www.irmbrjournal.com
International Review of Management and Business Research
September 2014
Vol. 3 Issue.3

Performance of Textile Sector of Pakistan: Application of Data Envelopment Analysis Approach

MUHAMMAD USMAN
Assistant Professor, Department of Management Sciences, University of Gujrat, Pakistan.
Email: drusman@uog.edu.pk

ALI HASSAN
MS Scholar, Department of Management Sciences, University of Gujrat, Pakistan.
Email: 10012720-046@uog.edu.pk

FAIQ MAHMOOD
Assistant Professor, Department of Business Administration, GIFT University, Gujranwala, Pakistan.
Email: faiq4_u@hotmail.com

HUMERA SHAHID
Assistant Professor, Hailey College of Banking & Finance, University of the Punjab, Pakistan.
Email: humera-shahid@hotmail.com

Abstract

This study aims to measure the performance and exploring the firm-specific factors which have impact on the performance of textile firms of Pakistan. The unbalanced penal data of 100 textile firms for the period of 2006 to 2011 has been used. Data envelopment analysis is employed to measure technical efficiency scores under constant as well as variable return to scale assumptions. The mean values of technical efficiency scores have been 0.82 and 0.86 under constant return and variable return to scale respectively, revealed that textile sector of Pakistan is near to efficient. Moreover, it is operated under decreasing return to scale and the existence of inefficiency is due to scale efficiency. Generalized least square estimation technique has been used to check the impact of firm specific factors on performance. Firm age, market share and sales growth have significant positive while firm size, export participation and financial leverage revealed significant negative impact on performance of textile sector of Pakistan.

Key Words: *Performance, Textile Sector, Data Envelopment Analysis, Technical Efficiency, Scale Efficiency.*

Introduction

Performance means the completion of tasks within given level of accuracy, cost and time. According to Richard et al. (2009) performance at organizational level includes achievement of end results (organizational goals). It is widely used dependent variable by many researchers in past. March and Sutton (1997) observed that 23% of research papers published in Strategic management journal, academy of management journal an administrative science, used performance as dependent variable in last three years. Performance can be measured by different ways for instance financial ratios, market share, growth, exports, product, employment and efficiency analysis. Mostly, researchers have measured business performance through financial variables but it should be measured through productivity and efficiency analysis (Kalirajan and Shand, 1999).

According to Fried et al (2008), financial variables are influenced by variations in prices of input and output and also by the productivity and efficiency. This study will also measure the performance of textile sector through technical efficiency. Technical efficiency refers the ability of any firm to generate maximum output within given level of input and technology (Coelli et al., 2005). It is considered in relative terms as production abilities of firm are compared with the best practices of input-output combinations (Alauddin et al., 1993).

Manufacturing sector is the 3rd largest sector of Pakistan and contribute in GDP at large extent (Credit Rating Company Limited, 2010).There are more than 13 sub sectors that are collectively known as large manufacturing sector and among these sectors textile is one of the largest subsector. According to the Federal Bureau of Statistics (2010), the growth rate of textile sector was -0.70 % in 2009 and -1.78% in 2010. The ruthless conditions of textile sector require to analyse the current condition of this sector and also to take necessary steps for its betterment. Textile sector is the back bone of Pakistan's Economy. Pakistan's textile sector has been the 8th largest exporter of textile products and 4th largest manufacturer of cotton in Asia. Its contribution towards GDP is 9.5% and providing employment to more than 15 million workforce of Pakistan. This sector significantly contributes in real GDP that's why it is necessary to analyse its performance and efficiency.

Research Oobjectives

The basic objective of this study is to measure the efficiency of listed textile firms of Pakistan, for the period of 2006 to 2011. There are following specific objectives of this study.

i. To measure the performance of listed textile firms of Pakistan.
ii. To identify factors which haveaffect on the performance of listed textile sector of Pakistan;
iii. To suggest valuable and facts based recommendation for the improvement of the performance of the listed textile firms of Pakistan.

Hypotheses

According the above mentioned objectives, six hypotheses have been developed for this study by reviewing the different studies on performance and firm specific factors.

H_o= There is no relationship between firm size and performance of textile sector of Pakistan.
H_1 = There is relationship between firm size and performance of textile sector of Pakistan.
H_o= There is no relationship between firm age and performance of textile sector of Pakistan.
H_2 = There is relationship between firm age and performance of textile sector of Pakistan.
H_o= There is no relationship between market share and performance of textile sector of Pakistan.
H_3 = There is relationship between market share and performance of textile sector of Pakistan.
H_o= There is no relationship between leverage (financial constraints) and performance of textile sector of Pakistan.
H_4 = There is relationship between leverage (financial constraints) and performance of textile sector of Pakistan.
H_o= There is no relationship between sales growth and performance of textile sector of Pakistan.
H_5 = There is relationship between sales growth and performance of textile sector of Pakistan.
H_o= There is no relationship between export participation and performance of textile sector of Pakistan.
H_6 = There is relationship between export participation and performance of textile sector of Pakistan.

Significance

It is the first study to measure performance through technical efficiency and discover factors which have significant impact on the performance of listed firms of Pakistan's textile sector from period 2006 to 2011.

In Pakistan, many researchers have also used firm's profitability and financial ratios to measure the performance of different sectors (Nazir&Afza, 2009; Khan, 2012).Most of the time its efficiency has been measured through profitability and other financial ratios, but in actuality, the origin of firm's performance and growth is change in productivity, efficiency and variations in the prices of inputs and outputs (Fried et al, 2008).

Literature Review

There are many different indicators used by researchers to measure the performance for instance in terms of financial performance, growth, market share, efficiency, exports, productivity and employment. Deloof (2003) used profitability as dependent variable and found its significant negative relationship with working capital for the Belgium firms. Owolabi et al (2012) in the study on Nigerian manufacturing sector observed significant positive relationship of liquidity measures on performance. Most commonly used profitability ratios are return on assets, return on investment, profit margins and return on equity (Muritala, 2012; Ogebe et al., 2013).

Khatab et al., 2011 measured firm performance through market ratio to analyze the impact of corporate governance for the listed firms of Karachi stock exchange. Demsetz et al (2001) also market measures for firm performance to evaluate the impact of ownership structure of randomly selected US firms. Firm performance has been measured, in several studies, by the market value and it is related with the stock prices (Claessens et al., 2000; Farooque et al., 2007).

