.65*	-1.91***	-0.11	-0.21	0.10	0.66
Foreign Ownership	0.03**	0.03**	0.01	-0.01***	-0.01	-0.02
State Ownership	-0.003	0.02**	0.03***	0.002	-0.003	0.01
Export	-0.01	-0.0004	-0.01**	-0.01**	-0.002	-0.01
Age	0.001	-0.07**	-0.01	0.01	0.01	-0.05
ISO certification	-0.19	-0.55	-0.69**	-0.27	-0.19	-0.50
σ^2	0.44	2.85	0.63	0.47	0.43	0.67
γ	0.35	0.93	0.49	0.35	0.12	0.35
LR test	32.02***	109.61***	34.07***	35.15***	21.57*	17.63
Observations	164	334	288	260	254	124

Notes:

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

Second, the state ownership variable also has a small change, in which the SOEs are inefficient not only in Food and Beverage (F&B) but also in Apparel-Leather-Textile (ALT) industry. Nevertheless, this finding is more rational than in the individual indicator model because these sectors concentrate the high density of the SOEs. By contrast, the SOEs are found efficiency in Machine-Equipment-Metal (ME&M) industry. Third, the export, considered as a learning process through which the firm could improve the technical efficiency, is verified in Food and Beverage (F&B) and Machine-Equipment-Metal (ME&M) industry. This finding is consistent as revealed in the individual indicator model. The impact of the investment climate on the firm technical inefficiency is manifested in the table 8. We continue to verify that the investment climate is valid in interpreting the firm technical inefficiency discrepancies but quite distinct with the individual indicator model. We first note that the almost all industries are quite sensitive and susceptible by the investment climate deficiencies, except for Rubber and Plastic (R&P) industry. This argument is consistent with the individual indicator model. Second, the infrastructure-service is statistically significant, not only in Apparel-Leather-Textile (ALT) but also in Food and Beverage (F&B). This result is somewhat distinct from the individual indicator model in which the infrastructure-service is only significant in Apparel-Leather-Textile (ALT). This result suggests that, by capturing more dimensions of the investment climate, the composite indicator model authorized to achieve the results more consistent and reliable than in the individual indicator model.

Table 8. The composite indicator model in the explanation of technical inefficiency by industries

Variables	CM	F&B	ALT	M&ME	WP	R&P
Infrastructure-service	0.01	1.08***	0.12***	-0.02	-0.01	-0.46
Government Business relation	-0.28*	-0.18	-0.32**	-0.21***	-0.08	-0.21
Access to finance	0.27	0.31*	0.18	0.03	0.15	-0.004
Human capital	-0.05	0.63***	-0.24	0.14*	0.26***	-0.07

Notes:

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

Third, the important function of the human capital in determining the firm efficiency is being demonstrated in the table 6. More particular, the insufficient human capital is significantly detrimental to the firm technical efficiency in the major industries, including

Food and Beverage (F&B), Machine-Equipment-Metal (M&ME) and Wood and Furniture (W&F). We note that, in the individual indicator model, some coefficients of the human capital show an unexpected sign and ambiguous in explanation. On the contrary, in the composite indicator model, they indicate a desirable sign and consistent with the literature. Fourth, the financial constraints are dramatically devastating the firm technical efficiency in Food and Beverage (F&B) industry but insignificant in Apparel-Leather-Textile (ALT) as investigated in the individual indicator model. We remind that this result is astonishing but in line with investigation of the previous section in which we explore that around 60% the firms did not need a loan from the bank for doing business. The financial constraint, therefore, might not be severe to firm operation. Fifth, the government business relation acts as catalyst or greases for the wheels of business in Construction Material (CM), Apparel-Leather-Textile (ALT) and Machine-Equipment-Metal (ME&M). This finding is somewhat different from the individual indicator model, but more rational since these sectors concentrate high density of the SOEs, which are tremendously criticized by the high degree of corruption (ECNA, 2013; World Bank, 2012). Furthermore, we stress that the some coefficients of the government business relation show an unexpected sign and ambiguous in individual indicator model, thus complicating to explain the role of the government in firm business. By contrast, the sign of the government business relation is homogenous in the composite indicator model.

The influence of the investment climate deficiencies by specific ownership types is expressed following the table 9. Our regression by the ownership types validates that the investment climate constraints are robustly harmful to the firm technical efficiency but quite different between the ownership types. The result of the table 9 first shows that the private ownership appears to be more sensitive and vulnerable than others to the poor investment climate. By contrast, the foreign ownership seems to be immune from the negative influences of the poor investment climate. These findings are similar to the individual indicator model in the previous section.

