Ownership Structure and Technical Efficiency of Large Scale Industrial Sector of Pakistan

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CERTIFICATE

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Dedicated to my beloved

Parents and Siblings

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Abstract

Technical efficiency is the fundamental measure to check performance of any sector. This study examines the effect of ownership structure on the performance of large scale manufacturing sector of Pakistan. Data from Census of Manufacturing Industries (CMI) has been used for the years 1991 and 2006. Three digit industries of Pakistan comprising of 32 large scale groups have been analyzed. Maximum likelihood estimation technique has been used for stochastic frontier cobb-Douglas production function to estimate technical efficiency. Labor and capital enhance the industrial output. Private and public ownership structures as compare to joint ventures have negative impact on output of the industry. Foreign ownership proved to be more profitable as compare to joint ventures in both years. Further more efficiency scores are calculated through SFA and 29 out of 32 LSM came up as having increasing trend in efficiency in 2006 as compare to 1991. Petroleum refinery turned up as top efficiency scorer while ginning and bailing of fiber as least scorer. Mean efficiency for the year 1991 stood at 19.08 and 53.03 for 2006. This can be attributed to the reforms initiated in late 1980s which were aimed at creating a better business environment for foreign and domestic investors. Regressing efficiency scores on ownership structures revealed that all structures are negatively impacting efficiency in 1991 whereas for the year 2006 these coefficients turned out to be positive for 2006. As far as ownership structure is concerned private ownership has been increased in almost all of the industrial groups except beverage industry, ginning and bailing of fiber, tobacco, industrial chemical and products of petroleum. Public ownership has been decreased in all industries while foreign ownership structure has also increased. In a nutshell, this study deduced that ownership structure actually influences the performance of LSM. So high attention must be paid on deciding which form of ownership is feasible for which producing unit so that industrial sector can operate at full potential.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Technical efficiency is fundamental measure to check performance of any sector: It refers to the maximum output given a set of inputs or a given set of output by minimizing inputs. Pioneer work on efficiency was done by Farrell (1957) who drew upon the work of Debreu (1951) and Koopmans (1951). Two components of efficiency namely Technical efficiency and allocative efficiency was proposed by him. Technical efficiency is the most appropriate method to compare different organizations specifically when ownership structure is being considered. Over pricing and cost differences are eliminated while focusing on technical efficiency as non-financial data is likely to be more reliable (Pestieau & Tulkens, 1990).

Technical efficiency and ownership structure are the concepts relating to each other in direct or indirect manner. Ownership, with a special reference to public ownership, has also been linked with profitability by Mehdi (1984), Sarmad (1984) and Gillis (1977). Basically,it is used to measure that how efficiently resources are being used under different ownership structures. The question here is: Do the firms having different ownership structure eventually come up with different efficiency scores or not?

In developing countries like Pakistan ownership does have some important implications just like other developed countries although nature can be different. Wave of ownership diversification hit the Pakistan as well in eras of 70's. Researchers tried to explore performance differentiation in different sectors by ownership structure. Performance of banking sector of Pakistan has been analyzed with special reference to their ownership structure by many researchers. They come up with the results that efficiency remained somehow stagnant in both

domestic and foreign bank. Although foreign banks were outperformed by domestic banks (Khan et al. 2002, Haneef 2010).

Considering private sector to be more efficient is an important issue not around the globe alone rather in Pakistan also. Transfer of ownership from public to private leads to more efficient management of internal resources, better investment and economic growth (The Financial Times, August 1, 1999). Mehdi (1991) and Sarmad (1984) find out that private ownership in industrial sector is much more profitable than public. But their work has been criticized on the point that they have used profitability ratio to check this which itself is very weak measure to check efficiency. Kamal and Naqvi in 1991 found that public enterprises are relatively more efficient as compared to private sector. It is administrative quality, competition from world market and private counterparts, higher job security and lower effective rate of protection which are affecting performance rather than ownership structure alone.