Productivity refers the ratio of output and input utilized for the production of output and it is also used as a measure of performance. Mostly it is measured in the terms of total factor productivity and all the factors of production are considered for the measurement of productivity (Coelli et al., 2005). .Aw et al (2001) also measured productivity by considering the all factors of production and concluded that firm's turnover significantly affects the industrial performance (growth) for the manufacturing firms of Taiwan using firm level data. Lichtenberg & Pushner (1992) analyzed the impact of ownership structure on performance of Japanese firms for the period of 1976 to 1989 and firm performance was measured by productivity. It is measured by the productivity as an economic indicator in many empirical studies by economic researchers (Hollingsworth, 2008; Wu, 2007).

Efficiency is also used to measure firm performance and in economic terms, it is divided into four important components of technical efficiency, allocative efficiency, scale efficiency and cost and revenue efficiency. Firm performance is also measured by growth that is another important indicator. Evans (1987) found negative relationship of firm size and age with the firm growth. Hall (1988) also analyzes the relationship between size and growth of firm and found no relationship with attributes of firms of US manufacturing sector. Many empirical studies used growth, with the help of profitability and sales growth as important component, to analyze its relationship with other variables (Morgan et al., 2009; Iqbal et al., 2012).

Technical efficiency refers the ability of any firm to generate maximum output within given level of input and technology (Coelli et al., 2005). The concept of technical efficiency was firstly introduced in the work of Debreu (1951) and Koopmans (1951). This work was further extended by Shephard (1953) before the work on measurement of technical efficiency by Farrell (1957). Farrell (1957) was the first who purposed that measurement of efficiency based on efficient production function. The idea purposed by him was to measure efficiency with the help of efficient frontier. He explained the concept of efficiency with the help of two factors inputs (x) and with output (y). He further elaborated by drawing efficient frontier from input-output ratios and firms which lied on the frontier were considered technically efficient.

Moreover, when the efficiency of any firm is considered with reference to its marginal revenue and cost then such efficiency is allocative efficiency (Kalirajan&Shand, 1999). It was also firstly discussed and

explained by the Farrell (1957), he proposed that considering price information with efficiency measurement leads towards allocative efficiency. According to Coelli et al (2005) most of the time, firms may be technically efficient but still not at the point of allocative efficiency. It can be measured in terms of output orientation in which it is assumed that output will increase with fixed inputs.

A firm is facing scale inefficiency, when it is efficient in terms of technical and allocative efficiency but still not operating at its optimal level (Coelli et al., 2005). They further purposed that under variable return to scale assumption, if any firm operating at very small scale then it should go for increasing return to scale and vice versa. Efficiency has been used extensively to measure performance of different sectors but more specifically for the firms engaged in manufacturing.

In developing countries of Asia, performance of manufacturing sectors is also very important. Mini &Rodriguez (2000) observed that technical efficiency of Philippine's manufacturing sector was dependent of size of firms. Baten et al, (2006) investigated the technical efficiency of manufacturing firms of Bangladesh. They used SFA (Stochastic frontier analysis) with Cobb-Douglas production function to estimate efficiency and found that output level of half normal distribution was almost 55%. Binam et al. (2008) also measured performance in terms of technical efficiency.

Technical efficiency of Indian manufacturing firms was also analyzed. It was also confirmed the impact of factors disturbing the performance of different manufacturing sectors by using maximum likelihood models (Dimitriu & Savu, 2010). Another study conducted on the manufacturing firms of Kenya to analyze technical efficiency by Haron & Chellakumar (2012). They used Pearson correlation and data envelopment analysis with input orientation to measure efficiency. They concluded that performance of smaller firms with the comparison of medium size and large firms have been greater from 2009 to 2011 for the manufacturing sector of Kenya.

There are some evidences from developed countries which used technical efficiency as the determinant of performance. Renuka & Kalirajan (2000) concluded in his study that manufacturing sector of Singapore was not operating its optimal level and it has potential to improve efficiency level. His result from technical efficiency measurement showed that quality of labour and capital intensity should be improved to enhance technical efficiency. Wu (2007) performed empirical analysis of manufacturing firms of china to estimate performance. Performance was measured through technical efficiency of individual manufacturing sectors for the purpose of comparison among sectors. They found that rewards to labour and benefits from taxes were more important for the further improvement in performance level of manufacturing sectors of China. Technical efficiency and its determinants of Greek Power industry were measured by Roboli & Michaelides (2010). They used stochastic frontier approach to estimate efficiency for the period of 1970 to 1997. They found that average efficiency was 94% and scale of operations and country's incorporation were important macroeconomic factors. Castiglione, (2012) purposed that investment in information and telecommunication sector has significant impact on performance of manufacturing sector of Italian along with using translog production function.

The association between firm performance and size is yet unconvincing; differences exist in firm size and performance relationship on regional and sector bases. Lundvall & Battese (2000) analyzed the relationship of firm size and age with efficiency of Korean manufacturing firms (food, wood, textile and metal sectors) from 1993 to 1995 and found its positive relationship with performance. Contrary to the findings of Lundvall & Battese (2000), Yasuda (2005) found negative impact of firm size on performance for the Japanese manufacturing firms for 1992 and 1998. Many other empirical studies analyze the role of firm size and performance in different regions (Hall, 1987; Mini & Rodriguez, 2000; Castiglione, 2012). Performance in terms of growth decreases for the older firms while firm's survivability increases with experience and getting more expertises by learning experience (Evans, 1987). Majumdar (1997) investigated the impact of firm age on productivity and performance of 1020 Indian firms for the period between 1988 and 1994 and found that firm age was positively associated with productivity

(performance).Castiglione (2012) also confirmed that firms with higher experience has higher efficiency level as compared to the firms with lower experience for the Italian manufacturing firms during the period of 1995 to 2003.