Table 9. The composite indicator model in the explanation of the technical inefficiency by ownership types

Dependent variable: Log (Added value of total sale)			
Variables	**FOREIGN**	**SOE**	**PRIVATE**
Constant	0.77	0.48**	1.77***
Log (Labor)	0.39***	0.48***	0.45***
Log (Capital)	0.68***	0.60***	0.50***
Firm characteristics (regressed on technical inefficiency)			
Constant	-3.82	-1.42	-1.38
Time	-0.01	-0.14	-0.16
Region	-3.75***	-0.66	-0.008
Size	-1.20	0.07	-1.96***
Export	0.012	-0.007*	-0.032**
Age	-0.15**	0.008	-0.003
ISO certification	1.48	-2.88***	-1.86***
Investment Climate (regressed on technical inefficiency)			
Infrastructure and service	-2.33*	0.15***	0.31***
Government-Business Relation	-0.27	-0.63***	0.05
Financial constraint	0.46	0.025	0.10*
Human capital	1.23***	0.26**	0.27***
σ^2	3.70***	1.18***	1.49***
γ	0.95***	0.67***	0.77***
LR test	74.71***	39.45***	57.20***
Observations	202	682	1104

Notes:

1. ****, **, and * represent statistically significance at the 1%, 5%, and 10% level, respectively.*
2. *Production Frontier regression is controlled for time and region and sector dummies.*

Second, the poor infrastructure-service is harmful to only the domestic participants, not for the foreign ownership. As previously argued, both the state ownership and the private ownership strongly depend on the domestic market and therefore are more fragile than to the poor infrastructure-service. Third, the financial constraint indicates a significant damage in only the private ownership. We remind that this finding is consistent with the result exposed by the individual indicator model. Fourth, we reconfirm that the human capital deficiencies substantially destroy the firm technical efficiency in all ownership classes but seem to be more severe than for the foreign ownership. Finally, and fifth, the government business relation works as catalyst or greases for the wheels of business in only the state ownership, whereas it is harmful to the private ownership but insignificant.

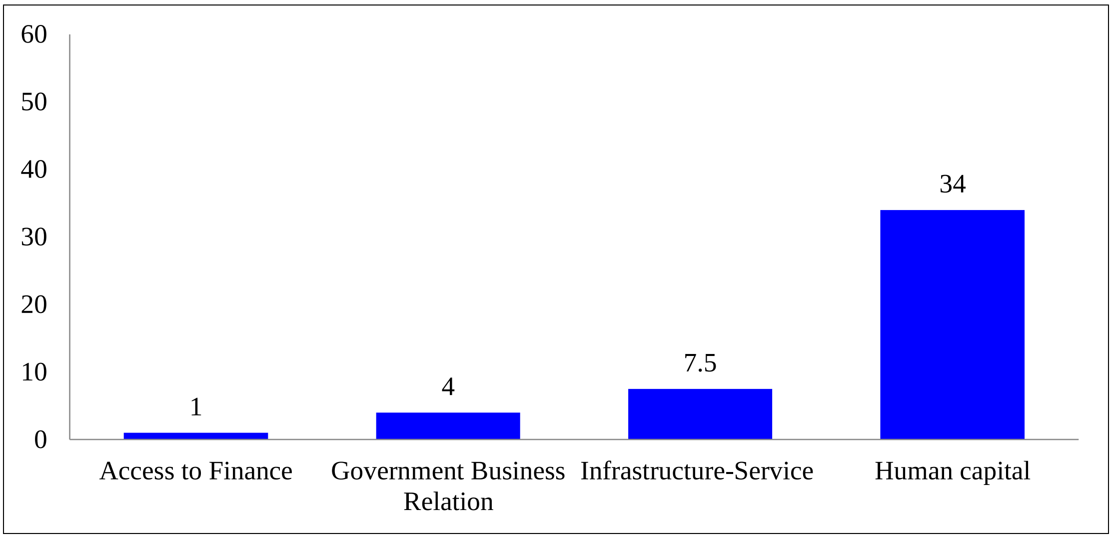
To sum up, the composite indicator model is valid in determining the firm technical efficiency. This conclusion is robustly verified by the consistent results between the individual indicator model and the composite indicator model. We first remark that the results by the overall manufacturing, specific industries, and separate ownership types show that the poor infrastructure-service, the financial constraint and the deficient human capital are greatly harmful to the firm technical efficiency. By contrast, the government business relation works as catalyst or greases for the wheels of business in the state ownership. Second, the private ownership firms seem to be more sensitive and vulnerable to the investment climate impediments, whereas the oversea ownership firms are less affected. Third, the policy of the government to boost the economy based on the SOEs is completely inefficient. Fourth, we find both positive and negative effect of the FDI inflow in the Vietnamese industry. Fifth, the composite indicator model has a slight fragility by dropping the statistical significance of some coefficient, especially in Rubber and Plastic (R&P). This fragility is no surprise because reducing the dimensionality of the original data by the PCA method can induce a minor loss of the information of the initial variables. However, in general, the composite indicator model is more proper than the individual indicator model in explaining the firm technical inefficiency in almost all cases. The compensation of the composite indicator model is tremendous information of the investment climate variables now interpreting the firm technical efficiency differences, thereby obtaining the best picture of the relationship between the investment climate and the firm productive performance. In addition, utilizing the aggregate indicators of the investment climate can avoid both the omitted variable bias and the collinearity; therefore, we could obtains the more consistent and reliable results than in the individual indicator model. This conclusion is strongly substantiated at the sign of the estimators. Specifically, in the composite indicator model, the sign of the coefficients are homogeneous and consistent with the literature, in contrast to the individual indicator model, they are quite heterogeneous and ambiguous. Furthermore, the benefit of the composite indicator model is valid of another variable of interest: the government business relation, which captures the diverse aspects of the government influencing on business activities. Besides, the composite indicator model is more valuable in terms of policy making by allowing us to determine what factors matter most to the firm efficiency. Finally, and sixth, to formulate the policies effectively, the results of both models should be used. The composite indicator model provides a comprehensive picture of the investment climate to determine what priority factors needed to improve, whereas the individual indicator model provides detailed solutions in each of priority factors.

