

Chapter 1. Introduction

1.1. Background and relevance of the thesis

The garment industry is an important industry in Vietnam. Its importance presents on both output aspect and employment aspect. Despite the important role of the garment industry, we still have not enough studies about its productivity in general and total factor productivity (TFP) in particular. Researchers usually use simple indicators and methods to analyze efficiency and productivity problems of the field. A recent study by Thanh (2001) on efficiency analysis for the textile and garment industry applied a more sophisticated and well justified methodology, but still had many limitations, one of which was the use of cross-sectional data in 1998 only. This limitation led the author to study only technical efficiency in one year and so did not see the overall change in efficiency as well as firm-specific change. Also, Thanh (2001) did not study technical progress and in general about TFP change in the field.

This thesis aims to fill the gap in the field by studying TFP change of Vietnam's garment industry during the period 1997-2000. The main contributions of the research are expected to be: (i) Providing a system review about theories on total factor productivity, its concept, and measurement. This is a development of the technical efficiency concept in Thanh's (2001) thesis. (ii) Investigating patterns of total factor productivity change of Vietnam garment firms in 1997-2000. (iii) Providing some policy recommendations in order to help increase total factor productivity and output of garment industry.

1.2. Research questions

The thesis aims to answer the following questions:

- How have TFP of garment firms changed over the study period?

- What is the main source of TFP change in that period? Technical efficiency or technological progress?
- How do firms' characteristics affect TFP change and its components?
- How to improve TFP of Vietnamese garment firms?

1.3. Research methodology

The thesis uses both qualitative and quantitative methods. It firstly reviews theoretical issues related to TFP concept, TFP measurement and factors that may affect TFP growth. Secondly, the thesis will review the performance of the garment industry in Vietnam by using descriptive methods. Quantitative method is applied to measure the level of TFP change and the level of its components' change (technical efficiency change and technological progress). Finally, some policy recommendations are drawn from the empirical results.

1.4. Structure of the thesis

The main contents of the thesis is organized as follows:

- Chapter two presents the theoretical framework for analysis of TFP. Issues of definition, measurement and affecting factors are included in this chapter.
- Chapter three is an overview of Vietnam's garment industry from its history to its current performance and features.
- Chapter four is about the empirical results from the sample data estimation. In this chapter, the DEA method is used to estimate Malmquist TFP indexes. These results will be analyzed to find out the main source of TFP growth, affections of firms' characteristics on TFP change and its components.

- Chapter five will give some concluding remarks and policy recommendations as well as suggestions for further study.

Chapter 2. Theoretical Framework for Productivity Analysis

2.1. Concept of TFP and its components

Generally speaking, TFP can be understood as the productivity of all purchased inputs (Norsworthy and Jang, 1992), or the output per unit input. State in different way, “TFP is a measure of the efficiency with which all inputs are combined and utilized in the production of goods and services” (Nishimizu and Page, 1991).

In another paper, Nishimizu and Page (1982) decomposed TFP change into technological progress and changes in technical efficiency. The former is appropriate for TFP growth trends in the long term when there are diffusion of technology, exit of inefficient firms and improvement in the best technology. The latter is more appropriate for TFP change in the short term when firms use their resources better. We can think of the two components of TFP change as a shift in the production possibility frontier itself and a movement of firm closer to its frontier. Han, Kalirajan and Singh (2000) decomposed output growth as follows:

$$\begin{aligned}y_2 - y_1 &= (y_2^* - TE_2) - (y_1^* - TE_1) \\ &= (TE_1 - TE_2) + (y_2^* - y_1^*) \\ &= (TE_1 - TE_2) + (y_1^{**} - y_1^*) + (y_2^* - y_1^{**}) \\ &= (TE_1 - TE_2) + TC + \Delta y_x\end{aligned}\tag{1}$$

Where: $y_2 - y_1$ = Output growth

$(TE_1 - TE_2)$ = Technical efficiency change

TC = Technical progress

Δy_x = Output growth dues to input growth

That is to say, output growth can be explained by the change in technical efficiency of firm (how close to the frontier it is) plus the change in technology (shift of the frontier) and growth due to input growth. The first two terms constitute TFP growth.

