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SCALE ELASTICITY, CONGESTION MANAGEMENT AND OPTIONS FOR FIRM DEVELOPMENT IN THE GARMENT INDUSTRY OF VIETNAM

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ABSTRACT

The garment industry plays a very important role in the Vietnamese economy, yet it has been operating inefficiently. Using a non-parametric approach (DEA) and data extracted from the surveys on enterprises in 2004, 2006 and 2007 conducted by the GSO of Vietnam, in this study we identify sources and degrees of congestion; measure degree of scale diseconomies, the percentage reduction in inputs congested and the percentage increase in value added of firms congested in inputs; estimate the total amount of fixed assets and number of workers wasted in garment firms and congestion-induced GDP losses. These will be bases for determining whether to expand (contract) the firm scale and improving firm productivity and competitiveness. Findings from this paper could have strategic implications for faster, efficient and sustainable development of the garment industry of Vietnam. Thus, the results of this paper will make a significant contribution to the development of the Vietnamese economy.

Keywords: DEA, Scale elasticity, Congestion, Garment Industry, Vietnam

JEL Classification: C44, C61, D21, L25, L67, O12.

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1. Introduction

Since 1986, at the start of the open-door policy introduced by the Vietnamese government, the Vietnamese economy has grown impressively, with an annual average growth rate of gross domestic product (GDP) of 7.6% at constant 1994 prices for the period 1991–2007, and the business environment has been continuously improving. Additionally, firms of all economic sectors, especially firms of the garment industry, have increased their production capacity and their significant contribution to national socio-economic development. The government has set goals for its development to become one of the key industries and to raise its competitiveness. However, there are many obstacles preventing the industry's development.

In the context of a market-oriented economy like Vietnam's, almost all enterprises have been facing a decreasing supply of resources and fiercer competition. This has forced enterprises in the garment industry to pay more attention to the efficient utilization and allocation of on-hand resources by building larger operating units to achieve the advantages of scale economies. Additionally, there are many sources affecting the performance of a firm when there is "wasteful use" of such resources. This wasteful use will not only cost the firm, but also society as a whole. The phenomenon of the wasteful use of resources causing a decrease in its produced output(s) is referred to in economics literature as "congestion". When congestion is present, it will shrink business markets and reduce the economies of scale. Thus, identifying sources and degrees of congestion and measuring scale elasticity in production in the presence of congestion or degree of scale diseconomies (DSD) will have great significance for the success of firms in the competitive market. From the viewpoint of policy-makers and firms' decision-makers, measuring the DSD of firms is highly significant to define potential scopes to expand or contract the scale of firms for increased productivity.

Pinpointing exactly scale elasticity in production in the presence of congestion in inputs of firms has an important bearing on deciding the success of firms in increasingly competitive circumstances, yet there seems so far to be no empirical analysis applied to Vietnamese manufacturing firms, especially garment firms. Thus, the results of this study will provide insights for firms to operate efficiently and suggest that the Vietnamese government implement appropriate policies to restructure the garment industry and speed up the development of the enterprise sector. Ultimately, these would help the government to achieve its overall goal of socio-economic development of the nation.

Our study focuses on scale elasticity in production in the presence of congestion. To deal with this, in this paper, we make use of the non-parametric approach and the firm-level unbalanced panel data of the garment industry in 2003, 2005 and 2007, drawn from surveys on enterprises conducted by the General Statistics Office of the SR of Vietnam (GSO) in 2004, 2006 and 2008. Findings from this paper could have strategic implications for faster, efficient and sustainable development of the industry. The results of this paper will make a significant contribution to the development of the Vietnamese economy.

The rest of this paper is organized as follows. Section 2 represents the main objectives of the paper. Section 3 gives some facts of the actual situation of garment firm development in Vietnam. The theoretical background concerning the method and models chosen for the empirical analysis is addressed in Section 4. In Section 5, we apply the selected method and models to given datasets to detect congested firms, to find sources and the degree of congestion, and to calculate the degree of scale diseconomies of garment firms. Section 6 is reserved for policy implications. Conclusions and some concluding remarks will follow in Section 7.

2. Objectives of the Research

Our goals are to help garment firms and government make appropriate policies to improve the competitiveness of the garment industry and that of the economy. Given the observed datasets, the authors use the total value added of firms as an output and total number of workers and total undepreciated fixed assets of years concerned as two inputs of the selected approach and empirical models to identify important indicators and information related to scale elasticity in production in the presence of congestion in inputs. These indicators and information will be good bases for policy implications for the firms and to the government. In this regard, the main objectives of this paper are as follows:

- Detecting congested garment firms; finding sources and degrees of congestion of firms and measuring scale elasticity in production in the presence of congestion or degree of scale diseconomies (DSD) of firms;
- Calculating the percentage reduction in inputs congested and the percentage increase in output of firms congested in inputs;
- Estimating total fixed assets and total number of workers wasted that cause a reduction in value added for the firms, total congestion-induced GDP losses; and potential improvements of value added for the firms, and hence the national GDP.

- Providing important bases to firms and the government in order for them to have appropriate policies and strategies for the success and development of the garment industry.
- All these objectives are applicable to specific scales and/or types of ownership in each year and in the studied period.

3. Actual Situation of Garment Industry Development

According to the General Statistics Office (GSO), in 2005, the garment industry had 1745 enterprises consisting of 1303 small and medium sized enterprises (SMEs) with less than 300 employees and 442 large-scale enterprises (LSEs). The industry, together with the textile industry, employed 8% of the total number of workers nationwide and 16% of those of the manufacturing sector. Also, it contributes 5% of the total industrial output value of the country and 6% of the manufacturing sector's. The export turnover of this industry has consistently ranked second among exporting industries since 1986. The share of export turnover of this industry, together with the textile industry, of the total export turnover of the country is currently about 16%.

Despite some important achievements so far obtained by the policies and efforts of the government in firm development, garment firms still remain weak and there are still some regulatory shortcomings, which limit the development of firms in the garment industry. In the first place, the official definition of an SME or large-scale enterprise is unclear because it is based on the total registered capital and general number of annual laborers. Both criteria used to define the scale of a firm are not distinguished by specific sectors or industries. So the efficiency of government policies to support the development of manufacturing firms, especially garment firms, is limited, because these policies cannot meet specifically targeted groups that really need the support.

In terms of technology, low investment mobilization limits ability to renovate technologies and equipment. This influences the productivity of firms, and hence of the industry since the productivity of firms varies greatly depending upon level of equipment, techniques, managerial competence and skills of the labor force.

In regards to the labor force, Vietnam is a populous country with a young population and about 1.2 million new workers entering the labor market every year. The garment industry has an abundant labor force, which is easily trained and has low wages, but its labor productivity remains low. There has been a lack of highly skilled laborers in the industry. Additionally, the high concentration of garment firms in big cities and provinces, such as Ho Chi Minh City, causes a lack of labor force for the firms in these cities and provinces. Moreover, well trained managers and technicians are scarce. These shortcomings negatively impact on firm performance.