In finance literature, financial constraints, most importantly measured in terms of debt-constrained (leverage) have been used to check its relationship with firm performance in many empirical studies (Bridges & Guariglia, 2008; Maietta & Sena 2010). Muritala (2012) found the significant negative relationship of leverage (debt to assets ratio) with performance of Nigerian firms for five years. Pouraghajan et al. (2012) investigated the relationship of leverage and firm performance of 400 firms listed at Tehran stock exchange. They measured leverage by debt to assets ratio and also found that leverage was negatively associated with firm performance during the period of 2006 to 2010. Moreover, Hansen & Wernerfelt (1987) analyzed the importance of economic as well as firm specific factors for the 60 US firms and found significant positive impact of market share on performance. Schwalbach (1991) also measured relationship between firm performance and market share for firms included in PIMS data base and concluded the negative association between market share and performance.

Additionally, Alvarez & Lopez (2005) analyzed the three dimensions of exporting activities of Chile by using panel data. They support first dimension of self-selection hypothesis for exports and found that firms entering in foreign markets were more productive and efficient as compare to non-exporting. Second dimension, they found that after entering into export market firms improve their performance level to compete in foreign market and supported the significance of learning by exporting for firm performance. Finally, they also observed that self selection is conscious process. Many empirical studies considered self-selection export participation and learning by experience export participation as important indicator for firm performance (Greenaway et al., 2003; Alvarez & Lopers, 2005).Sales growth is important indicator and has been used extensively by many researchers.Cowling (2004) examined the relationship between sales growth and performance and concluded the positive impact of sales growth on performance. Many other studies have examined the relationship between firm performance and sales growth (Voulgaris et al., 2003; Hermelo & Vassolo, 2007).

Methodology

Data Description

This study selected textile sector for the performance measurement and only listed textile firms has been selected. There are more than 155 textile firms are listed at Karachi Stock Exchange and only 100 firms are considered for the period of 2006 to 2011. The data is unbalanced and has 594 observations as some outlier has been removed. This study consideredonly those firms which provided complete information regarding the variables of this study. In this study, annual data of these 100 firms is taken from the statement of non-financial sector analysis published by the State Bank of Pakistan. In addition to this, further information was taken from the official site of selected companies.

Variables Description

This study used input and output variables for the calculations of efficiency score and then firm specific factors are used as independent variables. The description of the variables is given as follows.

Output Variables

Output of manufacturing sectors can be easily identified as compared to service sectors. Textile sector is also a major manufacturing sector that produces tangible goods. The output is most commonly measured by many researchers through value added and gross outputs (Rehman et al., 2008; Roboli & Michaelides, 2010; Mini & Rodriguez, 2010). Rehman et al (2008) used sales as output variable for calculation of

efficiency for 11 large manufacturing sectors of Pakistan. Mahadevan (2010) applied value added as output for the manufacturing firms of Singapore during the period of 1974 to 1994. This study used sales (gross output) to measure output for efficiency scores. Value added cannot be used as output variable because it creates the problem of negative values. DEA analysis does not support negative values and these values also reduce panel data because of negative profitability in different years for different firms.

Input variables

Coelli et al (2005) suggested the division of input variables into five categories capital, labour, energy, material inputs and purchased services that are collectively known as KLEMS. These variables can also be cognised into three categories capital, labour and other inputs. Different studies used different set of input variables and selection of input variables depend on the nature of firms and availability of data. Sharma et al (1997) used capital, labour and other inputs as proxy for input variables to measure efficiency for the swine industry of Hawaii. Lundvall and Battese (2000) also used intermediate inputs as input variable for the manufacturing firms of Kenya. On the other hand Roboli and Michaelides (2010) used energy as input variable along with capital and labour for the Greek power industry.

Research evidences supported that different set of input variables have been used in different empirical studies. This study used three input variables capital, cost of sales and operating expenses. Capital as input variables has been used in most of empirical studies. Labour and capital have also been used extensively for input variable but this study cannot use labour and raw material because of data availability. Cost of sales of textile firms include the major portion of material and labour cost. Due to this, cost of sales is used second input variable. Third, operating expenses used for input variable and the reason of selecting this proxy is that gross output (sales) is used as output variable. When "sales" is used as output then it is reasonable and justified to use operating expenses as output variable because these expenses also contribute to produce sales.

Independent Variables

In this study, firm specific factors have been used as independent variables to analyze their impact on efficiency. These variables are firm size, firm age, market share, leverage and export participation. Firm age has been measured in terms of operating years, from the year of starting to date.Castiglione (2012) measured firm age in terms of firm's operating years for manufacturing sector of Italy. Many other firms used number of operating years as proxy for firm age (Majumdar, 1997; Lundvall et al., 2000; Yasuda, 2005). Natural log of total assets has been used proxy for firm size in this study. Majumdar (1997) used natural log off total assets as proxy for firm size. Chu (2011) also measured firm size by the logarithm of total assets for the public firms of Taiwan. Additionally, firm size has been measured by natural log of total assets extensively in many empirical studies (Majumdar, 1997; Mini & Rodriguez, 2000; Castiglione, 2012).

Financial constraint (leverage) has been measured by Long term debts to total assets ratio in this study. Khan (2012) measured leverage by long term debts to total assets (LDA) ratio for the manufacturing firms of Pakistan. Moreover, Muritala (2012) also measured leverage by LDA for the listed firms of Amman. Leverage has also been measured by LDA in many other empirical studies (Bridges and Guariglia, 2008; Maietta and Sena 2010). The proxy for market share in this study has been used relative market share. It has been measured by the ratio of sales of individual firms to the sales of total sector. Hansen and Wernerfelt (1987) measured market share in terms of relative market share. Schwalbach (1991) also used the same proxy for market share to measure its relationship with performance.Alvarez and Lopez (2005) considered the dimensions of exports like; self selection hypothesis and learning by export hypothesis. Several studies also considered export participation in terms of self selection hypothesis and learning by export hypothesis (Greenaway et al., 2003; Alvarez and Lopers, 2005; Granér and Isaksson, 2009).

Efficiency Concepts and Models

Economic efficiency was introduced by Debreu (1951) and Koopmans (1951). It was further extended by Shephard (1953) but the measurement of efficiency was firstly purposed by Farrell (1957). He proposed the idea of efficient production function to measure efficiency. Moreover, he also explained the efficiency in terms of technical and allocative efficiency. Technical efficiency is attaining higher level of production with given set of inputs and when the efficiency of any firm is considered with reference to its marginal revenue and cost then such efficiency is allocative efficiency.

