EFFICIENCY OF TEXTILE MANUFACTURING FIRMS IN PAKISTAN: A STOCHASTIC FRONTIER PRODUCTION FUNCTION APPROACH

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Abstract

The permissible US safeguards against China's textile exports has been phase out on 01 January 2009. To accept challenges of quota free textile exports under the new economic globalization defined by the WTO regime, firm ability to export has become very important for their long-term survival and growth. This depends on firm capacity to remain internationally competitive. Productive efficiency is the key which will enable a firm to deliver products at lower costs. We want to determine the technical efficiency level of textile manufacturing firms in Pakistan during the year 2008-09. The data used is taken from the annual reports of 127 companies. A stochastic frontier production model is measured by the MLE. The LR test statistics revealed that translog production function with truncated normal distribution is appropriate for the data. The estimated value of γ shows that approximately 91.9% of the deviations in production of firms are because of difference in technical efficiency. The technical efficiency of the firms is between 42.7% and 97.8% with a mean 89.82%. This implies that in the short run on average production of the firms can be raised by at least 10.18% while utilizing existing resources and by using the best practiced (the most efficient) firm's procedures.

Key Words: Pakistan's textile manufacturing firms, technical efficiency, stochastic frontier production, cross sectional data.

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1. INTRODUCTION

The role of textile manufacturing sector is an extremely significant for developing countries. This sector generates value-adding activities which provide the largest number of reliable jobs to the workforce. It contributes to meet the domestics' needs for Textiles and clothing. Textiles exports have also the largest share in total merchandise exports in some developing countries such as Pakistan. The strong exports generally provide a base for economic growth. Throughout the world's history, textile industry and export have been thought a catalyst to economic development and growth. In the world trade, Textiles are the second most dynamic products, whose exports growth rate is 13 per cent per annum while the first most dynamic products are electrical and electronic goods, whose exports growth rate is 16 per cent per annum (UNCTAD, 2008, 9). The world demand for textiles is likely to increase in the near future. Also from a development perspective, the growth of textile sector is considered particularly important because historically, the process of industrialization of a number of economies started with trade in textiles and clothing which served as, ultimately, the engine for the growth of economic (UNCTAD, 2008, 10).

The exports of textiles and clothing are often the first major labor intensive manufactured export items from a developing country and growth of this sector leads the path for the transition from low income country to more rapid industrialized country. In parallel with other countries, it was the textile sector which provided a base in the early stage of industrialization in the UK, some parts of the North America, and East Asian countries (Adhikari & Weeratunge, 2006, 113). The textile industry also holds the key to the growth and expansion of the Pakistan's economy.

The Multi-Fiber Agreement (MFA) commenced in 1974 has been expired on 31 December, 2004. Developed countries abolished import quotas on textile products previously imposed by the MFA. Elimination of quota has opened intense competition in trade of textiles among the low cost producers. International trade theory demonstrates that trade is almost always beneficial. It is supposed that trade encourages and rewards efficient firms and discourages the inefficient firms, subsequently the country benefits from efficient firms. Now textile manufacturing firm's success rate depends on internal competences and performance by using the existing economic resources of the country efficiently than depends on protected trade policies.

The challenges of global environment defined by the WTO regime and quota free textile exports will require additional adjustments to cope with new situations. Pure economic performance and production efficiency will count more than ever before. Now if producers and suppliers are to survive, they will have to become more competitive and efficient. The competitiveness of a firm is the ability to compete with the best practiced firm. It is expected that textile manufacturing firms in Pakistan will use resources of production efficiently and move towards technologically efficient production frontier to reduce production cost and improve the quality of products to compete with the firms in the domestic and international textile market. In this study, our purpose is to evaluate the technical efficiency of Pakistan's textile manufacturing firms. It is not determined before by a stochastic frontier production model so this study will add in the literature on firm level efficiency.

The organization of the paper is as: we overviewed the Pakistan textile industry in section 2. In section 3, we discussed measurements of technical efficiency and data source. In section 4, we gave the details of estimated of the models, empirical results and also the ranking of Pakistan textile firms. In Section 5, we wrote the conclusion with policy implications. At the end, we quoted references.