4. Theoretical Background and Empirical Models

4.1 Concept of Data Envelopment Analysis

Data Envelopment Analysis (DEA), outlined by Farrell (1957) and operationalized by Charnes, Cooper and Rhodes (1978), is known as a non-parametric methodology for estimating production frontiers and evaluating the relative efficiency of DMUs (Decision Making Units). This methodology involves the use of distance functions and linear programming methods to maximize the ratio of virtual output to virtual input to evaluate the efficiency of DMUs relative to the frontier of a production possibility set. It first identifies a reference set of DMUs or a best comparison set that is then used to find out causes and remedies for inefficiencies. DEA models (including the congestion model), which have been built to measure the efficiency performance of DMUs based upon basic DEA models including the CCR model introduced by Charnes, Cooper and Rhodes (1978), the BCC model introduced by Banker, Charnes and Cooper (1984) and the Slack-based Measure of efficiency (SBM) introduced by Tone (2001), differ from each other based upon the assumption imposed on the production possibilities.

DEA addresses the problem of measuring the efficiency of a DMU by a scalar measure ranging between zero (the worst) and one (the best). This scalar value is determined through a linear programming model (Tone, 2001). Specifically, the CCR model introduced by Charnes et al. (1978) deals with the ratio of virtual output to virtual input in an attempt to gauge the relative efficiency of the DMU concerned among all DMUs. This methodology involves the use of linear programming methods to maximize this ratio. DEA utilizes techniques of mathematical programming, which can handle large numbers of variables and relations (constraints) to be considered and this relaxes the requirements that are often encountered when one is limited to choosing only a few inputs and outputs due to the techniques used, which will otherwise encounter difficulties (Cooper et al., 2007). The standard assumption of DEA models is to build the boundary of the production possibility set based on best practice observations (Forsund et al. 2007). By using a set of mathematical programming models, DEA constructs various envelopment surfaces without assuming specific production functions as does the other methodology, i.e., stochastic frontier production function. Relative to the constructed envelopment surfaces, DEA determines the inefficiency level of a DMU which is compared with a single frontier unit or a linear combination of frontier units (Fukuyama, 2000, p.93).

The CCR model in which the term DEA was first used had an input orientation under an assumption of constant returns to scale (CRS), hence this model is referred to as the CRS model. The variable model of the CCR is the BCC model introduced by Banker et al. (1984). The factors causing a DMU to be not operating at optimal scale include imperfect competition, government regulations, constraints on finance and so on, thus Banker et al. (1984) suggested adjusting the CRS model to allow variable returns to scale (VRS) situations (Coelli et al., 2005). Thus, the BCC model is often referred to as the VRS model.

Upon these seminal basic models (i.e. the CCR and BCC model), there have been many models developed that can be used in DEA to estimate the performance of a DMU in terms of efficiency, especially scale elasticity in production in the presence of congestion in inputs and so forth. In this paper, the output-oriented BCC model is employed as it aims at maximizing output levels under at most the present input consumption or without requiring more of any of the observed input values.[1] Additionally, the authors devote attention to measuring the effects of scale elasticity in production on the output side. More importantly, this model is an important base for the congestion model that identifies and estimates scale elasticity in production when congestion is present in input(s).

4.2. Methodology and Empirical Models

4.2.1 Overview of congestion in inputs

It can be recognized that congestion is a term that is applicable in a variety of disciplines in our society. The concept of congestion was initially introduced by Färe and Svensson (1980), and then was developed by Färe and Grosskopf (1983) who consider congestion as a type of inefficiency which occurs whenever inputs are "wasted" or potential output is "lost". Later on, Byrnes et al. (1984) and Färe et al. (1985a) develop it further and specify simple linear programming techniques used to calculate these efficiency measures for a sample of 15 Illinois strip mines and 153 public and private electric utilities operating in the US in 1970. Färe et al (1985b) inherit the above achievements and suggest a procedure for identifying input factors that account for the congestion and finalize the models that they used to analyze the congestion that is identified only with DEA. In general, this approach makes use of an input-oriented approach under the assumption of CRS. This approach rules out the case where both factors in a model of two inputs have negative marginal products. More importantly, this approach does not address the measurement of degree of scale diseconomies.

[1] Whereas, the input-oriented BCC model aims at reducing the input amounts by as much as possible while keeping at least the present output levels.

Alternatively, Cooper et al. (1996) introduce an alternative approach of identifying and measuring congestion. After that, this approach was extended and applied into Chinese data by Brockett et al. (1998) and by Cooper et al. (2000, 2001). This approach makes use of an output-oriented BCC model under the assumption of VRS and applies a slack-based approach to detect and measure congestion and to identify the input(s) accounting for congestion. Similarly to the first one, there is no information about marginal products and DSD in this approach.

Recently, Tone and Sahoo (2004) have proposed a new unified approach to identify sources and degrees of congestion, and simultaneously measure scale elasticity in production in the presence of congestion or DSD. This approach is similar to the second one mentioned above because it also uses the output-oriented BCC model under the assumption of VRS. However, the ways of defining and measuring congestion in this approach are different from those of the second approach. This approach has many attractive features that the other two approaches do not have. Firstly, it allows the case where both factors in a model of two inputs have negative marginal products. Secondly, all information related to the congestion status of DMUs is shown in the result sheets, e.g., improved inputs, slacks of inputs and output(s), and DSD. Thirdly, results obtained from applying this approach enable us to calculate the percentage reduction in each congested input and the percentage increase in output of firms congested in inputs.[2]

Up until now we have found that Tone and Sahoo's (2004) approach (hereafter referred to as the K.Tone approach for the ease of reference) has many prominent and attractive features that can serve our purposes. Thus, we choose this approach and apply it to our empirical analysis.

For simplicity, the presentation of the congestion model in this chapter adopts the approach and the notations applied in Tone and Sahoo (2004). The significant point of this model is to measure the DSD of firms on the efficient frontier. Inefficient firms lying under the efficient frontier will be projected onto the efficient frontier by an output-oriented BCC model introduced by Banker et al. (1984) with a two-stage evaluation process.