In case of Pakistan statistics showed that during the last two decades share of private ownership has increased in most of the industrial groups. Only beverage, tobacco, ginning and bailing of fiber, and products of petroleum and coal industries have indicated decreasing trend in private ownership share. But still a positive upward trend in labor productivity is experienced in these industries. Only two industries namely ginning and bailing of fiber and handicrafts showed a decline in labor productivity. So, what are the factors behind this increased productivity although private ownership has decreased in these two industries? Structural changes occurred or some internal resources are its reasons? This study will try to find answer to this question.

Existing work provides evidence that ownership structure has some specific implications on performance indicators. Researchers have explored this relationship but mostly in financial terms. Furthermore, they have taken only two ownership structures namely public

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and private in industrial sector. The most recent phenomenon of foreign ownership is completely ignored in case of industrial sector which is going to be analyzed in this study. This research work will try to explore the structure responsible for better performance purely in economic terms by calculating technical efficiencies of three-digit industries[1] of Pakistan for the years 1991 and 2006(as 2006 data is the most recent data available).

Literature guides us to measure technical efficiencies by two commonly used approaches: Stochastic Frontier Analysis (here in after SFA) and Data Envelopment Analysis (here in after DEA). Merits and demerits both are attached to these techniques. As no specific functional form is needed in DEA but it overestimates the results by ignoring random errors and adding it in inefficiency term. SFA however considers the random error and provide separate estimates for inefficiency term and random error but at the same time it requires specific functional form to be used. This study will use SFA as these two terms must be separated to get accurate results.

1.2. Purpose of Study

This study of ownership structure and efficiency associated is intended to estimate the performance of three-digit industry of Pakistan for the years 1991 and 2006.Different ownership structures like public, private and foreign will be considered and it is to be checked that in which ownership structure these industries have performed well and which structure has an adverse impact on efficiency of the industry. To meet the key objectives of the thesis relationship between ownership structure and firm performance will be inspected.

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[1] An establishment is classified in a particular industry on the basis of value of major products and by products or services rendered according to the Pakistan Standard Industrial Classification (PSIC-2007). Three-digit classification is according to the specific groups. (Census of Manufacturing industries 2005-2006)

1.3. Objectives of the study

This study is specifically intended to observe the linkage between ownership structure and efficiency scores allied to these forms of ownership (private, public, foreign) in three-digit industries of Pakistan. The objectives of study are classified as follows:

- What is the ownership structure in 1991? How it changed in 2006?
- Whether the industrial efficiency is affected by ownership structure of enterprises or not?

1.4. Research Hypothesis

H_o: There is no impact of ownership structure on technical efficiency of manufacturing sector.

H_1: There is an impact of ownership structure on technical efficiency of manufacturing sector.

1.5. Significance of the study

Ownership is an important concept as an index of wealth and social position. In Pakistan there are enormous factors that can be attributed to explain the difference in performance between firms. Ownership structure is one of them. This study will try to explain how the firms have different performances depending upon the ownership structures (public, private and foreign). Performance indicators have also been found in earlier studies but they are mostly in financial terms. Moreover, ownership structure that has been chosen was confined to private and public-sector enterprises. This study will bridge this gap by exploring efficiency difference caused by ownership in enterprises specifically taking economic indicators (technical efficiency),

including foreign ownership structure and three-digit industries of Pakistan into account. The main concern of this work is to estimate the technical efficiencies of three-digit industries of Pakistan for the two different years (1991 & 2006) to check whether ownership structure cause a change in performance of industries or not. To the best of our knowledge, this type of analysis for Pakistan is hardly available in literature. A variety of ownership structures will be considered as publicly owned, privately owned and foreign controlled. So, this study fills the gap by scrutinizing industrial sector of Pakistan with respect to their ownership structure purely in economic terms. This study will also contribute to the policy debate regarding privatization. As we will come to know whether private ownership is more profitable than public and foreign or not.

1.6. Organization of the study

This study is organized in six chapters. Chapter one deals with introduction, purpose of the study, objective, research hypothesis and significance of the study. Chapter two provides a brief review of manufacturing sector of Pakistan. Chapter three provides a review of existing literature on ownership structure. Fourth chapter deals with data and variables. Theoretical and empirical model is presented in chapter five. Conclusion and policy recommendations are presented in chapter six.

