
Total Factor Productivity Growth of Indian Fabrics Sector: A Firm level Analysis**Susobhan Maiti**

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Abstract

The present paper examined the extent of Total Factor Productivity Growth (TFPG) of Indian Fabrics Sector using firm level panel data over the period 1991-92 to 2015-16 in a single-output, multi-input model, inputs used are capital, labour, raw material and power & fuel, employing Data Envelopment approach. The paper also attempted to find out the determinants of TFPG of Indian Fabrics Sector, the possible determinants considered are Firm age, Market share, Employees' contribution and Export Intensity. The result suggests that TFPG of all the sample firms taken together varies across the years. Firm Age negatively and significantly affects TFPG whereas Market share affects TFPG positively. A U-shaped relationship is found between TFPG and Employees' contribution in Indian Fabrics Sector. The relationship between TFPG and Export Intensity is found to be of inverted U-shaped. An interesting result found is that there is positive and significant effect on TFPG due to dismantling of Multi-Fiber-Agreement.

Key words: Indian Fabrics Sector; Total Factor Productivity Growth, Data Envelopment Analysis, Multi-Fiber-Agreement

1. Introduction

Indian Fabrics Sector is an integral part of Indian Textile Industry and holds a very momentous position in the field of our economy. Unlike in weaving preparatory of the fabric where emphasis is on the quality of fabric but in the fabrics sector, productivity has significant importance along with quality of cloth produced. More importantly, a small increase in the productivity of the fabrics sector will result in considerable reduction in the manufacturing cost of cloth.

Some efforts have been taken to analyse Indian Fabrics Sector empirically. In this connection some names can be mentioned. Dikshit, Basa & Vagrecha (2015) measured the growth of production and export of Indian fabrics sector during the period 2001-02 to 2011-12 and concluded that export fabrics have increased substantially. Ahmad and Parrey (2013) discussed about the socio economic Potential, opportunities and challenges of fabrics Industry in Jammu and Kashmir. Tandon and Reddy (2013) investigated the scope and emerging trends of Indian fabrics sector and its contribution in the GDP. Kumar, Gupta et. al.(2012) measured the efficiency of Indian weaving industry using Data envelopment analysis for the period 2012 and 2013 and concluded that average technical efficiency score was increased from 0.90 to 0.96. Verma (2000) discussed

about the effect of dismantling of Multi-Fiber-Agreement on export of fabrics and found a positive effect of dismantling of MFA on export. Rao (1989) measured the productivity of Indian spinning and weaving industry separately and concluded that Indian spinning industry is more productive than weaving industry among others.

The literature review suggests that there is dearth in the study analyzing Total factor productivity growth (TFPG) of Indian Fabrics Sector. Also little attempt has been taken to analyse the different firms of Indian Fabrics Sector in terms of total factor productivity considering dismantling of Multi-Fiber-Agreement (MFA) which remove quotas on the amount of product developing countries could export to the developed countries. The paper adds to the literature in this direction and measures total factor productivity growth of Indian Fabrics Sector using firm level data employing Data Envelopment Method (DEA) approach. Side by side the major determinants of TFPG that can promote TFPG is attempted to be find out.

Thus the main objective of the paper is to find out Total factor Productivity growth of Indian Fabrics Sector as well as the factors affecting TFPG over time.

The rest of the paper is structured in the following manner:

Section 2 outlines the data source and the methodology of non-parametric approach of DEA to compute the Total factor Productivity growth of Indian Fabrics Sector as well as the methodology of panel regression to find out the determinants of TFPG. The results of estimation are reported in section 3. Section 4 concludes.

2. Methodology and Data source

This section presents the methodology and the data used in the analysis.

2. 1 Methodology

2.1.1 Measurement of Total factor Productivity growth (TFPG)

The present paper estimates TFPG of Indian Fabrics Sector using Data Envelopment Analysis Approach.

No explicit functional form of the production function is assumed in DEA. DEA lets one to construct the production possibility set empirically from the observed data according to Charnes, Cooper, and Rhodes (CCR) (1978) and further by Banker, Charnes and Cooper (BCC) (1984).

Consider, for simplicity, a single input - single output industry. Let m_n^t and o_n^t represent the input and output quantities of firm n at time t. The average productivity (AP) of this firm at time t is

$$AP_n^t = \frac{O_n^t}{m_n^t} \dots\dots\dots (1)$$

Thus, a productivity index (P) for this firm at time t+1, with period t treated as the base,

will be

$$P_{n(t+1)} = \frac{AP_n^{t+1}}{AP_n^t} = \frac{o_n^{t+1} / m_n^{t+1}}{o_n^t / m_n^t} \dots\dots\dots (2)$$

Which does not in any way depend on the assumptions about returns to scale.

A bench-mark technology is needed to identify the sources of productivity change, where returns to scale assumption becomes important.

The present study has used the BCC (1984) Model of DEA in a single-output, multi-input model, output being sales plus change in stock, inputs being capital, labour, raw material and power & fuel.

2.1. 2. Determinants of TFPG

A second-stage panel regression analysis has been done under a seemingly unrelated regression (SUR) framework using the estimated productivity values which may help to identify the factors that enhance or hinder productivity.

The possible determinants of Total factor Productivity growth (TFPG) of Indian Fabrics Sector considered are Firm age (FA), Market share (MS), Employees' contribution (EC) and Export Intensity (EXI).