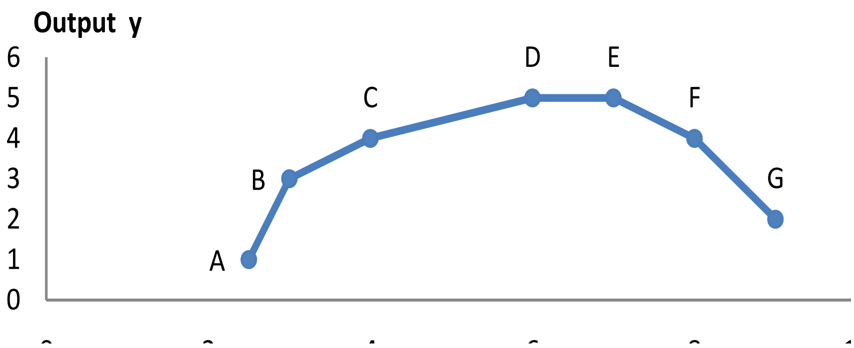
Hereinafter, we deal with *n DMUs*, each having *m* inputs for producing *s* outputs. For each DMU_o ($o = 1, \ldots, n$), we denote $\boldsymbol{x_o} \in R^m$ and $\boldsymbol{y_o} \in R^s$ as the input and output vectors, respectively. This means that using $(\boldsymbol{x_o}, \boldsymbol{y_o})$ represents a point with coordinate values corresponding to the multiple inputs and outputs recorded for each DMU_o. The input and output matrices are defined by $X=(\boldsymbol{x_1}, \boldsymbol{x_2}, \ldots, \boldsymbol{x_n}) \in R^{m \times n}$ and $Y=(\boldsymbol{y_1}, \boldsymbol{y_2}, \ldots, \boldsymbol{y_n}) \in R^{s \times n}$. X and Y are the given data set and we assume that $X > 0$ and $Y > 0$.

[2] When the observed dataset contains BCC-inefficient DMUs, i.e. the DMUs have pure technical efficiency scores of 1 but nonzero input slacks, the K.Tone approach has a shortcoming as it takes the total input slacks (consisting of the inefficient amount of inputs and congested amount of inputs) to calculate the DSD of a congested firm. Fortunately, the observed datasets used in this study do not contain any BCC-inefficient DMUs, the use of the K.Tone approach in this study is reliable.

4.2.1.1 K.Tone approach. In practice, there exist some cases where an increase in one or more inputs induces a decrease in one or more outputs, i.e., DSD is negative. Figure 1 illustrates such a phenomenon, particularly an increase in input x results in a decrease in output y as is shown in the case of points F and G. To deal with this sort of situation, Tone and Sahoo introduce the convex production possibility set P_{convex} as

$$P_{convex} = \{(\boldsymbol{x}, \boldsymbol{y}) | \boldsymbol{x} = X\boldsymbol{\lambda}, \boldsymbol{y} \le Y\boldsymbol{\lambda}, \boldsymbol{e\lambda} = 1, \boldsymbol{\lambda} \ge \boldsymbol{0}\}. \quad (1)$$

Figure 1: Congestion



Upon this P_{convex} a *DMU is congested if it is strongly efficient with respect to* P_{convex} *and there exists an activity in* P_{convex} *that uses fewer resources in one or more inputs for making more products in one or more outputs.* In other words, congestion is identified when a reduction in one or more inputs causes an increase in one or more outputs. Congestion, according to Cooper et al. (2001), is commonly understood as an increase (decrease) in one or more inputs causing a decrease (increase) in one or more outputs. Especially, there is also a case where a proportionate reduction in all inputs of a firm warrants an increase in all outputs. In this case, the firm has strong congestion in input.

4.2.2.1.1. Model Specification. In the first place, the concerned DMU $(\boldsymbol{x_o}, \boldsymbol{y_o})$ is assumed to be strongly efficient in the production possibility set P_{convex}.[3] If not, we project $(\boldsymbol{x_o}, \boldsymbol{y_o})$ onto the efficient frontiers of P_{convex}.[4] For this DMU $(\boldsymbol{x_o}, \boldsymbol{y_o})$, we solve the following linear program with variables $\boldsymbol{\lambda}$, $\boldsymbol{t}^-$ and $\boldsymbol{t}^+$.

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[3] This means that $\phi^* = 1$, $q^{+*} = 0$ for every optimum for the problem of Max ϕ subject to $\boldsymbol{x_o} = X\lambda$; $\phi \boldsymbol{y} = Y\lambda - \mathbf{q}^+$; $\boldsymbol{e\lambda} = 1$; $\lambda \ge \mathbf{0}$, $\mathbf{q}^+ \ge \mathbf{0}$.

[4] The inefficient DMU $(\boldsymbol{x_o}, \boldsymbol{y_o})$ is projected onto the efficient frontiers of P_{convex} by the following formulas: $\boldsymbol{x_o}^* \leftarrow \boldsymbol{x_o}$ unchanged, and $\boldsymbol{y_o}^* \leftarrow \phi^* \boldsymbol{y_o} + \boldsymbol{q}^{+*}$. This input-output vector $(\boldsymbol{x_o}^*, \boldsymbol{y_o}^*)$ is strongly P_{convex}-efficient. In this case, when the original DMU $(\boldsymbol{x_o}, \boldsymbol{y_o})$ is purely technically inefficient, then the projected DMU may

[Congestion] $\max \frac{1}{s}\sum_{r=1}^{s}\frac{t_r^+}{y_{ro}}$ (2)

subject to

$$\boldsymbol{x_o} = X\lambda + \boldsymbol{t}^-$$
$$\boldsymbol{y_o} = Y\lambda - \boldsymbol{t}^+$$
$$\boldsymbol{e}\lambda = 1$$
$$\lambda \geq \mathbf{0},\ \boldsymbol{t}^- \geq \mathbf{0},\ \boldsymbol{t}^+ \geq \mathbf{0}.$$

To solve [Congestion], a two-stage process is employed: firstly, we maximize the objective function in (2), and secondly we maximize $\sum_{i=1}^{m} t_i^- / x_{io}$, while keeping the objective value of (2) at the optimum level. We illustrate the objective function in the following form:

$$\max \frac{1}{s}\sum_{r=1}^{s}\frac{t_r^+}{y_{ro}} + \varepsilon \frac{1}{m}\sum_{i=1}^{m}\frac{t_i^-}{x_{io}} \tag{3}$$

for the two-stage evaluation process, where ε is non-Archimedean element smaller than any positive real number.

We now let an optimal solution vector be $(\lambda^*, \boldsymbol{t}^{-*}, \boldsymbol{t}^{+*})$, then we have two cases as follows:

Case 1: $\boldsymbol{t}^{+*} = 0$. In this case, there is no congestion observed in activity $(\boldsymbol{x_o}, \boldsymbol{y_o})$ because a decrease in inputs cannot increase any outputs.

Case 2: $\boldsymbol{t}^{+*} \neq \mathbf{0}$. In this case, $\boldsymbol{t}^{-*}$ is also not zero because the activity $(\boldsymbol{x_o}, \boldsymbol{y_o})$ is strongly efficient in P_{convex}. Thus, we identify congestion in activity $(\boldsymbol{x_o}, \boldsymbol{y_o})$.