2. OVER VIEW OF PAKISTAN TEXTILE INDUSTRY

The cotton and textile industry holds unique place in the Pakistan's economy. Pakistan is the fourth largest producer of cotton in the world and due to this abundant factor Pakistan has a comparative advantage over her competitors. Pakistan is also third largest consumer of cotton. The textile sector has also significance in Pakistan's economy because this is the second largest sector which provides a reliable to women (MEDI, 2007). The Pakistan's Textile sector has shown vital role in earning foreign exchange and job providing in the economy for over the last 50 years. It will continue to play a significant role in growth of the economy as there is no other sector that has the same potential to benefit the economy. (See Table 2)

Table 2 Significance of Textile Industry

	2006-07	2007-08	2008-09

% Share in Total Exports	62.1	54	53.8
% Share in Manufacturing	46	46	46
% Share in Employment	38	39	39
% Share in GDP	8.5	8.5	
Textile Exports	$ 6.6 billion	$ 7.8 billion	8.5
			$7.2 billion

Source: Adapted from various issues of Pakistan, Economic Survey

Textile sector of Pakistan maintained its position and has shown its strength in world textile market even in quota free scenario. Exports textiles of Pakistan have also increased from 2005 to 2007 and have decreased in 2008 due to financial and economic crises in the whole world. In the overall exports of Pakistan, share of Textile exports items have been decreased (66 percent in 2004) and it is 53.8 percent of total exports. (See Table 3)

Table 3 Percentage Share of Textiles Exports in total Exports of Pakistan

Commodities ↓	**02-03**	**03-04**	**04-05**	**05-06**	**06-07**	**07-08**	**08-09**
Cotton Manufactures	63.3	62.3	57.4	59.4	59.7	51.9	52.2
Synthetic Textiles	5.1	3.8	2.1	1.2	2.5	2.1	1.6

Source: Government of Pakistan, Economic Survey 2009-10, 13

The Textile Industry in Pakistan has not shown full ability to take all the advantage of quota free regime as China, India and Bangladesh have shown by virtue of their competitiveness. (Economic Survey 2008-09, 42)

3. Measurement of Technical Efficiency

There are different methods and techniques to determine the technical efficiency on the firm level. In this study, we made an attempt to analyze the technical efficiency of the textile manufacturing firms of Pakistan by specifying and estimating a stochastic frontier production model which is a parametric approach. Technical efficiency is regarded as the ability of a firm to maximize production or minimize inputs. Theoretically, for a given level of production, technical efficiency level is the distance of a specific firm from the potential frontier. Therefore if a firm adopts the "best practice" frontier it is referred as technically efficient.

This concept has particular significance for manufacturing firms as their profit depends on their level of technical efficiency. For example, those firms which have the same technologies and input quantities will have different levels of production due to different levels of technical efficiency. This will generate a larger profit for the more efficient firm although all have the same cost of input quantities.

Aigner, Lovell and Schmidt (1977) and Meeusen and Broeck (1977) were the first to propose the stochastic frontier production model with composite error term, independently, in order to evaluate technical efficiency. The original model of a production function is specified for cross-sectional data. The general statistical model of stochastic production frontier is as follows:

$$Y_i = X_i\,\beta + \varepsilon_i \quad \text{and} \quad \varepsilon_i = v_i - u_i \quad (i=1, 2, 3 \ldots.\ N)$$

Where

Y_i is the logarithm of the production of the ith firm;

X_i are the input quantities of ith firm,

β is a vector of parameter of input variables,

N is the sample size and ε_i is a “composed” stochastic term of two components, namely v_i and u_i. The v_i is a two-sided ($-\infty<v_i<\infty$) normally distributed random error ($v_i \sim N\,[0, \sigma_v^2]$) that is for random effects on production due to external factors and they are outside the control of the firm (e.g. climate, natural disasters, risk, luck and measurement error) while the u_i , which is a firm specific and is one-sided ($u_i \geq 0$), measures deviation from the best practiced frontier due to internal factors. It represents technical inefficiency effects which are behavior factors and can be controlled by a firm. It reflects the managerial capability. Here we assume that u_i can have a half-normal distribution ($u_i \sim |N\,[0, \sigma_u^2]|$) or truncated normal distribution (ui ~ |N [μ, σu2]|) and ui is distributed independent of vi.

The technical efficiency of a specific firm is predicted from estimated stochastic production frontier as:

$$TEi = E\,(Qi^*|\ ui, Xi)/\ E\,(Qi^*|\ ui=0, Xi)$$

Where Qi* denotes the production of the ith firm and is equal to exp (Qi) as the frontier production function is defined for the logarithm of production (See Battese and Coelii, 1988) and technical efficiency (TE) is defined as:

$$TEi = \exp\,(-ui)$$

Technical efficiency may have a value between zero and one. It is equal to one only if the firm shows zero inefficiency effect and the technical inefficiency (u_i) takes the value zero on the production frontier and greater than zero below the frontier.