Efficiency is also attributed to scale of production. If a firm is gaining technical and allocative efficiency but still not performing at optimal level then it is facing the scale efficiency. Efficiency is further divided into two important components of cost and revenue efficiency. If efficiency based in terms of input prices then it will be cost efficiency and in the terms of output prices will be the revenue efficiency.

Efficiency is measured by two approaches 1) Parametric Approach and 2) Non-Parametric Approach. Parametric approach for efficiency is SFA (stochastic frontier analysis) while non-parametric approach is DEA (data envelopment analysis). DEA was firstly introduced by Charnes et al (1978). They assumed that all firms were operating at optimal scale and measured efficiency with constant return to scale. This model is also known as CCR model. Later on, Bankers et al (1984) observed the deficiencies in CCR model and modified it by using variable return to scale (VRS) assumption. They identified two important problems with CCR model. First, it was not possible that all firms operate at optimal level. Second, results of efficiency measurements under CRS assumption were same for input and output orientation. These problems were covered by the presenting BCC model.

In DEA, efficiency is measured by the ratio of output with input. Mathematical form of this calculation can b solved as follows.

$$\begin{aligned} &\text{Max}_{u,v} && (u'y_i/v'x_i) \\ &\text{Subject to} && uy_j/\ v'x_j \leq 1 \qquad j=1,\ 2.....I \\ & && u,v \geq 0 \end{aligned}$$

In the above equation x and y are for inputs and outputs respectively. U is denoted for output weights and v for input weights and u and v will be calculated for efficiency maximization with following constraints. First, the efficiency scores of all the firms must be less than or equal to 1. Secondly, u and v weights must be equal or greater than zero. Efficiency scores calculated in such way will provide infinite values and this problem can be solved by modifying above equation as follows (Coelli et al., 2005).

$$\begin{aligned} &\text{Max}_{u,v} && (u'y_i), \\ &\text{Subbject to} && v'x_i = 1, \\ & && uy_j - v'x_j \leq 0, \qquad j=1,\ 2.....I \\ & && u,v \geq 0, \end{aligned}$$

In the same way duality in linear programming can be presented in the form of following equation.

$$\begin{aligned} &\text{Min}_{\theta,\,\lambda} && \theta, \\ &\text{Subject to} && -y_{i\,+} Y\,\lambda \geq 0, \\ &\theta x_i - X\,\lambda \geq 0, && j=1,\ 2.....I \\ & && \lambda \geq 0, \end{aligned}$$

In the above equation θ is scalar and λ is constant. Efficiency scores are indicated by θ and its value less than 1 shows the technical inefficiency while equal to 1 point out the technical efficiency of firms. Most of the empirical studies concluded that CRS assumption cannot be applied for the measurements of efficiency. They purposed that it is not reasonable to assume that firms operate at their optimal level due to many factors and preferred VRS for efficiency (Banker et al., 1984). The above equation can be modified for VRS by adding convexity condition (I1 λ' =1) to relax the assumption of optimal scale. Convexity condition makes it possible to compare inefficient firms with similar firms in terms of firm size. This condition is not possible under CSR assumption to compare firms with similar size (Coelli, 2005).

Two Stage DEA Analysis

This study used panel data of 100 textile firms from 2006 to 2011. In DEA, technical efficiency of panel data is calculated with malmquist TFP index. In this study, malmquist TFP index has been used under VRS and CRS assumption with output orientation to measure technical efficiency. The model specification under VRS has been derived from malamquist TFP index output oriented under CSR assumption. First step is to derive the model specification under CRS which is given below.

$$M_o\,(y^{t+1}, x^{t+1}, y^t, x^t) = \left[\frac{d_c^t(x^{t+1}, y^{t+1})}{d_c^t(x^t, y^t)} \times \frac{d_c^{t+1}(x^{t+1}, y^{t+1})}{d_c^{t+1}(x^t, y^t)}\right]^{1/2}$$

Above malmquist index has two parts first for technical efficiency change ($EEFCH_c$) and second for technical change ($TECHCH_c$) under CRS. It has been used to calculate the productivity of point (y^{t+1}, x^{t+1}) relative to point (y^t, x^t). M_o stands for malamquist under output orientation and $d^t_{c(x^{t+1}, y^{t+1})}$ for distance of time period t+1 to t technology. Model specification under CRS is given below.

$$TE_c = \left[\frac{d_c^t(x^{t+1}, y^{t+1})}{d_c^t(x^t, y^t)}\right]^{1/2}$$

Fare et al (1994) suggested that technical efficiency change portion of CRS can be decomposed into two parts; pure technical efficiency change (means technical efficiency for VRS) and scale efficiency. In the above equation, "v" stands for VRS and SE stands for scale efficiency.

$$\left[\frac{d_c^t(x^{t+1}, y^{t+1})}{d_c^t(x^t, y^t)}\right]^{1/2} = \left[\frac{d_v^{t+1}(x^{t+1}, y^{t+1})}{d_v^t(x^t, y^t)}\right]^{1/2} \times \left[\frac{SE^{t+1}(x^{t+1}, y^{t+1})}{SE^t(x^t, y^t)}\right]^{1/2}$$

The leaner programming to measure technical efficiency scores under VRS is as follows.

$$TE_v = \left[\frac{d_v^{t+1}(x^{t+1}, y^{t+1})}{d_v^t(x^t, y^t)}\right]^{1/2}$$

The second part of two-stage DEA is to identify firm specific and business specific factors that effects performance of listed textile sector of Pakistan. These factors have been identified by using performance efficiency as dependent variable. Efficiency scores have been calculated under two assumptions of CRS and VRS and there are two regression models.

Generalized Least Square

Most commonly used estimation techniques for regression analysis are OLS and maximum likelihood (ML). The estimation technique of ordinary least squares was proposed by Carl Friedrich Gauss. Due to strong statistical properties and simplicity, the extensively recommended estimation technique is OLS. In this study, generalized least square estimation technique has been used due to the violation of homoscedasticity assumption. The functional forms of GLS under CRS and VRS are as follows.