Hereinafter, we deal with case 2, i.e. $\boldsymbol{t}^{+*} \neq \mathbf{0}$, $\boldsymbol{t}^{-*} \neq \mathbf{0}$ to measure the degree of diseconomies. Based on the optimal solution vector $(\lambda^*, \boldsymbol{t}^{-*}, \boldsymbol{t}^{+*})$, we define $\hat{\boldsymbol{x}}_o$ and $\hat{\boldsymbol{y}}_o$ as follows:

$$\hat{\boldsymbol{x}}_o = X\lambda = \boldsymbol{x_o} - \boldsymbol{t}^{-*} \tag{4}$$
$$\hat{\boldsymbol{y}}_o = Y\lambda = \boldsymbol{y_o} + \boldsymbol{t}^{+*} \tag{5}$$

$(\hat{\boldsymbol{x}}_o, \hat{\boldsymbol{y}}_o)$ is an improved activity and it is less congested than $(\boldsymbol{x_o}, \boldsymbol{y_o})$.

As a proxy measure for scale elasticity, Tone and Sahoo propose the following formulas. First, they define an approximation to the marginal production rate (MPR) as

$$\text{MPR} = -\frac{1}{\bar{s}}\sum_{r=1}^{s}\frac{t_r^{+*}}{y_{ro}} \Bigg/ \frac{1}{\bar{m}}\sum_{i=1}^{m}\frac{t_i^{-*}}{x_{io}} \tag{6}$$

Where $\bar{s}$ and $\bar{m}$ are defined as the numbers of positive t_r^{+*} ($r=1, \ldots, s$) and positive t_i^{-*} ($i= 1,\ldots, m$), respectively. The average production rate (APR) is defined as follows:

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be BCC-efficient, technically inefficient (i.e., the projected DMU has ϕ^* =1, zero output shortfalls and nonzero input slacks) or congested.

$$\text{APR}= \frac{1}{s}\sum_{r=1}^{s}\frac{y_{ro}}{y_{ro}} \bigg/ \frac{1}{m}\sum_{i=1}^{m}\frac{x_{io}}{x_{io}} = 1 \quad (7)$$

Thus, we have the following approximation measure for DSD, which is given by

$$\text{DSD} = \frac{MPR}{APR} = -\frac{1}{s}\sum_{r=1}^{s}\frac{t_r^{+*}}{y_{ro}} \bigg/ \frac{1}{m}\sum_{i=1}^{m}\frac{t_i^{-*}}{x_{io}} \quad (8)$$

DSD that is defined in (8) can be interpreted as the ratio of the average reduction (improvement) in outputs to the average increase (reduction) in inputs. In this approach, the improved DMU $(\hat{x}_o, \hat{y}_o)$ defined by (4) and (5) is proved to be not congested.

5. Empirical Analysis

5.1 Data and Variable description

Statistical data used for the empirical analysis are drawn from the surveys on enterprises conducted by GSO in three years (2004, 2006 and 2008), in which the core information collected from enterprises includes: type of ownership; area of business and production activities; number of workers at the end of the year; income of employees; total assets (including total undepreciated fixed assets) and depreciation; turnover from areas of business and production activities; and gross profits before taxes from business and production activities and from other activities. The statistical information, therefore, is of the years 2003, 2005 and 2007.

In this study, the authors make use of the unbalanced panel data (or pooled data) of the three industries after implementing data mining for the cross-sectional datasets of the three years under consideration.

5.1.1 Data description

The sample sizes of the datasets are composed of 1212, 1745 and 2623 enterprises of the years 2003, 2005 and 2007, respectively. After data mining, 642, 864 and 1211 enterprises of the years 2003, 2005 and 2007, respectively will be used in the empirical analysis.

For the purpose of the analysis, the authors deal with the unbalanced panel data with the following steps: Firstly, the authors classify each cross-sectional dataset by three scale groups of enterprises based on their total number of workers (TW). In particular, the small scale group (called Small) consists of enterprises with TW from 10 to 49; the medium scale group (called Medium) includes enterprises with TW from 50 to 299; and the large scale group (called LSEs) encompasses enterprises with TW of more than 299. Secondly, the authors mix data of each scale group of three years under consideration into one new dataset respectively. Here we assume that firms in each scale group have the same technology. Each year's firm's annual performance is considered a distinct DMU. Each scale group consists of three main types of ownership, that is, state-owned enterprises (SOEs), domestic private enterprises (DPEs) and enterprises with foreign investment (FIEs). See Table 1 for detailed information.

Table 1. Composition of garment enterprises by type of ownership

	Total		SOEs		DPEs		FIEs	
	No. of firms	%	No. of firms	%	No. of firms	%	No. of firms	%
In 2003	**642**	**100%**	**63**	**23%**	**397**		**182**	
LSE	281	44%	57	20.3%	108	38%	116	41%
Medium	248	39%	6	2.4%	182	73%	60	24%
Small	113	18%	-	-	107	95%	6	5%
In 2005	864	**100%**	**46**		**393**		**425**	
LSE	347	40%	42	12.1%	139	40%	166	48%
Medium	301	35%	4	1.3%	244	81%	53	18%
Small	216	25%	-	-	10	5%	206	95%
In 2007	**1211**	**100%**	**26**		**837**		**348**	
LSE	463	38%	23	5.0%	194	42%	246	53%
Medium	410	34%	3	0.7%	316	77%	91	22%
Small	338	28%	-	-	327	97%	11	3%

Source: Authors' calculations

In terms of ownership, the number of SOEs in all three scale groups decreases over time; there is no SOE in the Small group. This tendency is attributed to the government's policy of equitizing SOEs and of reducing the number of small-scale SOEs. The number of DPEs and FIEs in all three scale groups has been increasing as a result of the amelioration of the Vietnamese business environment with the promulgation of Laws on Enterprises in 1999 and 2005 and the Common Law on Investments for all types of ownership in 2005.

5.1.2 Data constraints

Due to the limitation of all datasets that the authors have, there is no information about environmental variables or conditions in which firms are operating, thus this study could not distinguish the input slacks, output shortfalls and output losses from environmental impacts and the effect of management incompetence.

In regards to the labor force of firms, there is no information about unskilled, skilled and management labor, thus this study could not measure the impacts of skilled and unskilled workers on firms' performance.

In terms of capital input, there is no specific information about the components of the total fixed assets, about the history of investment expenditures for each firm as well as service lives of assets, and depreciation methods of total fixed assets. Thus, the authors could not determine the specific gross capital stock of each firm under consideration. As a result, the authors use total undepreciated fixed assets as a proxy for the capital input of the selected models in empirical analysis.

The normal way to measure total value added of a firm is based upon gross turnover and the cost of immediate inputs. However, the datasets that the authors have do not contain information about immediate inputs, thus the authors have to use the indirect way, namely through the gross profit and total wage bill (including allowances) and the consumption of fixed assets (i.e. depreciation within the year concerned).