2.2. TFP measurements

2.2.1. Divisia TFP index

Following Sadoulet and Janvry (1995), the Divisia input index is based either on cost shares or on input shares in total revenue. That is:

$$\dot{X} = \sum_j \frac{p_j x_j}{C} \dot{x}_j \quad \text{or} \quad \dot{X} = \sum_j \frac{p_j x_j}{\sum_k p_k q_k} \dot{x}_j$$

And the Divisia output index is:

$$\dot{Q} = \sum_i \frac{p_i q_i}{\sum_k p_k q_k} \dot{q}_i$$

Sadoulet and Janvry (1995) then come to the resulting Divisia TFP index:

$$TFP = \dot{Q} - \dot{X}$$

In the above equations:

p_j = Price of input j

x_j = Quantity of input j used

C = Total cost

p_k = Price of output k

q_k = Quantity of output k

The dot is used to express rate of change

2.2.2. Törnqvist TFP index

This index is an approximate formula of Divisia TFP index in case discrete data.

$$\Delta TFP = \sum \frac{1}{2}(r_{it} + r_{i,t-1})(\ln q_{it} + \ln q_{i,t-1}) - \sum \frac{1}{2}(s_{it} + s_{i,t-1})(\ln x_{it} + \ln x_{i,t-1})$$

Where: $r_{i,t}$ = Revenue share of output q_i in period t

$s_{j,t}$ = Ratio of the cost of input x_j to total revenue (or total cost) in period t .

2.2.3. Malmquist TFP index

According to Coelli (1998), the Malmquist index is defined using distance functions which allow one to describe a multi-input, multi-output production technology without the need to specify a behavioral objective (such as cost minimization or profit maximization).

The output distance function is defined as:

$$d_0(x,y) = \min \{ \delta : (y/\delta) \in P(x) \}$$

Where $P(x) = \{ y : x \text{ can produce } y \}$ is the output set which represents the set of all output vector y which can be produced using input vector x .

$d_0(x,y) \leq 1$ if $y \in P(x)$ and > 1 if y is located outside the feasible production set.

The (output-orientated) Malmquist TFP index is calculated as follow:

$$m_0(y_s, x_s, y_t, x_t) = \left[\frac{d_0^s(y_t, x_t)}{d_0^s(y_s, x_s)} \times \frac{d_0^t(y_t, x_t)}{d_0^t(y_s, x_s)} \right]^{1/2}$$

Where:

$m_0(y_s, x_s, y_t, x_t)$ = Malmquist TFP change index between period s (the base period) and period t.

$d_0^s(y_t, x_t)$ = Distance from the period t observation to the period s technology.

If m_0 is greater than one then we have a positive TFP growth from period s to period t while a value of m_0 less than one indicates a TFP decline.

An equivalent way of writing the above index is:

$$m_0(y_s, x_s, y_t, x_t) = \frac{d_0^t(y_t, x_t)}{d_0^s(y_s, x_s)} \left[\frac{d_0^s(y_t, x_t)}{d_0^t(y_t, x_t)} \times \frac{d_0^s(y_s, x_s)}{d_0^t(y_s, x_s)} \right]^{1/2}$$

In this formula, the ratio outside the square brackets is in fact the ratio of Farrel (1957) technical efficiency between period t and s. The remaining part measures technical progress and is equal to the geometric mean of the shift in technology between the two periods, evaluated at x_t and also at x_s .

2.3. Factors affecting productivity from the theoretical perspective

2.3.1. Firm's level factors

These factors include firm's size, firm's age, geographical location, ownership structure and market orientation. There are two points of view on firm size. One argues that small firms are more efficient since they are exposed to more competition. The other argues that large firms are more efficient due to economy of scale. Older firms are considered as more efficient since they are results of selection process. Geographical location affects firm's productivity in a sense that better infrastructure areas will help firms to raise productivity. Ownership type also has affections. Foreign companies are usually considered as more productive since they are better in

technology, skill workers and administration experience. Firms that export are also more productive since they face fiercer competition from international competitors.

2.3.2. Government policies and productivity

Government policies, especially trade policy, also have effects on firm's productivity. Open policies will help firms to raise its productivity since they must face international competition and can learn from foreign partners. Closed policies are worse in term of productivity than open policies.