Model 1

$$\frac{Y_{1it}}{\sigma_{it}} = \beta_0\left(\frac{X_{0it}}{\sigma_{it}}\right) + \beta_1\left(\frac{X_{1it}}{\sigma_{it}}\right) + \beta_2\left(\frac{X_{2it}}{\sigma_{it}}\right) + \beta_3\left(\frac{X_{3it}}{\sigma_{it}}\right) + \beta_4\left(\frac{X_{4it}}{\sigma_{it}}\right) + \beta_5\left(\frac{X_{5it}}{\sigma_{it}}\right) + \beta_6\left(\frac{X_{6it}}{\sigma_{it}}\right) + \frac{\mu_{it}}{\sigma_{it}}$$

Model 2

$$\frac{Y_{2it}}{\sigma_{it}} = \beta_0\left(\frac{X_{0it}}{\sigma_{it}}\right) + \beta_1\left(\frac{X_{1it}}{\sigma_{it}}\right) + \beta_2\left(\frac{X_{2it}}{\sigma_{it}}\right) + \beta_3\left(\frac{X_{3it}}{\sigma_{it}}\right) + \beta_4\left(\frac{X_{4it}}{\sigma_{it}}\right) + \beta_5\left(\frac{X_{5it}}{\sigma_{it}}\right) + \beta_6\left(\frac{X_{6it}}{\sigma_{it}}\right) + \frac{\mu_{it}}{\sigma_{it}}$$

The detail of both models is as follows.

β_0 = Intercept Term
β_1 = Coefficient of Size
β_2 = Coefficient of Share
β_3 = Coefficient of Age
β_4 = Coefficient of Sales Growth
β_5 = Coefficient of Leverage
β_6 = Coefficient of Export

X_{1it} = Size
X_{2it} = Share
X_{3it} = Age
X_{4it} = Sales Growth
X_{5it} = Leverage
X_{6it} = Export
μ_{it} = Error Term

$$Y_{1it} = TechnicalEfficiencyunderCRS$$
$$Y_{2it} = TechnicalEfficiencyunderVRS$$

In the above models $\frac{1}{\sigma_{it}}$ is multiplied to give weights for generalized least square.

Results and Analysis

Descriptive Results

Description of all the variables used in the study is given in the Table 1.1. There are three input and one output variables used to calculate efficiency scores. Moreover, six independent variables have been used to measure the impact of firm specificfactors on efficiency. In the table 1.1, average age has been observed almost 30 years that shows the higher experience of textile sector's firms. Textile sector of Pakistan sold approximately 47% goods in foreign market and contributing at large extent in overall export volume of Pakistan.

Table 1.1: Descriptive results

Variables	Mean	Maximum	Minimum	Std. Dev.	Observations
Output Variable					
Sales	3130840	48565144	5660	4544575	594
Input Variables					
Cost of Sales	2717653	40718697	6560	3746694	594
Operating Expenses	159032.6	3278472	797	317857.3	594
Capital	1693973	38339694	30817	3178974	594
Independent Variables					
Age	30.67	76	2	13.7773	594
Exports	0.47828	4.7	0	0.332636	594
Leverage	0.248833	2.078	0.001	0.223592	594
Share	0.010001	0.09237	0.00002	0.0129	594
Size	14.30478	18.07	10.43	1.245689	594
Sales Growth	0.242334	6.911157	-0.97789	0.724117	594
Dependent Variables					
Technical Efficiency (CRS)	0.82831	1	0.087	0.134078	594
Technical Efficiency (VRS)	0.86117	1	0.106	0.125934	594

Source: Author

Average leverage ratio is 24%, showing dependence on equity financing and strong financial position of this sector. Leverage ratio is also very low because almost whole textile sector based on family ownership. Average market share is very low because of too much firms in textile sector. There are almost more than 150 firms in textile sector and maximum market share of any textile firm is not more than 1.29%. Average sales growth level is almost 24% while variation in sales growth is very high. Mean values of technical efficiency under CRS (0.82) and VRS (0.86) showing that textile sector is not fully efficient but near to achieve efficiency in terms of technical efficiency.

Results of Data Envelopment Analysis

Table 1.2 provides results on annual basis, from 2006 to 2011, about different dimensions of economic efficiency. Average annual scores, from 2006 to 2011, of technical efficiency under CSR as well as VRS showing ups and downs as if textile sectors efficiency in one year is increasing at the same time in next year decreasing and vice versa. The average technical efficiency level of textile sector of Pakistan, from 2006 to 2011, is greater than 62.33 percent found by Oguchiet al. (2006) for Malaysian manufacturing sector. However, it is almost consistent with the average efficiency level of 87% found by Wiboonchutikula (2002). According to Tybout (2000), average technical efficiency scores of manufacturing sector in developing countries have been observed within the range of 60 to 70% and hence Pakistan textile sector is quite efficient. However, on the basis of Tybout (2000) findings, it cannot be concluded that Pakistan textile sector is efficient as compare to the manufacturing sectors of other developing countries. Scale efficiency change results, from 2006 to 2011 and overall average (0.9994), are suggesting that textile sector has been operating on decreasing return to scale. Overall change in scale efficiency is less than 1 indicating the decreasing return to scale and is consistent with the result found by Ahmadi & Ahmadi (2012). They found that overall manufacturing industries of Iran were operating on decreasing return to scales. The comparison of scale, pure and technical efficiency changes reveal that the overall inefficiency of textile sector is due to scale efficiency and consistent with Ahmadi & Ahmadi (2012). According to table 1.2, pure efficiency is increasing from 2006 to 2011 but ups and downs in scales efficiency change have been observed and if change in scale efficiency score is increasing at the same course technical efficiency is also increasing and vice versa.

Table 1.2: Results of data envelopment analysis

Years	EFFCH	TECHCH	PECH	SECH	TFPCH	TE(CRS)	TE(VRS)
2006	-	-	-	-	-	0.822	0.843
2007	0.977	1.052	1.004	0.974	1.028	0.794	0.836
2008	1.331	0.833	1.113	1.016	0.942	0.899	0.927
2009	0.837	1.204	0.86	0.973	1.007	0.764	0.81
2010	1.138	0.892	1.095	1.04	1.015	0.872	0.891
2011	0.996	1.015	1.002	0.994	1.011	0.819	0.858
Averages	1.0558	0.9992	1.0148	0.9994	1.0006	0.828333	0.860833

Source: Author

Results of Generalized Least Square Estimates

Generalized least square estimation technique has been used to regress firm specific factors on performance (efficiency). Efficiency of textile sector of Pakistan has been considered under CRS as well VRS assumption. There are two regression models for both assumption and results of the models are given in table 1.3 and 1.4.