5.1.3 Variables

The selection of specific inputs used in the empirical analysis depends upon the use of outputs in the analysis. The selection of outputs used in the empirical analysis, in turn, depends on the purposes of the study. For the purposes of this paper and due to the data constraints, the authors use total value added (TVA) as an output of the selected models in the empirical analysis, and hence two inputs employed in the analysis include the total number of workers (TW) at the end of the studied years as a proxy for the number of full-time equivalent employees and total undepreciated fixed assets (FIAS) as a proxy for capital input. The TVA and FIAS are measured in million VND at accounting value. The TW is measured in terms of people. These three values are all, as of the end of the year, under consideration.

In this study, there are two nominal variables including TVA and the FIAS. Before carrying out the empirical analysis, we need to convert all these nominal variables into their real ones. Ideally, each input and output value should be deflated with its own deflator. However, due to the data constraints and the fact that in the Vietnamese national accounts publications, these prices indices are unavailable, we employ producer's price indices (PPIs) in three years, i.e., 2003, 2005 and 2007 of the garment industry as a proxy for the deflation of nominal TVA of all observations in respective years with 2000 as the base year.

For the capital input, the key ingredient for the computation of productive capital stock is producer price indices (PPIs) of investment goods to deflate the investment expenditure series and to obtain constant price value measures of invested capital (OECD, 2001). However, FIAS is used as a proxy for the capital input in this study consisting of not only machines, equipment, vehicles etc., but also buildings and land, and there is no specific PPI for this aggregate value of

FIAS in the national accounts publications. For this case, according to Coelli et al. (2003), the second best strategy is to use general price indices, but these indices are not available in the national accounts publications. Therefore, we will be employing CPIs in three years, i.e., 2003, 2005 and 2007 with 2000 as the base year as a proxy deflator for the deflation of the nominal FIAS of all observations in respective years.

5.2 The empirical results

The empirical results in this chapter are obtained by applying the selected models to each scale group. Before considering the issue of congestion, it is worth examining the *pure technical efficiency* (PTE) of the garment industry over the three years under consideration. Table 2 presents the results obtained from the output-oriented BCC model by scale groups. As is seen in the table, the average PTE indices of all three scale groups have been increased over the period studied. However, the TVA shortfalls due to pure technical inefficiency are rather serious, particularly their shares over the TVA at 100% PTE of the three year from 63% to 70%, and of specific scale groups from 69% to 81%. Because we assumed firms in each scale group have the same technology, these TVA shortfalls are attributed to four issues consisting of the managerial incompetence of managers of firms, environmental conditions under which the firms were operating (e.g. business environment), skills of workers and congestion management in production (i.e. congestion in input) of the firms. Therefore, improving congestion management in production of a firm (if it has congestion in input) is one way that may help the firm to achieve its TVA at 100% PTE and 100% TE. The table also shows the decreasing tendency of these shares which indicates that the positive trend may result from the improvement of one or the combination of some or all four issues mentioned above. Therefore, if firms and the government make adequate policies and strategies in order to ameliorate these four issues, the TVA of firms and GDP of the country will be significantly improved. For instance, in the medium and long run, with the assumption that the three issues could be improved and only about 50% number of firms over the whole industry considered in this paper could achieve 60% and 90% of the TVA shortfalls, respectively, then GDP could have been improved by 1.27%, 1.91% in 2003, 1.16% and 1.74% in 2005 and 1.13% and 1.7% in 2007, respectively.

Table 2: Pure Technical Efficiency and loss of Total Value Added

Unit of monetary items: billion VND

	No. of firms	%	Efficiency index		TVA loss (*)	Ratio of (*) to TVA at PTE (%)	Share of (*) over GDP	
			Mean	Std. Dev.			60%	90%
2003	**642**	**100%**			**14,994**	**70%**	**1.27%**	**1.91%**
LSEs	281	44%	0.270	0.190	12,216	69%	1.04%	1.55%
Medium	248	39%	0.229	0.167	2,523	80%	0.21%	0.32%
Small	113	18%	0.209	0.157	255	81%	0.02%	0.03%
2005	**864**	**100%**			**17,950**	**70%**	**1.16%**	**1.74%**
LSEs	347	40%	0.289	0.184	14,673	68%	0.95%	1.43%
Medium	301	35%	0.249	0.166	2,858	78%	0.19%	0.28%
Small	216	25%	0.217	0.188	420	80%	0.03%	0.04%
2007	**1211**	**100%**			**22,053**	**63%**	**1.13%**	**1.70%**
LSEs	463	38%	0.366	0.212	17,806	60%	0.91%	1.37%
Medium	410	34%	0.295	0.189	3,737	74%	0.19%	0.29%
Small	338	28%	0.274	0.183	510	74%	0.03%	0.04%

Source: Authors' calculations

According to the concept of congestion, a firm has congestion in input when a reduction in TW and/or FIAS causes an increase in TVA for the firm. A DSD here means that given a 1% average reduction in inputs (i.e. TW and FIAS), each congested firm could obtain an average improvement in output (i.e. TVA) by DSD%. The cause of congestion in inputs is mainly attributed to managerial incompetence of firms and possibly to environmental conditions. Additionally, before examining congestion in production of garment firms, it is necessary to take a look at the reasons why congestion in TW and/or FIAS causes a decrease in TVA for the firms.

Firstly, congestion in total fixed assets (FIAS) will cause a decrease in output for firms because the components of FIAS in this study consist of land, buildings, vehicles, machines, equipment and so forth. In the first place, in the narrow space of a plant, too many machines and equipment will make lots of noise and troubles that causes a reduction in productivity for the firm. Additionally, when firms hold vehicles, machines and equipment over the optimal scale or more than needed, the “extra” amount of these components of FIAS will be either idle or underutilized. This can occur, for instance, when an increase in the number of vehicles, machines and equipment induces a lack of workers who operate the “extra” amount of them. The situation is apparent when a firm equips itself with a lot more vehicles, machines and equipment than the required level or optimal scale.[5] In this case, some of them might remain idle. When vehicles, machines or equipment are operated with a lower TW than needed, they are not optimally exploited while necessary operating costs are unchanged. This causes a decrease

[5] This is mainly due to the managerial incompetence of the firm.

in TVA for the firm as a whole. When vehicles, machines and equipment are idle, they will be tangibly and intangibly worn out. Thus, even though these FIAS are idle, the firms still (1) need investment for capital to repair these fixed assets; (2) have expenditures for maintenance of vehicles, machines and equipment; and (3) need to pay interest on loans or credit, depreciation expenditures, etc. All these expenditures will result in an increase in total indirect costs and hence reduce the total value added of the firms. In the end, these kinds of FIAS may have no value due to two kinds of wear. This causes a great wastage of resources for the firms and the economy as a whole. In Vietnam, this phenomenon can be found in many firms, especially in SOEs where they just bought machines and equipment without exploiting them. In the second place, when firms hold more land and buildings than needed, the “extra” amount of these kinds of FIAS causes a decrease in total value added for the firms. This is because although these buildings and land are unused, the firms still need indirect costs for electricity, rents, cleaning costs, land taxes, costs of maintenance and repair, etc. All of them cause an increase in total indirect costs, and hence reduce total value added.