Chapter 3. Overview of Vietnam's garment industry

3.1. History in brief and current trends of Vietnam's garment industry

Fabric weaving and clothes making are traditional works in Vietnam society, but up to the end of the 19th century, they were more to be handicrafts than industries. The history of Vietnam textile and garment (T&G) industry just began from the establishment of Namdinh textile complex in 1889. From this time forward, Vietnamese garment industry has experienced up and down periods through French colonial, wars against French and American, central planning and "opening" period.

Table 1. Main Indicators of Vietnam's garment industry in 1995-2000
(At constant 1994 prices)

	<i>Unit: %</i>					
	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>Prel. 2000</i>
Growth rate of garment	18.9	15.3	27.2	7.9	11.8	14.5
Garment/GDP	1.3	1.2	1.4	1.3	2.0	2.2
Garment/total industry	2.9	2.9	3.2	3.1	3.1	3.1
Garment/Manufacturing	3.5	3.6	4.0	3.9	3.9	3.8
T&G export growth rate	53.4	35.3	30.7	-3.5	20.5	8.3
T&G export/country export	15.6	15.8	16.4	15.5	15.1	13.2

Source: GSO (2001)

Since the beginning of the 1990s, Vietnamese government had realized the importance role of garment industry and so had launched many favorite policies as well as tried to find new markets for the industry. Thanks to

various efforts, garment industry has developed considerably (see table 1). Output and export growth rate were at high level. Large markets like EU, Japan, Canada and recently America have been initially penetrated.

3.2. Some important features of Vietnam's garment industry

As in other industries, there are three sectors in garment industry: state, non-state and foreign invested sector. The non-state sector still has very important role since Vietnamese consumers have habit of making clothes at local tailors besides buying ready-made clothes. Foreign invested sector is also quite important since it produced more than 1/5 out of total output of the whole industry.

Garment is considered as a labor-intensive industry. This is an important feature with a developing country like Vietnam. According to the "Enterprise census at 1st April 2001", garment created 14.5% of total jobs in manufacturing. It is also the industry that has highest share of female laborers. In this industry, state-owned enterprises have the largest labor size and followed by foreign invested enterprises.

Geographical distribution of garment firms shows that they concentrate mainly in the North and the South where there is better infrastructure and larger market than in the Centre. There is also difference between the North and the South about distribution of garment firms by type. State owned enterprises (SOEs) and collectives locate mainly in the North while private, mixed and especially foreign invested enterprises locate mainly in the South.

100% foreign invested enterprises are exporters while the figure for state owned enterprises is 84,4%. The others are more inward orientated.

Chapter 4. Empirical Results on Vietnam's garment industry

4.1. Methodology and data

4.1.1. Methodology

To investigate the productivity pattern of Vietnam's garment industry, a Malmquist TFP index will be used. Reasons are Malmquist index does not require all firms to be profit maximizing and can be decomposed into technical efficiency (TE) and technical progress (TP).

To estimate the Malmquist TFP index, the thesis used Data Envelopment Analysis (DEA). This is a non-parametric, linear programming method. The DEA method is chosen because: (i) DEA is a non-parametric method so we do not need to assume a functional form for the frontier function. This will avoid the risk of choosing a wrong functional form if SFA method is used. (ii) The estimation of SFA method may suffer from low degree of freedom due to small sample.

DEA is a method that considers line connecting data points of most efficient firms as production frontier of the industry. It then uses the linear programming method to estimate necessary distance to calculate Malmquist TFP index.

4.1.2. Database and variables

4.1.2.1. Data source

The primary data used to estimate TFP change indexes in this chapter are from the two "Vietnam Textile and Clothing Competitiveness surveys" conducted by the Institute of Economics. These two surveys occurred in

1999 and 2001 respectively. The sample sizes were 96 and 150 T&G firms. Data were collected for four years from 1997 to 2000.

Because the estimation of Malmquist TFP change index using the DEA method requires balanced panel data so it is necessary to have observations on firms over 4 year period. Selecting firms from primary data include 39 firms that meet the requirements. Totally, there were 156 observations over the four years.