4.3. What matters most?

The policy making raises the question of what priority factors of the investment climate need to be improved for firm development. However, it is not simple to rank the relative importance of each component of the investment climate in explaining the firm technical efficiency. It should be noted that we cannot base on the weight of coefficients in the model to arrange the relative importance of each dimension of the investment climate since the investment climate aggregate indicators extracted by the PCA technique do not have a scale. Furthermore, it is immensely complicated in the multiple regression contexts where the regressors are not entirely independent. To rank the relative magnitude of these investment climate components, we follow the methodology proposed by Kruskal (1987), which is commonly known as partial correlation coefficients. The aim of the partial correlation analysis is to find correlation between two variables after excluding the effects of other variables. Therefore, this method authorizes to acquire pure correlations as well as to expose hidden correlations. A one-dimensional index measuring the relative importance of each dimension of the investment climate is constructed by squaring and averaging the coefficients. Further discussion of this procedure is given in the appendix 3. The normalized index score of each investment climate component is given in the figure 14.

The result, given in figure 14, shows that the human capital obstacle matters most to the firm technical efficiency, in which it explain more than 34 times as much variation as financial constraints. Similarity, the second and third most importance are the infrastructure-service and the government business relation with interpreting approximately 7.5 and 4 time as much variation as access to finance, respectively.

Figure 14. What the factor matters most to the firm efficiency



Note:

1. *Normalized Scores with the Access to Finance as the base*

CHAPTER 5

CONCLUSION AND POLICY IMPLICATION

Drawing from the Investment Climate Assessment Survey of World Bank (World Bank, 2005), this paper first shows that the investment climate is significant in explaining the firm technical inefficiency discrepancies. Improving the investment climate in terms of infrastructure-service, access to finance, and human capital could increase the firm technical efficiency. Second, using the multiple variables to capture for the diverse dimensions of government affecting on business activities, our paper reveals that the government regulation is distorting the market, creating monopolies and inequalities in competitiveness. This situation is greatly harmful to the economy because of eroding the belief and motivation of investment and technological innovation. This finding, therefore, suggest the Vietnam government needs more effort than in institutional reform, especially in fighting against corruption and providing the efficiency of public services. Third, over the years, the private firms have emerged as an engine of economic growth and employment creation; however, this paper shows that the private firms are crowded out by the foreign firms and the state ownership enterprises (SOEs) caused by the privilege policies of the government. Therefore, reorienting policies to create a level playing field for the private firms to grow is a key strategy for long-term development of Vietnam. Fourth, our result shows that the government policy to boost the economy based on the SOEs is completely ineffective. The SOEs are squandering the national resource, distorting the market and creating the monopoly, which lead to the unstable macroeconomy and the stagnation of the economic growth in recent years. Therefore, intensively privatizing and restructuring the SOEs are necessary to increase the efficiency and the contribution of the