Secondly, when firms employ more labor forces than needed, too many people may have to work in a narrow space, and hence reduce labor productivity and the amount of outputs produced. Moreover, tools, office supplies, telephone bills and so forth will increase as a result of employing more labor. Another serious problem is that if too many workers are employed more indirect workers or staffs have to be employed for monitoring them. In the end, the labor productivity of the firms will be dramatically reduced. Additionally, due to the fact that the Vietnamese labor force in the garment industry mainly consists of unskilled workers, and that skilled workers including line leaders who monitor the unskilled are scarce, the workers are likely to produce many products with some defects. All these factors could result in a reduction in TVA for the firms.

In regards to congestion in inputs of firms in the garment industry, Tables 3, 4 and 5 generally show that the garment industry is in a serious situation in terms of congestion management. The average ratio of the number of congested firms to total number of LSEs, Medium and Small is 47%, 13% and 23% respectively over the three years. The garment industry is considered a labor-intensive industry, but has a large number of firms congested in FIAS with a large amount of FIAS congested; approximately 80% of congested LSEs show congestion in FIAS.[6] Small and Medium dominate the number of firms congested in TW. This phenomenon can be explained by the fact that LSEs have advantages in obtaining credit, thus

[6] In another study, the authors find that almost all industries (including the garment industry) in Vietnam have firms congested in TW and/or FIAS. See Luong, Khoi V. and N. Matsunaga (2008) for more information.

they often have congestion in FIAS. Meanwhile most small and medium firms in Vietnam belong to the domestic private sector and most of them employ abundant labor force, including unpaid family workers, causing congestion in TW for these firms.

These three tables show us a mixed picture about congestion in production; in particular there is no tendency towards improving congestion management over three periods of time. LSEs have low average DSD, yet as their scales of production are large, a large amount of FIAS and/or TW is underused or wasted, causing a large decrease in TVA for LSEs. The congestion-induced TVA loss of LSEs accounted for about 3%, 3% and 6% of the TVA at full PTE for 2003, 2005 and 2007, respectively.

The Small and Medium groups have been serious in congestion with a large number of congested firms and extremely large DSD. In particular, the Medium has had 18%, 14% and 13% of firms congested in TW and/or FIAS with average DSDs of 2.79, 2.41 and 2.25 in 2003, 2005 and 2007, respectively. This scale group shows a high level of congestion in TW or FIAS. Worryingly, from 14% to 25% of congested firms show that they have congestion in both inputs. This means that these firms were operating over their optimal scales, causing a decrease in their TVA. The ratios of congestion-induced TVA of congested firms in this scale group to their TVA at full PTE are really high: almost 20% over the three years studied.

The Small is even more serious in congestion. As can be observed from Tables 3, 4 and 5, this scale group has had 27%, 23% and 21% of firms congested in TW and/or FIAS with average DSDs of 2.09, 2.55 and 8.19 in the three years studied, respectively. The shares of TVA of congested firms lost due to congestion in their production over their TVA at full PTE account for 20%, 28% and 27% in 2003, 2005 and 2007, respectively.

The empirical results show two important points: (1) congestion is a very important source of inefficiency of firms; (2) all three scale groups of the industry face serious congestion management problems. A large amount of FIAS and TW wasted causes a large TVA or GDP loss every year. This finding warns the business community of congestion in production which can happen to all scales of firms, and hence all firms in this industry should seriously take care of the marginal products of factors of production and utilize resources in an efficient way.

Table 3. DSD, amount of inputs congested, output shortfall of congested firms in 2003 (n=642)

Unit of monetary terms: billion VND

2003	No. of firms of respective groups (1)	Congested firms			TW		FIAS		% of firms- 2 inputs congested	TVA loss (*)	(*)/ TVA @ PTE
		No. of firms (2)	% (2)/(1)	Avg. DSD	% congested firms over (2)	Total congested amount	% congested firms over (2)	Total congested amount			
LSEs	**281**	**135**	**48%**	**(0.117)**	**15%**	**(4,500)**	**85%**	**(1,806)**	**-**	**306**	**3%**
SOEs	57	25	44%	(0.042)	**20%**	(1,119)	80%	(110)	-	15	1%
DPEs	108	43	40%	(0.135)	19%	(1,229)	81%	(257)	-	43	2%
FIEs	116	67	58%	(0.134)	10%	(2,152)	90%	(1,439)	-	248	5%
Medium	**248**	**44**	**18%**	**(2.79)**	**39%**	**(668)**	**39%**	**(236)**	**23%**	**201**	**22%**
SOEs	6	-	-	-	-	-	-	-	-	-	-
DPEs	182	21	12%	(1.49)	71.4%	(549)	14.3%	(25)	14.3%	67	17%
FIEs	60	23	38%	(3.98)	9%	(119)	61%	(211)	30%	135	25%
Small	**113**	**31**	**27%**	**(2.09)**	**77%**	**(138)**	**23%**	**(16)**	**-**	**26**	**20%**
SOEs	-	-	-	-	-	-	-	-	-	-	-
DPEs	107	27	25%	(2.22)	85%	(128)	15%	(8)	-	23	21%
FIEs	6	4	67%	(1.20)	25%	(10)	75%	(8)	-	3	15%
Total	**642**	**210**				**(5,307)**		**(2,058)**		**534**	

Source: Authors' calculations.

Table 4: DSD, amount of inputs congested, output shortfall of congested firms in 2005 (n=864)

Unit of monetary terms: billion VND

2005	No. of firms of respective groups (1)	Congested firms			TW		FIAS		% of firms- 2 inputs congested	TVA loss (*)	(*)/ TVA @ PTE
		No. of firms (2)	% (2)/(1)	Avg. DSD	% congested firms over (2)	Total congested amount	% congested firms over (2)	Total congested amount			
LSEs	**347**	**159**	**46%**	**(0.13)**	**21%**	**(8,547)**	**79%**	**(2,074)**	**-**	**366**	**3%**
SOEs	42	13	31%	(0.07)	23%	(1,570)	77%	(105)	-	26	2%
DPEs	139	56	40%	(0.15)	25%	(3,230)	75%	(359)	-	85	2%
FIEs	166	90	54%	(0.13)	18%	(3,746)	82%	(1,610)	-	256	4%
Medium	**301**	**43**	**14%**	**(2.41)**	**49%**	**(689)**	**37%**	**(357)**	**14%**	**157**	**18%**
SOEs	4	1	25%	(0.02)	-	-	100%	(4)	-	0.14	0.5%
DPEs	244	24	10%	(3.33)	71%	(540)	29%	(27)	-	80	20%
FIEs	53	18	34%	(1.30)	22%	(150)	50%	(325)	28%	77	18%
Small	**216**	**50**	**23%**	**(2.55)**	**88%**	**(248)**	**12%**	**(66)**	**-**	**52**	**28%**
SOEs	-	-	-	-	-	-	-	-	-	-	-
DPEs	206	44	21%	(2.50)	95%	(237)	5%	(29)	-	44	28%
FIEs	10	6	0.6	(1.74)	33%	(11)	67%	(38)	-	8	29%
Total	**864**	**252**				**(9,484)**		**(2,497)**		**575**	