Although in the original data set, firm characteristics were taken into account when stratifying the population to avoid biases in three dimensions of product profile (textile vs. garment), ownership form and geographical location, the data used in this thesis cannot be used to represent the whole industry. This is because not all the surveyed firms but only 39 repeated firms in the two surveys were considered. After DEA estimation, only garment firms were considered. This procedure will make the stratifying technique at the beginning of the surveys become meaningless. So the results in this thesis can only be considered as a case study for garment industry.

The thesis considered output as a function of intermediate inputs, labor input and capital input. Output is total revenue from firm's products. Intermediate input includes raw material, water, fuel and electricity. Capital is net value of equipment, machinery and buildings. Labor is cost for wage and salary.

4.2. Empirical results

Estimations of distance functions and indexes of TFP change, TE change and TP were done by using a computer program called DEA version 2.1. An index with value greater than 1 will indicate a progress while an index with value smaller than 1 will indicate a regress.

4.2.1. Total factor productivity change of garment firms

Over the period from 1997 to 2000, TFP of garment firms in the sample increased 20.7%, with annual growth rate of about 5% per year. Main contributor to this result was TP, which was estimated to increase 16.9% over the four years. Technical efficiency only changes slightly with total rate of about 3.2%.

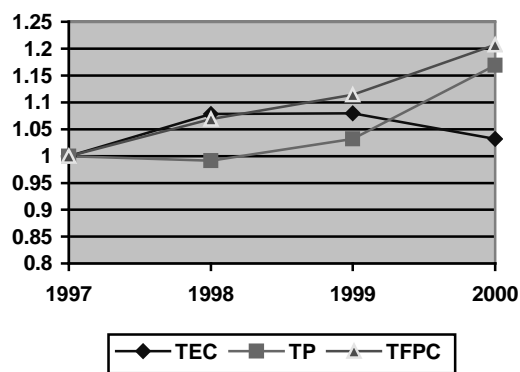


Figure 5. Cumulative Indexes of TE change, TP and TFP change of garment firms

Source: Based on author's calculation from sample data

4.2.2. Firm's characteristics and productivity

Regarding ownership structure, foreign invested enterprises have the highest TFP growth followed by SOEs and then non-SOEs. On average, over the four years, TFP of the first group increased 26.8%, of the second group increased 21.4% and of the last group increased 17%. The main contributor to TFP growth is technological progress.

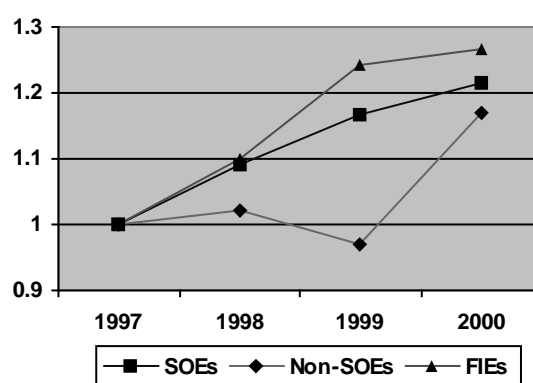


Figure 6. Cumulative index of TE change TP and TFP change of garment firms by ownership

Source: Based on author calculation

Geographical location also leads to some differences in TFP change. Firms in the North had higher rate of TFP change over the study period than firms in the South did (21.3% vs. 19.9%). However this performance of Northern firms seem to be not stable since TFP change of them depended too much on TE change while Southern firms depended more on TP.

Table 10. Cumulative Indexes of TE Change, TP and TFP Change by Geographical Location

Year	North			South		
	TEC	TP	TFP	TEC	TP	TFP
1997	1.000	1.000	1.000	1.000	1.000	1.000
1998	1.112	0.984	1.095	1.009	1.008	1.017
1999	1.148	1.005	1.153	0.952	1.088	1.036
2000	1.081	1.123	1.213	0.942	1.274	1.199

Source: Author's calculation based on the sample

Empirical results also show that outward-oriented firms (outward-oriented firms here are firms that had export share greater than the median of export

share of firms in each year) had rate of TFP change much greater than inward-orientated firms did. On average, over the four years, TFP of inward-orientated firms increased 2% but TFP of outward-orientated firms increased up to 31%. The main contributor to TFP change is still TP.