SOURSE OF DATA

Availability of necessary and the relevant data notably in economics is crux of the problem. The textile manufacturing firms are more challenging for data limitations. In this study, we have made an attempt to obtain a consistent dataset. The information are collected from firm level secondary data which is drawn from the annual reports of textile manufacturing publicly listed companies in stock exchanges. We use cross-sectional data for the year 2008-2009 to examine the firm-level efficiency. we could not find Information's about employees from all firms reports, thus in the empirical model we use all inputs in terms of rupees, i.e., we use wages, salaries and other benefits of labours instead of the total number of employees (Battese and Corra (1977), Jayatilake (2006) used labor cost and Singh et al (2007) also employed wages and salaries). This controls heterogeneity problem in labour quality across firms.[2] Although this is not a perfect measure but the proxy till the time when published total number of labourers on textile manufacturing firms' employees are available.

4. **Estimation of the Model and Empirical Results**

We examine the Cobb-Douglas as well as Translog production functions with the half-normal and truncated normal distributions for Pakistan textile manufacturing firms and selected the preferred specification functional form performing the generalized likelihood ratio tests. Maximum Likelihood estimation (MLE) technique is applied to obtain consistent parameters estimates and efficiency scores of stochastic frontier production function by using the FRONTIER 4.1, a computer program, written by Coelli (1996). The likelihood function is parameterized in terms of $\sigma^2 = \sigma_u^2 + \sigma_v^2$ and $\gamma = \sigma_u^2/\sigma^2$. The parameter γ may have the value between 0 and 1, which measures the deviations from the best practiced frontier because of technical inefficiency. When $\gamma = 0$, it shows that all production deviations are because of stochastic term only. If $\gamma = 1$, it indicates that all deviations from the best practiced frontier are

[2]See Feldstein (1967) for the problem produced by the employing of labour hours as input for employees in estimation of production functions.

because of inefficiency effects. The parameter estimates are shown in Table 6 and Table 8 along with their standard errors and t-values.

A Translog Stochastic Production Frontier model is:

$$Ln\ P_i = \beta_0 + \beta_1\ Ln\ C_i + \beta_2\ Ln\ M_i + \beta_3\ Ln\ E_i + \beta_4 Ln\ W_i + 1/2\beta_5\ Ln\ C_i^2 + 1/2\beta_6\ Ln\ M_i^2 + 1/2\beta_7\ Ln\ E_i^2 + 1/2\beta_8\ Ln\ W_i^2 + \beta_9\ Ln\ C_i\ Ln\ M_i + \beta_{10}\ Ln\ C_i\ Ln\ E_i + \beta_{11}\ Ln\ C_i\ Ln\ W_i + \beta_{12}\ Ln\ M_i\ Ln\ E_i + \beta_{13}\ Ln\ M_i\ Ln\ W_i + \beta_{14}\ Ln\ E_i\ Ln\ W_i + V_i - U_i \quad .... (1)$$

A standard log-linear Cobb-Douglas Stochastic Production Frontier model is:

$$Ln\ P_i = \beta_0 + \beta_1\ Ln\ C_i + \beta_2\ Ln\ M_i + \beta_3\ Ln\ E_i + \beta_4\ Ln\ W_i + V_i - U_i \quad ....(2)$$

Where, Subscript i denotes 1, 2, 3, ….., 127

Ln = Natural logarithms

β_0 = Intercept/ constant

β_1 = Parameters of variables, Subscript i denotes 1, 2, 3,… ,14

P = Production of the firm= Net Sale + Change in finished goods + Change in work in process – Purchase for resale

C = the value of Operating fixed assets of the firm

M = total expenditures spent on [Raw material + Stores and spare + Packing material + Chemical] consumed + Processing and stitching charges

E = total expenditures spent on Fuel and power and water charges

W = total expenditure on Salaries, wages and other benefits

V = Random error

U = Technical inefficiency

Table 5 Descriptive Statistics of Variable Used in Estimation

(Rs. Thousands)

Variable	Minimum	Maximum	Mean	Standard Deviation
P	51,564	24,201,868	2,912,911	3764551.815
C	851	11,102,355	1,533,110	1949871.645
M	17,042	16,617,553	1,993,642	2484795.615