Source: Authors' calculations

Table 5: DSD, amount of inputs congested, output shortfall of congested firms in 2007 (n=1211)

Unit of monetary terms: billion VND

2007	No. of firms of respective groups (1)	Congested firms			TW		FIAS		% of firms- 2 inputs congested	TVA loss (*)	(*)/ TVA @ PTE
		No. of firms (2)	% (2)/(1)	Avg. DSD	% congested firms over (2)	Total congested amount	% congested firms over (2)	Total congested amount			
LSEs	**463**	**224**	**48%**	**(0.27)**	**24%**	**(23,128)**	**76%**	**(3,011)**	**-**	**962**	**6%**
SOEs	23	9	39%	(0.12)	33%	(1,888)	67%	(69)	-	31	4%
DPEs	194	78	40%	(0.10)	18%	(3,793)	82%	(679)	-	108	2%
FIEs	246	137	56%	(0.37)	26%	(17,447)	74%	(2,263)	-	822	8%
Medium	**410**	**52**	**13%**	**(2.25)**	**40%**	**(658)**	**35%**	**(206)**	**25%**	**198**	**19%**
SOEs	3	1	33%	(2.25)	-	-	100%	17	-	2	17%
DPEs	316	34	11%	(2.38)	56%	(520)	20.6%	(68)	24%	117	19%
FIEs	91	17	19%	(2.09)	12%	(138)	53%	(155)	29%	79	18%
Small	**338**	**70**	**21%**	**(8.17)**	**89%**	**(390)**	**7%**	**(66)**	**4%**	**68**	**27%**
SOEs	-	-	-	-	-	-	-	-	-	-	-
DPEs	327	63	19%	(2.71)	94%	(362)	6%	(18)	-	51	24%
FIEs	11	7	64%	(5.46)	43%	(28.13)	14%	(48)	43%	17	41%
Total	**1211**	**346**				**(24,176)**		**(3,283)**		**1,228**	

Source: Authors' calculations.

When considering the percentage contribution of each input to congestion in congested enterprises or the average percentage reduction in all inputs, *i.e.* TW and FIAS, and the average percentage improvement in TVA by scale groups over the studied periods, Table 6 shows that Small and Medium were serious as they have had high average percentage improvement in TVA and relatively high average percentage reduction in all inputs, for instance 65%, 43% and 39% for Medium and 31%, 68% and 62% for Small in 2003, 2005 and 2007, respectively. In regards to the LSEs, although this scale group has the smallest average percentage of possible improvement in TVA, they have a large scale of operations, and hence the absolute amounts of TVA that could be improved are considerable. Additionally, the LSEs dominate the average percentage reduction in all inputs, especially in FIAS. This finding tells us that a large amount of FIAS and TW can be reduced and saved for other firms in the garment industry or in other industries to take advantage of scale economies. The reduction in TW and/or FIAS will cause a large percentage improvement in TVA for the firms and GDP for the country.

Table 6. Percentage contribution of each input to congestion by scales

(1) Year/ Scale	(2) Average percentage reduction in TW	(3) Average percentage reduction in FIAS	(4) Average percentage reduction in all inputs	(5) Average percentage improvement in TVA
2003				
LSEs	-2%	-32%	-34%	4%
Medium	-6%	-29%	-27%	65%
Small	-10%	-5%	-15%	31%
2005				
LSEs	-3%	-33%	-36%	6%
Medium	-6%	-25%	-27%	43%
Small	-12%	-6%	-18%	68%
2007				
LSEs	-5%	-31%	-36%	12%
Medium	-5%	-25%	-23%	39%
Small	-13%	-6%	-17%	62%

Source: Authors' calculations

Proceeding to further analysis, Table 7 shows a large amount of FIAS and TW wasted over the three years of the study. In particular, the former accounts for 4.5%, 4.6% and 5.0% of the total investment in the whole manufacturing sector in 2003, 2005 and 2007, respectively. Among these, the LSEs dominate with 3.8%, 3.8% and 4.5%, respectively. If these amounts could be saved and used by other firms, they could produce a lot more TVA and contribute significantly to GDP growth. Additionally, due to the waste of these amounts of FIAS and/or TW, the industry lost about 8%, 6% and 7% of the TVA in 2003, 2005 and 2007, respectively. The LSEs dominated congestion-induced TVA losses over the three years. In comparison, the national GDP lost due to congestion in TW and/or FIAS was 0.08%, 0.06% and 0.11% in the respective periods studied. This suggests the significance of improving congestion management in firms' performance in the garment industry. The improvement could help firms to save and utilize on-hand resources efficiently and significantly improve their TAV and the GDP of the country.

Table 7. Wasted resources inducing GDP loss

Unit of monetary terms: billion VND

	(1) TW waste (people)	(2) FIAS waste	(3) Ratio of (2) to the total investment in manuf. sector	(4) Total TVA (GDP) loss	(5) Ratio of (4) to TVA of garment industry	(6) Ratio of (4) to GDP
2003	**(5,548)**	**(2,112)**	**4.5%**	**572**	**8%**	**0.08%**
LSEs	(4,500)	(1,806)	3.8%	306	4%	0.04%
Medium	(658)	(240)	0.5%	198	3%	
Small	(390)	(66)	0.1%	68	1%	
2005	**(9,484)**	**(2,497)**	**4.6%**	**575**	**6%**	**0.06%**
LSEs	(8,547)	(2,074)	3.8%	366	4%	0.04%
Medium	(689)	(357)	0.7%	157	2%	
Small	(248)	(66)	0.1%	52	1%	
2007	**(24,176)**	**(3,317)**	**5.0%**	**1,228**	**7%**	**0.11%**
LSEs	(23,128)	(3,011)	4.5%	962	6%	0.08%
Medium	(658)	(240)	0.4%	198	1%	
Small	(390)	(66)	0.1%	68	0.4%	

Source: Authors' calculations

Notes: because values in columns (2) and (4) are in real terms, the authors use deflators of FIAS and TVA to convert them back to the nominal values and then use the nominal values of the total investment in manufacturing industries, TVA of garment industry and GDP in respective years in order to calculate ratios in columns (3), (5) and (6).