Results of model 1are given in table (1.3). In this model it has been assumed that all firms of textile sector are operating at optimal level. This model is highly fitted model as p-value of overall model is significant at 1%. It is also indicating that selected firm specific factors are playing their significant role as well as

effecting efficiency of textile sector's firms of Pakistan under CRS. Results of model 1 also showing the significance of these factors by adjusted r-square value of 0.63as they are explaining 63% variation in efficiency.

Table 1.3: Model 1

Variables	Coefficient	Std. Error	Prob.
SIZE	-0.674818	0.110808	0.0000
SHARE	0.084702	0.007759	0.0000
SG	0.421271	0.02247	0.0000
LEVERAGE	-0.009133	0.004336	0.0357
EXPORT	-0.008536	0.002813	0.0025
AGE	0.03751	0.011469	0.0011
C	1.874792	0.325226	0.0000
R-squared	0.700292	**S.E. of regression**	0.138524
Adjusted R-squared	0.63655	**Prob(F-statistic)**	0.0000

Source: Author

In model 2, the assumption is that textile sector of Pakistan is not operating at optimal scale. Efficiency scores under VRS have been regressed against firm specific factors. The results are showing the overall significance of model as p-value of overall model is significant at 1%. Moreover, selected factors are explaining 66% variation in efficiency of textile sector of Pakistan**.**

Table: 1.4: Model 2

Variable	Coefficient	Std. Error	Prob.
SIZE	**-0.4127**	**0.0923**	**0.0000**
SHARE	**0.0400**	**0.0071**	**0.0000**
SG	**0.4325**	**0.0211**	**0.0000**
LEVERAGE	**-0.0090**	**0.0036**	**0.0128**
EXPORT	**-0.0049**	**0.0026**	**0.0612**
AGE	**0.0243**	**0.0101**	**0.0165**
C	**1.0318**	**0.2753**	**0.0002**
R-squared	**0.7220**	**S.E. of regression**	**0.1373**
Adjusted R-squared	**0.6628**	**Prob(F-statistic)**	**0.0000**

Source: Author

Hypotheses Testing

In this section hypotheses are tested with help of results of generalized least square given in table 1 and 2. These are tested at 1%, 5% and 10% of level of significance. There is significant negative impact of size,at 1% of level of significance, on the efficiency of textile sector of Pakistan under both assumptions. This result is indicating that textile firms have no proper control over resources. It is also indicating the existence of mismanagement of resources as size of firms increase. This mismanagement is due to lack of capabilities to manage expansion in the size of firms. This result of significant negative relationship between size and efficiency is same as was found byYasuda (2005). The reason of negative impact of firm size of textile sector of Pakistan is due to higher investment in fixed assets during 2008 to 2010. According to (Credit Rating Company Limited, 2010), there was 190% increase in investment in fixed assets and this investment increases the size of firms as the new assets were more costly as compare to replaced assets. This investment was done to enhance output level of textile firms of Pakistan but no significant

improvements in sales growth have been observed. During 2008 to 2010, there was poor cotton harvesting which affects the textile sector's productivity as well as its sales level.

There is significant positive impact of firm age on the performance efficiency of textile sector of Pakistan under CRS as well as VRS assumption. It is indicating that experience increase learning to perform business activities which ultimately enhance the efficiency level. Several studies also found significant positive impact of firm age on performance (Majumdar, 1997; Castiglione, 2012).

Market share has significant positive effect, at 1% level of significance, on the efficiency of textile sector of Pakistan under the assumption of CRS and VRS. It is suggesting that Increase in market share means increase in sales level within sector which encourages firms to increase production level to gain upper head from other competitors that improve the utilization of resources and efficiency level as well. Hansen and Wernerfelt (1987) also concluded the significance of market share and firm performance relationship for the US firms.

The empirical results of both assumptions reveal that financial leverage has significant negative impact, at 5% level of significance, on efficiency of textile sector of Pakistan. Many studies also found the same results (Muritala, 2012; Pouraghajan et al., 2012). According to (Credit Rating Company Limited, 2010), there was 190% increase of investment in fixed assets during 2008 to 2010 and it was financed by long term debt financing. Due to this presence of long term debts in capital structure, there was increase in leverage and expectations were to improve performance. On the other hand, as already mentioned above, there was no significant growth in production as well as in sales due to poor harvesting of cotton and increase in its prices made raw material of textile sector more costly. Due to this in spite of increase in leverage, there was no improvement in productivity as well as efficiency performance.

There is strong evidence from the results of both assumptions that sales growth has significant positive impact on the efficiency of textile sector of Pakistan. Several researchers also found the same positive impact of sales growth on firm performance (House & Benefield, 1995; Cowling, 2004; Hermelo & Vassolo, 2007).

The empirical results of model 1(at 1% level of significance) and model 2(at 10% level of significance) reveal exporting experience of textile sector does not improve the performance of textile sector. Trofimenko (2005) explained the impact of export participation on firm performance by relating the idea of self selection hypothesis. He concluded that if firms enter in export market with higher performance level then the learning from export market will increase its performance level because more efficient firms have the ability to transform the experience in to higher performance level. For the textile sector of Pakistan, during 2006 to 2011, self selection hypothesis is not relevant. Firms in textile sector of Pakistan are export oriented and almost all the firms have export sales. This export participation is not due to their performance level. The self selection hypothesis has also been analyzed in this study and results are given below.

Table 1.5: Results of self selection hypothesis

		Model 1		
TEV	-0.21664	0.263774	-0.8213	0.4119
C	-1.20405	0.060403	-19.9336	0
		Model 2		
TEC	-0.2698	0.247829	-1.08864	0.2768
C	-1.22355	0.065868	-18.5757	0

Source: Author

According to the results given in table(1.5), there is no significant impact of performance on export participation. These results confirmed that firs of textile sector have not been entered into export market due to their higher performance level.