E	4,958	2,149,417	237,328	308847.0601
W	2,068	1,730,455	188,057	265746.4093

No. of observations/firms = 127

We employ generalized likelihood ratio (LR) tests which are suggested by Battese and Coelli (1995) for selecting the best functional form and specification of the production function for a given data set. The relevant test statistic is defined by

$$LR= -2[Ln (L_0) – Ln (L_1)]$$

Where, (L_0) is the likelihood of the restricted model, in which the parameter restrictions are specified by the null hypothesis, (L_1) is the likelihood for the unrestricted model. The null hypothesis is accepted if LR is less than $\chi^2_{C.}$

The translog production function changes into Cobb-Douglas production function when the coefficients of the squared and interaction terms of input variables are supposed equal to zero. We estimated the Cobb-Douglas and translog stochastic frontier production functions with half normal and truncated normal distribution. (Here we have given the results of Cobb-Douglas and translog production functions with truncated normal distribution only). We have also given here the results of Cobb-Douglas model as its coefficients directly show the elasticity of production.

Here (See Table 6) all variables have expected sign and are significant at 5 % level of significance except C (Operating fixed asset), which is significant at 10 % level of significance. This is an indication of low usage of operating fixed asset. Further M (material consumed) has maximum elasticity of production i.e. 0.730 than other inputs and it implied that one unit change in the material consumed will result in 0.730 unit change in the total textile production, keeping other factors constant at their mean level. And E (fuel and power) has the second maximum elasticity of production i.e. 0.127 (this support /validate the neo classical theory which stress that energy is also the factor of production) that shows for every one unit change in the fuel and power, production will change by 0.127 unit, keeping other factors constant at their mean level.

Table 6 The final MLE estimates for Cobb-Douglas (Truncated Normal)

Variables	**Parameter**	**Parameter Estimates**	**Standard-errors**	**t-ratios**
Intercept	β_0	0.91221924	0.18897405	4.8272197*
C	β_1	0.04051696	0.024394410	1.6609118**

M	β_2	0.73055035	0.032265769	22.641653*
E	β_3	0.12731984	0.030093580	4.2307975*
W	β_4	0.10795733	0.038147359	2.8300079*
Variance	σ^2	0.11028149	0.031331307	3.5198498*
Gamma	γ	0.81525791	0.083841797	9.7237647*
Mean	μ	-0.59969279	0. 22094152	-2.7142603*

Eta (η) is zero, Log likelihood function = 39.013214

No. of observations/firms = 127, Mean efficiency = 0.90202058

Note: * t-ratios are at 5 % and ** t-ratios are at 10 % level of significance

The estimated value of γ indicates that approximately 81.53% of the random variations in firms' production are due to difference in technical inefficiency. As observed in the above results, all the input elasticity are inelastic; a one percent increase in each input results in a less than one percent increase in production. The sum of coefficients is 1.0063; it reveals that the textile manufacturing firms have achieved constant returns to scale which is the main objective of a firm. So the textile manufacturing firms are being scale efficient.

We applied various null hypotheses about the stochastic frontier production function models and selected the preferred model for this study by using likelihood ratio tests (See Table 7).

Table 7 Log-Likelihood Ratio Tests of Hypothesis for Parameters

Assumptions	Null Hypothesis	Log-likelihood	Test Statistics	Critical Value	Decision
Cobb-Douglas (Half-normal)	$H_{0:}\ \beta_i=0$ i=5,6,7...14 $H_{0:}\ \mu=0$	36.68	4.66	3.84	Reject H_0
Cobb-Douglas (Truncated)	$H_{0:}\ \beta_i=0$ i=5,6,7….14	39.01	68.92	19.82	Reject H_0
Translog (Half-normal)	$H_{0:}\ \mu=0$	69.66	7.62	3.84	Reject H_0
T. inefficiency effect is not stochastic	H_0: $\gamma = 0$	73.47	18.30	3.84	Reject H_0

Source: Calculation of likelihood values are based on the Frontier 4.1 program.

Note: All critical values are at 5 % level of significance

To test the null hypotheses on the maximum likelihood estimates, the test statistics have an asymptotical mixed chi-square distribution. Therefore we have taken the critical values of the mixed chi-square distribution from Kodde and Palm (1986) Table 1 on page 1246.