In terms of ownership, as is seen in Tables 3, 4 and 5, all types of ownership in all three scale groups are in bad conditions with respect to congestion. Surprisingly, FIEs faced serious congestion in all three scale groups, although they could be expected to be the best in this matter as they have good conditions in regards to managerial competence. This type of ownership dominates the number of firms congested in TW or FIAS as well as the total amount of FIAS and TW wasted and congestion-induced TVA loss in the large scale group. In Small and Medium, the congestion situation in TW and/or FIAS of the FIEs was extremely serious over the periods studied with a large number of firms congested in input(s) and high average DSDs. This shows that FIEs often have advantages in terms of capital and they are overwhelmingly located in Ho Chi Minh City, thus they have problems in obtaining necessary labor, and hence congestion in FIAS is unavoidable. Additionally, in other provinces and cities, FIEs could take advantage of low labor costs; they tend to hire more workers than needed, and hence these firms have congestion in TW.

Regarding DPEs, this type of ownership also shows serious congestion in all three scale groups. In Small and Medium especially, as is seen in Tables 3, 4 and 5, they were congested in TW and/or FIAS and dominate the share of firms congested in TW over the total firms congested in input(s) with an average percentage of about 71%, 71% and 56% in Medium and 85%, 95% and 94% in Small in 2003, 2005 and 2007, respectively. They also have high average DSDs of 1.49, 3.33 and 2.38 for Medium, and 2.22, 2.50 and 2.71 for Small over the three years, respectively. Congestion in TW and/or FIAS of DPEs can be explained by the fact that most DPEs, especially in the small firms, often employ large numbers of relatives of the managers or owners of the firms, even if these firms do not really need such workers. This way of employing workers in DPEs results in congestion in firms' TW. Secondly, managerial skills and the knowledge of many top managers and supervisors of plants of firms are still limited and do not adequately meet the requirements of the firms; hence these managers and supervisors purchase more machines, equipment, vehicles, land and buildings than needed. This causes wasteful use of capital that induces a decrease in the TVA of their firms.

As for SOEs, because the number of SOEs in Medium and Small has been decreasing over time, most SOEs have a large scale of operations. Tables 3, 4 and 5 show that LSE SOEs have had bad congestion in either TW or FIAS. They almost dominate the ratio of the number of firms congested in TW over the total number of firms congested in TW or FIAS in this type of ownership over the periods studied. As SOEs are funded by the state budget, the waste of FIAS means the waste of state funds. Over the past three decades, SOEs have been implicitly considered as an important means of resolving Vietnam's unemployment issues. Many SOEs have been operating inefficiently, even in bad financial conditions, but they still exist and have been rescued because they could employ a large number of workers. Besides, many unskilled workers who are relatives of SOE managers have been recruited to work in SOEs, even though these SOEs have large labor forces and these enterprises do not need such workers. These are the reasons why SOEs are highly congested in total number of workers. In addition, SOEs are often in a good position to gain credit as they are guaranteed by the government, and hence creditors do not care much about the investment efficiency of the loans. This phenomenon could cause an increase in congestion in FIAS for SOEs.

6. Policy Implications

Findings from the empirical analysis show us that the pure technical efficiency of garment firms has been improving over time. This improvement is basically attributed to the significant amelioration of environmental conditions such as laws on enterprises and on investments, the business environment and so forth. Managerial competence in garment firms still remains weak as congestion in all three scales groups and in all types of ownership is really serious and there has been no improvement over the three years under consideration. The managerial incompetence of firms negatively impacts on firm performance. Additionally, an unskilled labor force is one factor with negative influence on congestion in inputs or in production of firms. Congestion, in turn, is a very important source of inefficiency of garment firms. Thus, improving effective congestion management is an extremely significant task that the government and business community should make their top priority. Concurrently, the government should continue to improve business environment for firm growth and development. Moreover, garment firms and the government should make appropriate policies and strategies in order to improve the skills of workers. Another point of significance is that the government should ensure the availability of factors of production such as skilled workers. In this regard, the authors recommend the following policies and options for development of firms in the garment industry.

- The government should create an enabling environment for establishing and developing qualified and effective systems of technical assistance, consultancy on firm management, and that of business development services to support the development of enterprises.
- The government should encourage stakeholders to effectively establish and strengthen co-operation and collaboration in training between enterprises and universities/research institutes, between enterprises and technical assistance centers for enterprises, especially for small and medium size enterprises, and consolidate existing vocational training systems in order to increase the supply of qualified labor in the labor market.
- The government should have and deploy effectively appropriate support programs and policies for small and medium firms in order to help them to improve managerial skills and knowledge of their managers, and working disciplines of workers.
- The government should establish and effectively run industrial zones in order to prevent the concentrations of garment firms in one or a few cities and/or provinces. Additionally, local and central governments should have appropriate policies and necessary allowances for workers and build necessary infrastructure such as parks, leisure centers, supermarkets, etc. around industrial zones to help workers keep their mind on their work, lessen their hardships of life and relax after hard working days.

7. Conclusions

Investigation of scale elasticity in production in the presence of congestion in inputs of garment firms has a great significance for improving productive efficiency, and thus the competitiveness of the firms and the industry, and for considerably increasing the national GDP of Vietnam. The findings of this paper will be important for the socio-economic development of Vietnam.

This study shows that although the average pure technical efficiency of garment industry has been improving during the periods studied before and after the laws on enterprises and investment were promulgated, it still remains low. A large amount of value added has been lost due to pure technical inefficiency that is attributed to environmental conditions, managerial competence, skills of workers and/or congestion in production. In regards to the problems of congestion, congestion in inputs of the firms is really serious in the garment industry by all scales and types of ownership. The improvement of pure technical efficiency, especially congestion management, should be given the top priority by firms and the government.

This study provides insights to firms as it shows a specific scope for increased productivity (*i.e.* DSD), sources and degrees of congestion, average percentage of possible reduction in total number of workers and/or total fixed assets, average percentage of possible improvement in total value added, congestion-induced total value added losses. All these will help firms to revise their future business plans and to make appropriate policies and strategies for improving their competitiveness. This study also provides insights to the government in order to make appropriate support polices for firm development, especially for specific scale groups of firms; to implement necessary structural adjustment for the industry by speeding up the equitization process of SOEs in order to effectively utilize and allocate the state budget. This study is significant for the country as a whole as it can help to save resources for other industries to increase the GDP.

It may be worth noting here that, in this paper, the term “scale economies” means “returns to scale” but not “economies of scale”. Thus, DSD bears the meaning of scale elasticity in production in the presence of congestion.

In this paper, the authors only consider the garment industry which has serious congestion; thus there is room to consider other industries of production in the economy. In doing so we could draw a comprehensive picture of congestion management in Vietnam. Based upon that, the government can have comprehensive solutions for firm development, and thus for economic growth and development in Vietnam.

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