SOEs. The process of restructuring the SOEs needs priority to strengthen transparency, improve the quality of management, and increase responsibility. Fifth, we find the limited evidences of the technological spillover effects from FDI inflow in the Vietnamese industry. Hence, the government needs to reorient the policies toward the attraction of the FDI inflow, particularly emphasizing on attracting the high-tech industries. Finally, and sixth, employing the partial correlation analysis, our paper shows that the human capital deficiencies impair most to firm technical efficiency. Accordingly, improving the quality of national human resource is a long-term strategy to enhance national competitive advantages, as well as sustainable development of Vietnam in the future.

Appendixes

Appendix 1. Principle Component Analysis

The main purpose of principal component analysis is to reduce the dimensionality of a data set with little loss of information. This reduction is implemented by transforming a large number of interrelated variables to a new set of variables, which is also called as the principal components (PCs), which account for the maximum amount of variances of the data, which are uncorrelated. Computation of the principal components reduces to the solution of an eigenvalue-eigenvector problem for a positive-semidefinite symmetric matrix (Jolliffe, 2002).

Assuming that a random vector X, taking values in $\Re^m$, has a mean and covariance matrix of μ_X and $\sum_X$, respectively. Let $\lambda_1 > \lambda_2 > \cdots > \lambda_m > 0$ be ordered eigenvalues of $\sum_X$, such that the i-th eigenvalue of $\sum_X$ means the i-th largest of them. Similarly, let a vector α_i be the i-th eigenvector of $\sum_X$, corresponding to the i-th eigenvalue of $\sum_X$. To derive the form of principal components, consider the optimization problem of maximizing $\mathrm{var}[\alpha_1^T X] = \alpha_1^T \sum_X \alpha_1$, subject to $\alpha_1^T \alpha_1 = 1$. The standard approach is to use the Lagrange multiplier method as below:

$$L(\alpha_1, \phi_1) = \alpha_1^T \sum_X \alpha_1 + \phi_1(\alpha_1^T \alpha_1 - 1)$$

$$\frac{\partial L}{\partial \alpha_1} = 2\sum_X \alpha_1 + 2\phi_1\alpha_1 = 0 \;\Rightarrow\; \sum_X \alpha_1 = -\phi_1\alpha_1 \;\Rightarrow\; \mathrm{var}[\alpha_1^T X] = -\phi_1\alpha_1^T \alpha_1 = -\phi_1 .$$

Because $-\phi_1$ is the eigenvalue of $\sum_X$, with α_1 being the corresponding normalized eigenvector, $\mathrm{var}[\alpha_1^T X]$ is maximized by choosing α_1 to be the first eigenvector of $\sum_X$. In this case, $z_1 = \alpha_1^T X$ is referred to as the first PC of X, α_1 is the vector of coefficients for z_1, and $\mathrm{var}(z_1) = \lambda_1$.

To find the second PC, $z_2 = \alpha_2^T X$, we need to maximize $\mathrm{var}[\alpha_2^T X] = \alpha_2^T \Sigma_X \alpha_2$ subject to z_2 being uncorrelated with z_1. Because $\mathrm{cov}(\alpha_1^T X, \alpha_2^T X) = 0 \Rightarrow \alpha_1^T \Sigma_X \alpha_2 = 0 \Rightarrow \alpha_1^T \alpha_2 = 0$, this problem is equivalently set as maximizing $\alpha_2^T \Sigma_X \alpha_2$, subject to $\alpha_1^T \alpha_2 = 0$, and $\alpha_2^T \alpha_2 = 1$. We continue to use of the Lagrange multiplier method.

$$L(\alpha_2, \phi_1, \phi_2) = \alpha_2^T \Sigma_X \alpha_2 + \phi_1 \alpha_1^T \alpha_2 + \phi_2(\alpha_2^T \alpha_2 - 1)$$

$$\frac{\partial L}{\partial \alpha_2} = 2\Sigma_X \alpha_2 + \phi_1 \alpha_1 + 2\phi_2 \alpha_2 = 0$$

$$\Rightarrow \alpha_1^T (2\Sigma_X \alpha_2 + \phi_1 \alpha_1 + 2\phi_2 \alpha_2) = 0 \Rightarrow \phi_1 = 0$$

$$\Rightarrow \Sigma_X \alpha_2 = -\phi_2 \alpha_2 \Rightarrow \alpha_2^T \Sigma_X \alpha_2 = -\phi_2 .$$