***Table 11.* Cumulative Indexes of TE Change, TP and TFP Change by Market Orientation**

Year	Inward			Outward		
	TEC	TP	TFP	TEC	TP	TFP
1997	1.000	1.000	1.000	1.000	1.000	1.000
1998	1.044	0.981	1.024	1.099	0.999	1.100
1999	1.083	0.938	1.015	1.085	1.077	1.169
2000	0.950	1.074	1.020	1.077	1.215	1.310

Source: Author's calculation bases on the sample

Firm size and productivity are also related. Firm size here is number of laborers that firm uses. The sample was divided into three quartiles. The first quartile includes 33% of the smallest firms while the third quartile includes 33% of the largest firms. The firms in these three quartiles can be named as small, medium and large enterprises for the first the second and the third quartile respectively. In the study period, small firms had the highest TFP growth rate (12.9%) followed by medium firms (7%) and then by large firms (5.2%). However these results seem to be not stable since they depended on when the period finished.

Table 12. Cumulative Indexes of TE Change, TP and TFP Change by Size Quartile

Year	Size quartile 1			Size quartile 2			Size quartile 3		
	TEC	TP	TFPC	TEC	TP	TFPC	TEC	TP	TFPC
1997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1998	1.074	1.018	1.093	1.103	0.989	1.091	1.055	0.970	1.023
1999	0.989	1.044	1.032	1.154	1.015	1.171	1.101	1.036	1.140
2000	0.974	1.158	1.129	0.969	1.104	1.070	0.927	1.135	1.052

Source: Author's calculation based on the sample

To investigate relationship between firm age and productivity, the sample was divided into two groups. One group contains all firms that have age in years smaller than the mean age of the sample. The other group contains all remaining firms, that is all firms with age greater than or equal to mean age. Empirical results show that, in this studied sample, elders firms had higher TFP growth rate in compare with the younger firms (36.6% vs. 12.5%). This is to show that experiences have strong effects on TFP growth.

Table 13. Cumulative Indexes of TE Change, TP and TFP Change by Age Quartile

Year	Age quartile 1			Age quartile 2		
	TEC	TP	TFPC	TEC	TP	TFPC
1997	1.000	1.000	1.000	1.000	1.000	1.000
1998	1.053	0.984	1.036	1.118	1.005	1.123
1999	1.015	1.039	1.054	1.208	1.014	1.224
2000	0.971	1.160	1.125	1.156	1.182	1.366

Source: Author's calculation bases on the sample

Chapter 5. Conclusions and Policy Recommendations

5.1. Some concluding remarks

TFP growth depends on two factors, technical efficiency and technological progress. Estimations of indices of technical change, technological progress and TFP change can be done by parameter or non-parameter methods. In this thesis, the non-parameter method has been used.

Empirical results estimated by DEA method show an increase in TFP of sample firms of about 20% during the studying period. Main contributor was technological progress. The thesis also investigated the relationships between firm characteristics and TFP. There were five firm features have been considered. They were ownership structure, geographical location, market orientation, firm size and firm age.

5.2. Policy recommendations

From the results of empirical study, some policy recommendations can be drawn.

- Government should launch policies that can encourage firms to invest in new technology since this is the basic for technological progress. TP is the main source of TFP growth.
- Firms should also fully exploit existing capacity, especially South-based, inward orientated and young firms.
- Government should have policies to attract more foreign investors. They will be leaders in TFP growth and then the spill effect will help other firms have higher TFP growth.

- Northern firms should invest more in technology if they want to have stable TFP growth.
- Government should make favor conditions in exporting procedures so that firms can export easily. Participation in foreign markets will improve TFP growth of garment firms.
- Government should support small and medium enterprises.

5.3. Suggestions for further study

- It is better if stochastic frontier production function method is also used to have a comparison.
- If there is a better data set which have more number of firms and time periods then the results are more reliable and more general.
- This thesis used net value of machinery and equipment and building as proxy for capital. If data permit one to use replacement cost then the replacement cost of capital should be used as proxy for capital.