We tested the null hypothesis of translog stochastic production frontier model against the Cobb-Douglas model and the null hypothesis of the technical inefficiency with half-normal distribution against the alternative general truncated normal distribution for the present dataset. The general truncated normal distribution changes into half-normal distribution, when the restriction $H_{0:}$ $\mu = 0$ is employed.

The null hypothesis H_0: $\gamma = 0$ specifies that the textile manufacturing firms are fully technically efficient in stochastic production frontier model. This implies that σ_U^2 is zero. Therefore U_i is zero; therefore we can consistently determine the parameters of the specified model by employing ordinary least square.

Table 8 Final MLE estimates of Translog (Truncated Normal) SFP MODEL

Variable	Parameter	Parameter Estimate	Standard-error	t-ratio
Intercept	β_0	1.4155148	0.99594906	1.4212723**
C	β_1	0.21278112	0.19560194	1.0878273
M	β_2	0.37024066	0.27475403	1.3475350**
E	β_3	-0.044728579	0.25203220	-0.17747169
W	β_4	0.40149804	0.34832339	1.1526588
C^2	β_5	-0.038187133	0.013652867	-2.7970046*
M^2	β_6	0.090012282	0.029514045	3.0498118*
E^2	β_7	0.081368208	0.025141203	3.2364485*
W^2	β_8	0.021071952	0.044525024	0.47326088
CxM	β_9	-0.0030209315	0.034536066	-0.087471789
CxE	β_{10}	0.088916221	0.039365322	2.2587449*
CxW	β_{11}	-0.018327008	0.037599015	-0.48743320
MxE	β_{12}	-0.17896631	0.051026352	-3.5073311*
MxW	β_{13}	0.0071607310	0.054072619	0.13242804
ExW	β_{14}	-0.046198153	0.057535591	-0.80294914
Variance	σ^2	0.10544376	0.027841451	3.7872940*
Gamma	γ	0.91867884	0.026344483	34.871773*

Mean	μ	-0.62247554	0.19929028	-3.1234616*

eta (η) is zero, Log likelihood function = 73.465507

No. of observations/firms = 127, Mean efficiency = 0.89821626

Note: * t-ratios are at 5 % and ** t-ratios are at 10 % level of significance

The LR test reveals that the null hypothesis that there are no technical inefficiency effects in textile production is rejected. Therefore technical inefficiency exists in our data set. We found, by employing the test statistics that the translog stochastic frontier production function with truncated normal distribution is an appropriate form for present data set.

Although (See Table 8) some of the parameter estimates turned out to be non-significant, the generalized likelihood ratio test carried out rejected the Cobb Douglas production function as an appropriate model for given the data. Also the parameter estimates of translog production function do not convey any direct economic meaning as Kalirjan & Tse (1989) have put it. However the coefficient of E (fuel and energy) has negative sign and statistically is not significant have problem to explain. But the estimated sigma square (σ^2) is 0.105 which is significantly different from zero. This indicates an adequate fit of the model and an appropriate specification of distributional assumption. Gamma (γ) is also positive and significant so our model is an adequate for estimating T.E. score for individual firm.

We see that the estimated value of γ is 0.919 approximately; it reveals that the variations in firms' production, due to difference in technical efficiency, are 91.9%. Mean technical efficiency score is 0.898. It shows that on average the firm, if it has comparable inputs, is obtaining 89.8 percent of the production that is possible for a best practiced firm.

The firm-specific efficiencies estimated by translog stochastic frontier production function with truncated normal distributions are shown in Table 10 and frequency distribution of the same is shown in Table 9. It is found that technical efficiencies (T.E.) ranged from 42.69 per cent to 97.81 per cent. Frequency distribution of technical efficiency for individual firms indicates that maximum number of firms (60 out of 127) have T.E. score in interval 0.90 to 0.95 while 8 firms have T.E. score in intervals less than 0.80.