Because $-\phi_2$ is the eigenvalue of Σ_X, with α_2 being the corresponding normalized eigenvector, $\mathrm{var}[\alpha_2^T X]$ is maximized by choosing α_2 to be the second eigenvector of Σ_X. In this case, $z_2 = \alpha_2^T X$ is also called as the second PC of X, α_2 is the vector of coefficients for z_2, and $\mathrm{var}(z_2) = \lambda_2$. Similarity, it is easy to show that the i-th PC $z_i = \alpha_i^T X$ is constructed by selecting α_i to be the i-th eigenvector of Σ_X, and has variance of λ_i. The key result in regards to PCA is that the principal components are the only set of linear functions of original data that are uncorrelated and have orthogonal vectors of coefficients. These arguments is substantiated by Jolliffe (2002) as below:

Proposition 1 [Jolliffe, 2002]: For any positive integer $p \le m$, let $B = [\beta_1, \beta_2, \ldots, \beta_p]$ be an real $m \times p$ matrix with orthonormal columns, i.e., $\beta_i^T \beta_j = \delta_{ij}$, and $Y = B^T X$. Then the trace of covariance matrix of Y is maximized by taking $B = [\alpha_1, \alpha_2, \ldots, \alpha_p]$, where α_i is the i-th eigenvector of Σ_X.

Proposition 2 [Jolliffe, 2002]: Suppose that we wish to approximate the random vector X by its projection onto a subspace spanned by columns of B, where $B=[\beta_1,\beta_2,\ldots,\beta_p]$ is a real $m\times p$ matrix with orthonormal columns, i.e., $\beta_i^T\beta_j=\delta_{ij}$. If σ_i^2 is the residual variance for each component of X, then $\sum_{i=1}^{m}\sigma_i^2$ is minimized if $B=[\alpha_1,\alpha_2,\ldots,\alpha_p]$, where $\{\alpha_1,\alpha_2,\ldots,\alpha_p\}$ are the first p eigenvectors of $\sum_X$. In other words, the trace of convariance matrix of $X-BB^TX$ is minimized if $B=[\alpha_1,\alpha_2,\ldots,\alpha_p]$. When $E(X)=0$, which is a commonly applied preprocessing step in data analysis methods, this property is saying that $E\left\|X-BB^TX\right\|^2$ is minimized if $B=[\alpha_1,\alpha_2,\ldots,\alpha_p]$.

Appendix 2. The statistical description of the Investment Climate and the Firm' characteristics

Variables	Mean	Std	Obs	Variables	Mean	Std	Obs
LnY (added value of total sale)	8.29	1.76	1938	Telecom Obstacle*	0.65	0.45	1938
LnL (labor)	4.77	1.44	1938	Tax administration Obstacle*	0.86	0.517	1938
LnK (capital)	8.94	1.65	1938	Access to Land Certificate Obstacle*	1.34	0.83	1938
Size dummy (for large firm)	0.51	0.49	1938	Business License Obstacle*	0.189	0.31	1938
Region dummy (for mega city)	0.57	0.49	1938	Corruption Obstacle*	0.97	0.65	1938
ISO certificate dummy (Yes or No)	0.31	0.46	1938	No finance from state bank (% of working capital)	97.47	11.29	1938
Foreign ownership (% of capital)	7.82	25.02	1938	No finance from state bank (% of working capital)	73.17	29.30	1938
State ownership (% of capital)	21.31	35.41	1938	Collateral ratio (%)	156.57	71.95	1938
Export (% of sale)	23.71	37.73	1938	Unskilled worker (%)	29.14	29.02	1938
Age (Years of Establish)	12.26	13.20	1938	Manager Education Obstacle*	1.34	0.94	1938
Transportation Obstacles*	1.40	0.68	1938	Unskilled Worker (% of total labor)	25.36	25.58	1938
Electric loss (Time per year)	12.06	26.17	1938	Manager Experience Obstacle*	3.47	0.708	1938
Water loss (Time per year)	0.53	3.95	1938				

** is indicated for the obstacles of the investment climate on the firm operation- measured from 0 to 4, with 4 highest obstacle*

Appendix 3. Partial correlation

To simplify, we consider the simple model with only two explanatory variables as below:

$$Y = \beta_1 + \beta_2 X_2 + \beta_3 X_3 + u$$

We define that: r_{12} is correlation coefficient between Y and X_2; r_{23} is correlation coefficient between X_2 and X_3; $e_{1.2}$ is the residual from regression Y and X_2; $e_{2.3}$ is the residual from regression X_2 and X_3.