CHAPTER 2

MANUFACTURING SECTOR OF PAKISTAN[2]

Manufacturing is the third largest sector of Pakistan economy. It accounts for 20.9 percent GDP and 15.3 percent of employment (Economic Survey of Pakistan, 2016). This sector scored the growth rate of 5.0 percent in 2016 as compared to 3.9 percent in previous year. At the time of Independence Pakistan was an agrarian economy. Pakistan was given only 34 industrial units out of 955 at the time of partition in 1947. Moreover, these units were of low capacity and centered on raw material. So, it was suggested to first establish those industries using domestically available raw material like cotton, jute, skins and hides. And preference was being given to consumer goods industry where we were highly depending on imports. Pakistan Industrial Development Corporation (PIDC) was established in 1952 for this purpose. By 1971 it could complete 59 units and laid foundation for a self-sustained progress in industrial sector. It was the time of early fifties when Pakistan was under structural shift and developing its industrial sector. Manufacturing sector share in GDP was below 8 percent in 1949-1950. Then Pakistan managed to increase this share to 12-15 percent of GDP in the years 1959-1960 and 1965-1966 respectively.

During initial time period these industries focused on domestic resources as inputs. The era of 1949-1970 comprises of establishments of different institutes for industrial growth like Pakistan Industrial Development Corporation (PIDC) in 1952, Pakistan Council of Scientific and Industrial Research (PCSIR) in 1953, Industrial Development of Pakistan (IDBP) in 1961, Trading Corporation of Pakistan (TCP) in 1967 and various industrial states. Industrial sector

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[2] The discussion in this chapter has been extracted from Zaidi, S. A. (2005), Amjad, R. (1984) and S. Jaleel (2012).

was thriving in fifties and sixties and Pakistan could achieve higher growth rates. Such excellent performance was due to the keen interest of the government in industrial growth. Secondly, the start was from very low base so the quick industrialization was relatively easy. But with the passage of time, these growth rates became difficult to maintain due to some weaknesses in policy implementation. As 1958-1968 era was said to be decade of development but this regime failed in just distribution of the shares that was a main reason of unrest in East Pakistan.

The period of 1970's was the most turbulent in Pakistan history. East Pakistan was separated and new Government (Pakistan People's Party) took the charge. Land reforms were introduced in 1972 which reduced limit of land holdings. In manufacturing sector, the government started Nationalization of many large-scale industries like basic metal, iron and steel, engineering, electrical, basic chemicals, power generation, cement and public utilities. Small scale industry was promoted in private sector. Defense related industries were established. Due to these Pakistan economies had far reaching and disastrous impact not only in terms of incentive structure for private sector but also moral and social landscape of homeland was altered. Moreover, hump in oil prices, international recession, floods and pest attacks also contributed to low growth rates of manufacturing sector in this era. In short, manufacturing sector more or less stagnated in this time period.

In July 1977 process of denationalization started. It restored the faith and confidence of private investors. Nationalized industries were given back to their former owners under Managed Establishment Order 1978. Economy was again on its way to free market system. Another major breakthrough of this era was the Structural Adjustment Program by IMF and World Bank as they imposed some conditions on developing countries for receiving finance from these institutions. These programs are comprised of economic policies for underdeveloped countries that have been

endorsed by IMF and World Bank by the provision of loans on the adoption of such policies. Main objectives of this program were to liberalize the economy and increase competitiveness. GOP took some serious policy measures following this program in 1980s although there are diverse opinions found in history (see, for example, Zaidi (1995), Zaman (1995), and Kemal (1994). These programs claimed to be helpful in reducing fiscal shortfalls, improving BOP situation and overall competence of the system. This decade can be regarded as an era of high growth rates for manufacturing sector and for whole economy as well. Apart from the benefits, these programs have adverse effects like higher unemployment, increased poverty, high inflation, delay in macroeconomic reforms and corruption in public sector as cheap credit was given to favored industries.