Conclusion and Recommendations

The focus of this study been to measure performance, evaluating factors effecting performance and providing evidence based recommendations and implications to enhance the performance of textile firms of Pakistan. On the basis of empirical results found for the six hypotheses, this study provided several recommendations and implications for the improvement of performance of textile sector of Pakistan. Performance of textile sector in near to efficient it is operating at decreasing return to scale during 2006 to 2011. Their reliance was on low value added production activities and focus should be on value added production as well as to upgrade technologies used in production processes to improve the performance of textile sector of Pakistan. Government authorities should provide benefits to the farmers engaged in the cultivation of cotton crop and also providing this cotton as raw material to textile firms. There should be special support to formers, in the form of guidance on cotton cultivation and financial support, to enhance cottons production with lower cost and higher quality so that textile firm can get their raw material at lower cost and higher quality.

With respect to the empirical results, of first hypothesis, revealed the significant negative impact of firm size on performance of Pakistan textile sector. There should be proper utilization of investments in fixed assets.Government authorities should motivate textile firms to provide training to labour which became unskilled due to technological advancement. For the significant positive impact of age on performance, the focus of policies introduce by government authorities should be to enhance the performance level of younger firms. Experienced and old firms should be motivated towards cross-learning training programs with younger firms. Moreover younger firms should be motivated towards networking with experienced firms.

The third hypothesis revealed the significant positive impact of market share on performance efficiency of textile firms of Pakistan. With reference to this relationship, government authorities should provide awareness to textile firms to improve their market share in local markets and then go for foreign markets. The efficient firms of local market, entering into foreign market, will be more capable of transforming their learning experience to enhance the performance level. The existence of financial leverage has been found unfavourable for the performance of textile sector of Pakistan and the higher amount of long term debt financing for capital assets must be reduced by transferring these investments to remove the problems of energy crises and higher cost of raw material.

The fifth hypothesis disclosed the significant positive impact of sales growth on performance of textile sector of Pakistan. Textile firms should increase their sales level by offering incentives to foreign and local customers. Production capabilities should also be improved, to increase production level, by making valuable investment to ensure the availability of skilled labour and raw material. Government authorities should also help textile firms to explore new markets. There should be awareness by the textile firms to the local citizens about the usage of Pakistan textile products instead of foreign imported products. Moreover, with respect to the significant negative impact of export participation on performance, textile firms must enhance and prove their efficiency level in their own market. There should be conscious efforts by the government for better trade relations that will help to reduce high tariff rates on textile goods of Pakistan as compared to other exporting countries like China, Bangladesh and India.

References

Ahmadi, V & Ahmadi, A. (2012). Application of data envelopment analysis in manufacturing industries of Iran. *Interdisciplinary Journal of Contemporary Research In Business,4(8),534-544.*

Alauddin, M., Squires, D., & Tisdell, C. (1993). Divergency between average and frontier production technologies: an empirical investigation for Bangladesh.*Applied Economics*, *25*(3), 379-388.

Alvarez, R., & López, R. A. (2005). Exporting and performance: evidence from Chilean plants. *Canadian Journal of Economics/Revue canadienne d'économique*, *38*(4), 1384-1400.

Aw, B. Y., Chen, X., & Roberts, M. J. (2001). Firm-level evidence on productivity differentials and turnover in Taiwanese manufacturing. *Journal of Development Economics*, *66*(1), 51-86.

Banker, R. D., Gadh, V. M., & Gorr, W. L. (1993). A Monte Carlo Comparison of Two Production Frontier Estimation Methods: Corrected Ordinary Least Squares and Data Envelopment Analysis. *European Journal of Operational Research* 67, 332–343.

Baten, M. A., Kamil, A. A., & Fatama, K. (2009). Technical efficiency in stochastic frontier production model: an application to the manufacturing industry in Bangladesh. *Australian Journal of Basic and Applied Sciences*, *3*(2), 1160-1169.

Battese, G. E. & Coelli, T. J. (1995) A Model for Technical Inefficiency Effects in

Belegri-Roboli, A., & Michaelides, G. P. (2010). Technical Efficiency and Macroeconomic Determinants for the Greek Power Industry before liberalization: a Stochastic Frontier Approach. *Journal of Economics and Business*, *13*, 37-53.

Binam, J.N., Gockowsk, J., & Nkamleu, G.B. (2008). Technical efficiency and productivity potential of cocoa farmers in west African countries. *The Developing Economies*, 242-263.

Bridges, S., & Guariglia, A. (2008). Financial constraints, global engagement, and firm survival in the United Kingdom: evidence from micro data. *Scottish Journal of Political Economy*, *55*(4), 444-464.

Castiglione, C. (2012). Technical efficiency and ICT investment in Italian manufacturing firms. *Applied Economics*, *44*(14), 1749-1763.

Charnes, A.,. Cooper, W. W., & Rhodes, E. (1978) Measuring the Efficiency of Decision-Making Units. *European Journal of Operational Research* 2, 429–444.

Claessens, S., Djankov, S., & Lang, L. H. (2000). The separation of ownership and control in East Asian corporations. *Journal of financial Economics*, *58*(1), 81-112.

Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*. Springer.

Cowling, M. (2004). "The Growth - Profit Nexus." Small Business Economics 22: 1.

Debreu, G. (1951). The coefficient of resource utilization. *Econometrica: Journal of the Econometric Society*.

Deloof, M. (2003). Does working capital management affect profitability of Belgian firms? *Journal of Business Finance & Accounting*, *30*(3-4), 573-588.

Demsetz, H., & Villalonga, B. (2001). Ownership structure and corporate performance. *Journal of corporate finance*, *7*(3), 209-233.

Dimitriu, M. C., & Savu, B. M. (2010). Econometric analysis of efficiency in the Indian manufacturing sector. *Romanian Journal of Economic Forecasting*, *13*(1), 182-197.

Evans, D. S. (1987). Tests of alternative theories of firm growth. *The journal of political economy*, 657-674.

Färe, R., Grosskopf, S., Norris, M., & Zhang, Z. (1994). Productivity growth, technical progress, and efficiency change in industrialized countries. *The American Economic Review*, 66-83.

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society. Series A (General)*, 253-290.

Federal Bureau of Statistics. 2010. Federal Bureau of Statistics annual report: Federal Government, Pakistan.

Granér, M., and Isaksson, A. (2009). Firm efficiency and the destination of exports: evidence from Kenyan plant-level data. *The Developing Economies* 47, 279–306.