The partial correlation between Y and X_2, while controlling and removing the effect of X_3 is defines as following equation:

$$r_{12.3} = \frac{\sum e_{1.2} \sum e_{1.3}}{\sqrt{\left(\sum e_{1.2}\right)^2 \left(\sum e_{1.3}\right)^2}}$$

In practice, it is simpler to express in terms of three bivariate correlation coefficients between them as below:

$$r_{12.3} = \frac{r_{12} - r_{13} r_{23}}{\sqrt{(1 - r_{13})^2 (1 - r_{23})^2}}$$

In this paper, we have four dimensions of the investment climate, including infrastructure-service, access to finance, government business relation, and human capital. Therefore, we will have the eight partial correlation coefficients for each dimension. Take the infrastructure-service for example:

- ❖ Let r_1 denotes the partial correlation coefficient between the firm technical inefficient (TE) and the infrastructure-service, holding the firm characteristics fixed.
- ❖ Let $r_{1.2}$ denotes the partial correlation coefficient between the firm technical inefficient (TE) and the infrastructure-service, holding the firm characteristics and the access to finance fixed

- Let $r_{1.3}$ denotes the partial correlation coefficient between the firm technical inefficient (TE) and the infrastructure-service, holding the firm characteristics and the government business relation fixed
- Let $r_{1.4}$ denotes the partial correlation coefficient between the firm technical inefficient (TE) and the infrastructure-service, holding the firm characteristics and the human capital fixed
- Let $r_{1.23}$ denotes the partial correlation coefficient between the firm technical inefficient (TE) and the infrastructure-service, holding firm characteristics, the access to finance, and the government business relation fixed.
- Let $r_{1.24}$ denotes the partial correlation coefficient between the firm technical inefficient (TE) and the infrastructure-service, holding firm characteristics, the access to finance, and the human capital fixed.
- Let $r_{1.34}$ r1.34 denotes the partial correlation coefficient between the firm technical inefficient (TE) and the infrastructure-service, holding firm characteristics, the government business relation, and the human capital fixed.
- Let $r_{1.234}$ denotes the partial correlation coefficient between the firm technical inefficient (TE) and investment climate dimension 1, holding firm characteristics, the access to finance, the government business relation, and the human capital fixed.

We do the same way for other investment climate dimensions. However, basing on partial correlation coefficients of each dimension, we are still ambiguous to determine which dimension matters the most to the firm technical inefficiency. To rank the relative importance of the investment climate dimensions, we need to transform the eight partial correlation coefficients of each dimension to a single index. To do this, (Kruskal, 1987) proposed a way of summarizing the information based on squaring and averaging the coefficients, forming the following indexes:

Equation 1: Kruskal index for infrastructure-service:

$$0.125\left[r_{1}^{2}+r_{1.2}^{2}+r_{1.3}^{2}+r_{1.4}^{2}+r_{1.23}^{2}+r_{1.24}^{2}+r_{1.34}^{2}+r_{1.234}^{2}\right]$$

Equation 2: Kruskal index for the access to finance:

$$0.125\left[r_{2}^{2}+r_{2.1}^{2}+r_{2.3}^{2}+r_{2.4}^{2}+r_{2.13}^{2}+r_{2.14}^{2}+r_{2.34}^{2}+r_{2.134}^{2}\right]$$

Equation 3: Kruskal index for the government business relation:

$$0.125\left[r_{3}^{2}+r_{3.1}^{2}+r_{3.2}^{2}+r_{3.4}^{2}+r_{3.12}^{2}+r_{3.14}^{2}+r_{3.24}^{2}+r_{3.124}^{2}\right]$$

Equation 4: Kruskal index for the human capital:

$$0.125\left[r_{4}^{2}+r_{4.1}^{2}+r_{4.2}^{2}+r_{4.3}^{2}+r_{4.12}^{2}+r_{4.13}^{2}+r_{4.23}^{2}+r_{4.123}^{2}\right]$$

It is now able to rank the relative importance of each component of the investment climate in explaining the firm technical efficiency.

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