Structural adjustment program along with privatization process continued in the period of 1990s. This era witnessed political instability as government was dismissed thrice in this period. In this decade manufacturing sector was severely affected as energy crisis started in this time. And in the second half energy prices got a hump among all other factor inputs. Many other institutional changes occurred like Pakistan membership of WTO, establishment of Board of Investment (1994), Private Power and Infrastructure Board (1994) and Small and Medium Enterprise Development Authority (SMEDA) in 1998. Considering the overall economic performance, history does not count 1990s a successful decade as there were sharp decline in foreign aid, increased fiscal deficit and debt crisis.

After 2001 economic revival took place and foreign aid again started to flow in. Investors' confidence boosted up due to stable military regime establishment. However, much needed gap was filled regarding issues like health standards, quality control and certification by some institutional developments. These include establishment of Pakistan Standard and Quality

Control Authority (PSQCA) in 2000, The Pakistan National Accreditation council (PNAC) in 2001, Intellectual Property Organization (IPO) in 2005 and Business Support Fund (BSF) in 2005 etc. During these years manufacturing sector index showed an upward trend. But still fluctuations are observed in these growth rates. Increased oil prices, political instability, war on terror and natural disasters can be reasons of this scenario.

After 2005 LSM has recorded its weakest growth of 0.98 percent in the decade during the FY2010. Main contributors towards this broad based decline were energy crisis, poor domestic law and order situation and sharp depreciation of rupee. Again the era of 2011-2014 was a revival time period with 5.31 percent growth of LSM in FY2013. Feasible macroeconomic policies and fuel price adjustment played significant role in uplifting this sector. Keeping the pace, LSM recorded 6.24 percent growth in FY2018. Ample liquidity in the banking sector, investment friendly interest rates, low inflation and strong domestic demand for consumer durable goods are responsible for the reasonable growth in this sector.

All we can say is, Pakistan started with narrow industrial base. After that admirable growth rates were achieved but could not be sustained as there were resource constraints, political instability, poor law and order condition, bad governance, poor infrastructure (both physical and institutional) and shortage of capable human resource development. Policies of Nationalization adopted in 1970s badly affected investors' confidence causing adverse performance of manufacturing sector. After that our manufacturing sector could not find the good in the 1980s and onward policies of trade liberalization. High energy prices, lack of quality check and political instability are the main reasons behind this. Although in recent years Pakistan has set its pace of growth but still there is a room for improvement.

CHAPTER 3

LITERATURE REVIEW

Ownership structure basically defines a firm's management behavior and objectives hence affecting firm's performance and efficiency. Strategic management theory and agency theory both provide the rationale that ownership influences firms' performance as different goals and objectives are pursued by different owners. Privately owned firms tend to increase their profits while public firms are bound to increase their profits as well as welfare in the state. Diverse ownership structure results in different efficiency scores. Some studies reveal that state-owned enterprises are outperformed by privately owned firms while other claim that foreign ownership improves profitability (Faruq 2008). Some specific characteristics of enactment are always attached to each ownership type which causes variability in their performance. As in general foreign ownership is considered to be more efficient due to the concept that these owners have easy access to modern technology, established distribution network and skilled human capital (Faruq 2008). At the same time, it can turn out to be less efficient due to greater cost of learning about different market and co-ordination hitches (Bernard and Sjo'holm 2003).

Advocates of public ownership like Kamal and Naqvi (1991), Diadone (2009) argue that publicly owned firms are more efficient as they have no or less budget constraint. Moreover, greater welfare distribution is pursued by public ownership. Thompson and Kay (1986) analyzed that gains from private ownership are tempered to some extent. But Butler (1985) and Hanke (1987) argued that private ownership is more profitable than any other form of ownership as they fully utilize their resources. Sarmad (1984) and Mehdi (1991) also support this proposition. According to Alchian and Demsetz (1973) property rights could be possessed by individuals, by the state or in collective terms, but use of these rights are specified according to the nature of

ownership. Therefore, theory tells about allocation of rights as an instrument of improving performance.