Firm age is calculated as the difference between present year and establishment year of the firm. There exists a debate between market share and productivity of the firm in the existing literature. Some of the studies found positive relation between the two while some of the studies postulated a negative relation. The present study uses share of a firm's sales in total industry sales as a measure of market share.

Employees per unit of sales are used to capture the Employees contribution (EC).

Export intensity is taken as the ratio of Export to sales.

A dummy variable for capturing the effect of dismantling of MFA on TFPG has been taken. It takes value 0 for the year 1991-92 to 2004-05 (MFA period) and 1 for the year 2005-06 to 2015-16 (Post MFA period).

2. 2 Data Source

The firm level data for this study were drawn from the Centre for Monitoring Indian Economy (CMIE) database during the period 1991-92 to 2015-16. For the empirical analysis and estimation, data on sales value, raw material expenditure, salaries and wages, Power and Fuel expenditure at the firm level were collected.

Those firms are selected for which all the data of inputs and output and the determinants are available over the sample period. On the basis of this fact, 21 firms have been selected.

3. Results of Analysis

3.1. Results of Estimation of TFPG of Indian Fabrics Sector

After getting TFPG for all the firms over the sample period, mean TFPG is calculated for each year considering all the 21 firms together. It is observed that there is no distinct trend in the mean TFPG of the firms over the years. The result suggests that the TFPG values are fluctuating over these time periods. The minimum TFPG is in the year 2014-15 and maximum in 2005-06. The results are presented in Table 1.

Table 1: TFPG values of Indian Fabrics Sector

Year	Mean TFPG	Year	Mean TFPG
1991-92	2005-06	1.258
1992-93	0.95	2006-07	0.958
1993-94	1.08	2007-08	0.979
1994-95	0.921	2008-09	1.173
1995-96	0.992	2009-10	1.064
1996-97	1.004	2010-11	0.94
1997-98	1.072	2011-12	1.086
1998-99	1.238	2012-13	1.089
1999-00	1.013	2013-14	1.077
2000-01	1.011	2014-15	0.905
2001-02	1.018	2015-16	0.936
2002-03	1.172	MIN.	0.905
2003-04	1.007	MAX.	1.258
2004-05	1.016		

3.2. Determinants of TFPG of Indian Fabrics Sector

Using a panel set-up under a seemingly unrelated regression framework where each regression was adjusted for contemporaneous correlation (across units) and cross section heteroscedasticity, the determinants of TFPG of Indian Fabrics Sector is tried to be identified. The Fixed effect model is found to be the better one. The major possible determinants of TFPG of Indian Fabrics Sector considered are employees' contribution, Export intensity, Firm age and Market share. The results of the estimated panel regression are presented in Table 2.

The coefficient of age of the firm is found to be negative and significant which means that with increase in age of firm, the TFPG will decrease. The reason may be that older firms have a much less fresh work force and hence can reduce TFPG.

Market share is found to affect TFPG positively. Thus large firms appear to become relatively more productive than small firms may be due to economies of scale.

There exists a non linear relationship between TFPG and Employees' contribution in Indian Fabrics Sector in India i.e. a U-shaped relationship is found between the two. Thus initially TFPG decreases due to increase in Employees' contribution but after some

threshold limit TFPG increases with rise in Employees' contribution.

The relationship between TFPG and Export Intensity is also found to be nonlinear i.e. of inverted U-shaped. In other words it can be said that at first TFPG increases with increase in Export Intensity but after some point TFPG diminishes when Export Intensity is increased.

Another interesting result found is that after the dismantling of MFA, TFPG increased compared to the MFA period. Thus it can be said that the dismantling of MFA has a favourable effect on TFPG and promotes TFPG of Indian Fabrics Sector.

Table 2: Determinants of TFPG of Indian Fabrics Sector

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.250321	0.076795	16.28129	0
FA	-0.004813	0.001402	-3.433694	0
MS	0.441053	0.057236	7.70588	0
EC	-0.033	0.00423	-7.802083	0
EXI	0.526169	0.015851	33.19486	0
EC*EC	0.000361	5.07E-05	7.128706	0
EXI*EXI	-0.053728	0.001918	-28.01863	0
D1	0.087437	0.018087	4.834153	0
R-squared	0.73906	Adjusted R-squared	0.724259	
S.E. of regression	1.020372	Durbin-Watson stat	2.129983	
F-statistic	49.93236	Prob (F-statistic)	0	

4. Conclusion

The paper using the Data Envelopment Analysis approach examines the extent of Total factor productivity Growth (TFPG) of Indian Fabrics Sector using firm level panel data from 1991-92 to 2015-16 in a single-output, multi-input model, the inputs being capital, labour, raw material and power & fuel. The present paper also attempted to find out the determinants of TFPG. The main findings of the present paper can be summarized as follows. The mean Total factor Productivity Growth varies over the sample period and the major determinants of Total factor productivity Growth are found to be Firm age, Market share, Employees' contribution and Export Intensity. The relationship between age of the firm and TFPG is found to be negative whereas Market share affects TFPG positively. There is a nonlinear relationship between TFPG and Employees' contribution and TFPG and Export Intensity in Indian Fabrics Sector. Effect of dismantling of MFA is found to have a positive effect on TFPG.

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