Greenaway, D., Guarigila, A., & Keneller, R. (2005). Financial factors and exporting decision. *Journal of International Economics*, 73(2), 377-395.

Hall, B. H. (1988). The relationship between firm size and firm growth in the US manufacturing sector. Journal of Industrial Economies.

Hansen, G. S., & Wernerfelt, B. (1989). Determinants of firm performance: The relative importance of economic and organizational factors. *Strategic management journal*, *10*(5), 399-411.

Hermelo, F.D., & Vassolo, R. (2007). The determinants of firm's growth: An empirical examination. *Revista Abante*, 10 (1), 3-20.

Hollingsworth, B. (2008). The measurement of efficiency and productivity of health care delivery. *Health economics*, *17*(10), 1107-1128.

Iqbal, N., Ahmad, N., Basheer, N. A., & Nadeem, M. (2012). Impact of Corporate Social Responsibility on Financial Performance of Corporations: Evidence from Pakistan. *International Journal of Learning and Development*, *2*(6), Pages-107.

Kalirajan, K. P., & Shand, R. T. (1999). Frontier production functions and technical efficiency measures. *Journal of Economic surveys*, *13*(2), 149-172.

Khan, A. G. (2012). The relationship of capital structure decisions with firm performance: A study of the engineering sector of Pakistan. *International Journal of Accounting & Financial Reporting (IJAFR)*, *2*(1).

Khatab, H., Masood, M., Zaman, K., Saleem, S., & Saeed, B. (2011). Corporate Governance and Firm Performance: A Case study of Karachi Stock Market. *International Journal of Trade, Economics & Finance*, *2*(1).

Koopmans, T. C. (1951). Analysis of production as an efficient combination of activities. *Activity analysis of production and allocation*, *13*, 33-37

Lichtenberg, F. R., & Pushner, G. M. (1994). Ownership structure and corporate performance in Japan. *Japan and the World Economy*, *6*(3), 239-261.

Lundvall, K., & Battese, G. E. (2000). Firm size, age and efficiency: evidence from Kenyan manufacturing firms. *The Journal of Development Studies*, *36*(3), 146-163.

Mahadevan, R., & Kalirajan, K. (2000). Singapore's manufacturing sector's TFP growth: a decomposition analysis. *Journal of Comparative Economics*, *28*(4), 828-839.

Maietta, O. W., & Sena, V. (2010). Financial constraints and technical efficiency: some empirical evidence for Italian producers' cooperatives. *Annals of Public and Cooperative Economics*,*81*(1), 21-38.

Majumdar, S. K. (1997). The impact of size and age on firm-level performance: some evidence from India. *Review of industrial organization*, *12*(2), 231-241.

March, J. G., & Sutton, R. I. (1997). Crossroads-Organizational Performance as a Dependent Variable. *Organization science*, *8*(6), 698-706.

Mini, F., & Rodriguez, E. (2000). Technical efficiency indicators in a Philippine manufacturing sector. *International Review of Applied Economics*, *14*(4), 461-473.

Morgan, N. A., Slotegraaf, R. J., & Vorhies, D. W. (2009). Linking marketing capabilities with profit growth. *International Journal of Research in Marketing*,*26*(4), 284-293.

Muritala, T. (2012). An Empirical Analysis of Capital Structure on Firms' Performance in Nigeria. *International Journal of Advances in Management and Economics*, 115-124.

Nazir, M. S., & Afza, T. (2009). Impact of Aggressive Working Capital Management Policy on Firms' Profitability. *IUP Journal of Applied Finance*,*15*(8).

Ogebe, P., Ogebe, J., & Alewi, K. (2013*). The Impact of Capital Structure on Firms' Performance in Nigeria* (No. 46173). University Library of Munich, Germany.

Oguchi, N., Karim, A. A., & Amdzah, N. A. (2006). Productivity of Large Firms and SMEs of Malaysian Manufacturing. *Senshu Shogaku Ronshu*, *83*, 135-146.

Owolabi, S. A., & Obida, S. S. (2012). Liquidity management and corporate profitability: Case study of selected manufacturing companies listed on the Nigerian stock exchange. *Business Management Dynamics*, *2*(2), 10-25.

Pouraghajan, A., Malekian, E., Emamgholipour, M., Lotfollahpour, V., & Bagheri, M. M. (2012). The Relationship between Capital Structure and Firm Performance Evaluation Measures: Evidence from the Tehran Stock Exchange.*International Journal of Business & Commerce*, *1*(9).

Raheman, A., Afza, T., Qayyum, A., & Bodla, M. A. (2008). Estimating Total Factor Productivity and Its Components: Evidence from Major Manufacturing Industries of Pakistan. *The Pakistan Development Review*, 677-694.

Richard, P. J., Devinney, T. M., Yip, G. S., & Johnson, G. (2009). Measuring organizational performance: Towards methodological best practice. *Journal of management*, *35*(3), 718-804

Schwalbach, J. (1991). Profitability and market share: A reflection on the functional relationship. *Strategic Management Journal*, *12*(4), 299-306.

Sharma, D. S. (2001). The role of cash flow information in predicting corporate failure: the state of the literature. *Managerial Finance*, *27*(4), 3-28.

Shephard, R. W. (1953) Cost and Production Functions. *Princeton: Princeton University Press.*

Trofimenko, N. (2008). Learning by exporting: Does it matter where one learns? evidence from colombian manufacturing firms. *Economic Development and Cultural Change*, *56*(4), 871-894.

Tybout, J. R. (2000). Manufacturing firms in developing countries: How well do they do, and why?. *Journal of Economic literature*, *38*(1), 11-44.

Voulgaris, F., Asteriou, D., & Agiomirgianakis, G. (2003). The determinants of small firm growth in the Greek manufacturing sector. *Journal of Economic Integration*, 18(4), 817-836.

Wiboonchutikula, P. (2002). Small and medium enterprises in Thailand: Recent trends (pp. 213-226). Springer US.

Wu, H. X. (2007). Measuring Productivity Performance by Industry in China, 1980-2005. *International Productivity Monitor*, (15).

Yasuda, T. (2005). Firm growth, size, age and behavior in Japanese manufacturing. *Small Business Economics*, *24*(1), 1-15.