Thus, ownership structure is considered to be an important determinant of industrial performance. Although ownership alone does not determine this efficiency yet it plays a vital role. Variety of ownership structures have been emerged in transition economies due to the process of privatization that also provided an extensive theoretical debate over which type of ownership form is more profitable. This debate concludes that certain ownership forms are given preference as they projected to be more efficient than others (Aghion and Blanchard, 1998). Private firms are assumed to be more efficient than SOEs and mixed ventures. Private ownership is much more profitable in Central and Eastern European countries as compared to CIS countries (Djankov and Murrel, 2002). Diverse results can be found for one single ownership form. According to Mishari et al. (2012) firm performance is negatively affected by state ownership while Mei (2013) and Trien et al. (2011) concludes that firm efficiency is positively affected by large state ownership.

In developing countries privately owned firms are more efficient than public enterprises (Ramamurti, 1991). At the same time many of the developing countries having low per capita income, lack of entrepreneurial managers, competent executives and capital have less influence from ownership structure whether its privately owned or public (Vernon-Wortzel and Wortzel 1989).Boardman and Vinning (1989) documented the relative performance of Mexican public and private enterprises and find that both SOEs and mixed enterprises are outperformed by private firms. There might be a situation where competitive environment is more decisive in terms of efficiency rather than ownership alone.

Profitability is significantly explained by technical efficiency in Chinese enterprises while these efficiency scores differ in different types of ownership. Joint ventures proved to be more efficient than domestic enterprises (Fung Ka Yin et al. 1999). Murakami et al. (1994) investigated this relationship for Chinese garment industry and find that SOEs and centrally owned enterprises are much less efficient as compare to joint ventures. Burgess et al. (1996) examined the United States hospitals and concluded that efficiency differs under different ownership structure. Military hospitals turned out to be more efficient than non-federal and non-profit hospitals. Examining the performance of firms in India Pradeep et al. (1991) found that foreign ownership exhibit comparatively superior performance. In France, for transport sector, Roy and billion (2005) concluded that public-private partnership will not be a good choice. In a nutshell, international evidence provides us the proposition that foreign ownership is more efficient than private followed by public enterprises.

3.1. Literature Review at International Level

Boardman and Vining (1989) investigated 500 industrial units of United States for the year 1983. They compared the performance of these 500 firms consisting of Private corporations, mixed corporations and State-owned enterprises. Variables chosen for the analysis are total assets, employees, sales, market share and concentration ratio (to control competitive environment). Profitability measures such as ROE (return on equity), ROS (return on sales), ROA (return on assets) and OLS regression have been used for the analysis. Results suggested that in the presence of competitive environment there is difference in performance of private and public firms. Private firms performed better than public and mixed enterprises taking in consideration all other factors. Partial privatization would prove to be bad decision.

Valdmanis (1990) has tried to assess the relative efficiency of public and non-profit hospitals in metropolitan state of America, Michigan for the year 1982. Data has been collected from hospital surveys and has been limited to large hospitals so that environmental differences can be avoided. He tried to explain their relative performance. Data envelopment analysis has been used. Multi-output and multi-inputs are used. Outputs are such as patients (aggregated by age), emergency room visits, acute inpatient days, number of surgeries, inpatient days, number of ambulatory visits and intensive-care inpatient days. Inputs are number of active physicians, medical residents, non-physician labor and nurses, hospital beds (capital) and patient admissions. Results showed that public hospitals were relatively more efficient than the private hospitals. Correlation coefficient is also determined to measure the cost implications and it has been found that hospitals having more efficiency will face lower cost as compare to less efficient. So, the overall results found that public hospitals outperformed the private hospitals.

As the economic reforms (1970) in china has boosted up its economy a lot. So, **Zheng et al. (1996)** tried to discover its impact regarding ownership structure by using Data Envelopment Analysis and found that township and village enterprises are much more efficient than the state-owned enterprises while collectively owned firms are somewhere between them. Data of seven three-digit industries of China was taken from 1986 to 1990. Study contained six main variables like industrial output, productive labor (three categories), productive capital and material. More developed areas proved to be more efficient because of less transportation cost. Non-productive labor has positive relationship with efficiency and highly significant. Management reforms' impact is inconclusive. It has also been proved that small scale collectively owned enterprises are much better than small scale state owned enterprises given that small scale SOE are larger as

compare to small scale COEs. So, scale of production is positively related to efficiency. Business cycle has also proved to have a constructive impression on technical efficiency.