Table 9 Frequency Distribution of Technical Efficiency for Individual Firms

T.E Interval[b].	Frequency
.400-.599	1

.600-.649	1
.650-.699	1
.700-.749	3
.750-.799	2
.800-.849	11
.850-.899	25
.900-.949	60
.950-.999	23
Min.	0.427
Max.	0.978
Average	0.898

No. of observations/firms = 127

[b.] T.E. near to one shows higher level of technical efficiency

Table 10 Ranking of Pakistan's Textile Firms/Companies

Rank	**Firm's Name**	**T.E.**	Rank	**Firm's Name**	**T.E.**
1	Towellers Ltd.	0.9781	65	Rupali Polyester Ltd.	0.9173
2	J.A. Textile Mills Ltd.	0.9750	66	Glamour Textile Mills Ltd.	0.9145
3	Ishaq Weaving Mills Ltd.	0.9698	67	Saritow Spinning Mills Ltd.	0.9136
4	Safa Textiles Ltd.	0.9670	68	Indus Dying & Manufacturing Co. Ltd.	0.9132
5	Artistic Denim Mills Ltd.	0.9619	69	Sapphire Textile Mills Ltd.	0.9124
6	Zephyr Textile Ltd.	0.9592	70	Dewan Mushtaq Textile Mills Ltd.	0.9122
7	Hala Enterprises Ltd.	0.9588	71	Kohinoor Textile Mills Ltd.	0.9106
8	Ishaq Textile Mills Ltd.	0.9588	72	Samin Textile Ltd.	0.9091
9	N.P. Spinning Mills Ltd.	0.9579	73	Island Textile Mills Ltd.	0.9079
10	Idrees Textile Mills Ltd.	0.9570	74	Ibrahim Fibres Ltd.	0.9066
11	Sadaqat Ltd.	0.9543	75	Fazal Textile Mills Ltd.	0.9066
12	Jubilee Spinning & Weaving Mills Ltd.	0.9537	76	Azam Textile Mills Ltd.	0.9057
13	Husein Industries Ltd.	0.9530	77	Crescent Fibres	0.9056
14	Nakshbandi Industries	0.9525	78	D. S. Industries Ltd.	0.9054

	Ltd.				
15	Chenab Ltd.	0.9524	79	Shahzad Textile Mills Ltd.	0.9011
16	Tata Textile Mills Ltd.	0.9524	80	Garton(Industries) Ltd.	0.9005
17	Al-Abid Silk Mills Ltd.	0.9520	81	Quetta Textile Mills Ltd.	0.9000
18	Sajjad Textile Mills Ltd.	0.9508	82	Allahwasaya Textile & Finishing Mills Ltd.	0.8996
19	Zahid Jee Tex. Mill Ltd.	0.9507	83	Sana Industries Ltd.	0.8996
20	Sitara Textile Industriese Ltd.	0.9505	84	Fateh Textile Mills Ltd.	0.8995
21	Reliance Cotton Spinning Mills Ltd.	0.9503	85	Premium Textile Mills Ltd.	0.8977
22	Liberty Mills Ltd.	0.9501	86	Ghazi Fabric Industries Ltd.	0.8973
23	Mubarak Textile Mills Ltd.	0.9496	87	Nagina Cotton Mills Ltd.	0.8954
24	Blessed Textile Ltd.	0.9490	88	Shaheen Cotton Mills Ltd.	0.8946
25	Globe Textile Mills(OE) Ltd.	0.9483	89	Chakwal Spinning Mills Ltd.	0.8939
26	Hira Textile Mills Ltd.	0.9480	90	Gadoon Textile Mills Ltd.	0.8936
27	The Crescent Textile Mills Ltd.	0.9455	91	Kohinoor Spinning Mills Ltd.	0.8908
28	Gulistan Spinning Mills Ltd.	0.9447	92	Dar Es Salaam Textile Mills Ltd.	0.8904
29	Ahamad Hassan Textile Mills Ltd.	0.9442	93	Saif Textile Mills Ltd.	0.8883
30	J.K. Spinning Mills Ltd.	0.9431	94	Ayesha Textile Mills Ltd.	0.8879
31	Faisal Spinning Mills Ltd.	0.9412	95	Ali Asghar Textile Mills Ltd.	0.8861
32	Ellcot Spinning Mills Ltd.	0.9407	96	Ideal Spinning Mills Ltd.	0.8854
33	Colony Thal Textile Mills Ltd.	0.9403	97	Regent Textile Industries Ltd.	0.8837
34	The National Silk And Rayon Mills Ltd.	0.9402	98	Nishat(chunian) Ltd.	0.8816
35	Shah Taj Textile Ltd.	0.9386	99	Bilal Fibres	0.8816
36	Mahmood Textile Mills Ltd.	0.9369	100	Sally Textile Mills Ltd.	0.8802
37	Sapphire Fibres Ltd.	0.9360	101	Sargodha Spinning Mills Ltd.	0.8757

38	Fazal Cloth Mills Ltd.	0.9358	102	Khalid Siraj Textile Mills Ltd.	0.8698
39	Ashfaq Textile Mills Ltd.	0.9343	103	Ishtiaq Textile Mills Ltd.	0.8696
40	Nadeem Textile Mills Ltd.	0.9336	104	Shadman Cotton Mills Ltd.	0.8682
41	Prosperity Weaving Mills Ltd.	0.9319	105	Service Industries Textile Ltd.	0.8645
42	Bhanero Textile Mills Ltd.	0.9311	106	Texila Cotton Mills Ltd.	0.8547
43	Gul Ahmad Textile Mills Ltd.	0.9307	107	Kohinoor Mills Ltd.	0.8534
44	Hussain Textile Mills Ltd.	0.9306	108	Shams Textile Mills Ltd.	0.8508
45	Colony Mills Ltd.	0.9305	109	Din Textile Mills Ltd.	0.8447
46	Dawood Lawrence Pur Ltd.	0.9303	110	Asim Textile Mills Ltd.	0.8440
47	Relaince Weaving Mills Ltd.	0.9275	111	Olympia Textile Mills Ltd.	0.8423
48	Reliance Weaving Mills Ltd.	0.9274	112	Hajara Textile Mills Ltd.	0.8394
49	Masood Textile Mills Ltd.	0.9272	113	Ravi Textile Mills Ltd.	0.8391
50	Sunrays Textile Mills Ltd.	0.9263	114	Aruj Garment Accessories Ltd.	0.8370
51	Haji Mohammad Ismail Spinning Mills Ltd.	0.9262	115	Dewan Khalid textile Mills Ltd.	0.8336
52	Quality Textile Mills Ltd.	0.9261	116	Khurshid Spinning Mills Ltd.	0.8179
53	Ruby Textile Mills Ltd.	0.9244	117	Hamid Textile Mills Ltd.	0.8174
54	Dewan Farooque Spinning Mills Ltd.	0.9230	118	Elahi Cotton Mills Ltd.	0.8095
55	Yousaf Weaving Mills Ltd.	0.9222	119	Olymia Spinning and Weaving Mills Ltd.	0.8071
56	Salfi Textile Mills Ltd.	0.9221	120	Ishaq Spinning Mills Ltd.	0.7772
57	Maqbool Textile Mills Ltd.	0.9216	121	Dewan Textiles Mills Ltd.	0.7707
58	Resham Textile Industries Ltd.	0.9215	122	Shadab Textile Mills Ltd.	0.7430

59	Suraj Cotton Mills Ltd.	0.9202	123	Fatima Enterprises Ltd.	0.7104
60	Mehr Dastgir Textile Mills Ltd.	0.9199	124	Kohat Textile Mills Ltd.	0.7068
61	Mian Textile Industries Ltd.	0.9195	125	Mohammad Farooq Textile Mills Ltd.	0.6872
62	ICC Textiles Ltd.	0.9194	126	Apollo Textile Mills Ltd.	0.6289
63	Nishat Mills Ltd.	0.9193	127	Dewan Salman Fibre Ltd.	0.4269
64	D.M. Textile Mills Ltd.	0.9189			

Mean Technical Efficiency (T.E.) = 0.898

5. Conclusions with Policy Implications:

We have determined the technical efficiency levels of Pakistan's textile manufacturing firms during the year 2008-09. The cross-sectional data used is taken from the annual reports of 127 companies. The stochastic frontier production function is measured by the MLE technique. The important findings are: (i) according to Cobb-Douglas (truncated normal) Stochastic Production Frontier Model estimates, M (material consumed) has maximum elasticity of production (i.e. 0.729) than other inputs. This implies that material consumed input is playing a major role in textiles production. The second important input is E (fuel and power) which has elasticity of production 0.137 which support the neo classical theory. (ii) The generalized likelihood-ratio test statistics show that translog production function with normal truncated normal distribution is appropriate for our data set. The estimated value of γ indicates that approximately 91.9% of the variations in firms' production are due to difference in technical efficiency. The level of technical efficiency of Pakistan's textile manufacturing firms is ranged from 42.7% to 97.8% with a mean 89.82%. It indicates that the textile manufacturing firms of Pakistan are not achieving 100 percent of potential production. This implies that in textile manufacturing firms of Pakistan there is potential to increase production if available resources are used more efficiently. Therefore, on average, in the short run, production of the firms can be increased by at least 10.18% by employing the most efficient methods and procedures.

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