Burgess et al. (1996) examined the effect of ownership structure on technical efficiency of selective US hospitals (FY1988). Data envelopment analysis is used here. Seven inputs such acute-care hospital beds, long-term beds (both as a proxy for capital), licensed practical nurses, registered nurses, clinical labor, nonclinical labor and long-term care labor are used. While six outputs like acute-care inpatient days, long-term care inpatient days, acute-care inpatient charges, number of outpatient visits, inpatient surgeries and long-term care inpatient days are used. Technical efficiency is subdivided in radial, scale and slack efficiency. Different ownership structures have diverse efficiency magnitude. For example, VA hospitals (like military hospitals) are more efficient in terms of radial efficiency as compare to Non-federal and Non-profit. While VA, s are less efficient in scale and slack efficiency. Main reason of this difference in efficiency in different ownership structures is due to incentives that are given to managers of hospitals. So we cannot say that one type is better than other type of ownership. It's just a matter of incentives.

Yanrui wu (1997) used the stochastic frontier approach to assess the economic growth (by decomposing it into efficiency change and technological progress) in china in results of economic reforms (1970). Data is taken from 1981 to 1995 of 27 Chinese provinces. GDP is taken as dependent variable whereas labor and capital stock is supposed to be independent variable. Results revealed that most of the China's prosperity during 1980 was because of technical efficiency and input growths. Moreover, this efficiency has been converged which proves the success of economic reforms. Furthermore after 1990's growth potential in efficiency was exhausted and after that it was mainly due to innovations.

Fung Ka yin et al. (1999) observed the determinants of profitability and its relationship with ownership structure of different enterprises in Shanghai's industrial sector. Panel data of more than two thousand and thirty one firms of Shanghai has been taken from 1989 to 1992. Output is supposed to be dependent on ratio of fixed assets (net to original), original fixed assets' value, labor, materials and technical efficiency index. Fixed effect model has been used for estimation. Results supported the evidence that profitability is significantly explained by technical efficiency while these efficiency scores differ in different types of ownership. Joint ventures have proven to be more efficient as compare to domestic enterprises. But there is a still room for improvement for the joint ventures to maintain a high level of profitability.

Swiss Rail industry is inspected by **Jonatha Cowie (1999)** and it has been categorized as public and private share holdings. Data for Swiss rail industry has been obtained from two sources (individual financial accounts and Swiss federal statistical office) for the year 1997. Output is identified as train kilometer (distance covered) while inputs are labor, capital and land. Data envelopment analysis has been used. Private railways are about 13% more efficient than public which is mostly attributed to managerial efficiency. Private operators have less organizational barriers hence attained higher technical efficiency. Difference in performance can also credited to difference in subsidies given to them. More subsidized part is not supposed to work at its maximum potential.

Sleuwaegen et al. (2001) aimed to check the technical efficiency, economies of scale and firm performance in case of market imperfections. Data is taken from 1995 & 1996 of African country Cote d'Ivoire. Stochastic frontier approach is used to calculate efficiency. Efficiency is being determined by foreign linkages of the firm and its formal status. It is explored that formally registered and foreign firms tend to be more efficient than the other informal firms.

Market imperfections both in product and input market is the main reason behind this as the formal and large firms gained advantaged position as they secure economies of scale. Firms that are in collaboration with foreign ownership found to be more technically efficient as they have relatively less resource constraint. Same is the case with the formal firms. Small firms facing resource constraint usually trap into complex process of competition and are forced to make inefficient use of resources (below PPF) which can be a major growth barrier in many African countries.

Evis et al. (2001) tried to check how the efficiency of firm behaves in different forms of ownership. Data of 2174 Estonian observations from agriculture, manufacture and construction was taken from 1993-1999. Firm's efficiency is supposed to be dependent on ownership structure and many other variables such as competition, soft budget constraint, investment and quality of labor. Determinants of firm's efficiency and its dynamics are investigated by using stochastic frontier approach. Foreign ownership turned out to be most efficient form among employee owned and private sector. Employee owned was at second for manufacturing sector. But at the same time, it can be argued that it was only in the earlier time of privatization in Estonia. For construction and agriculture employee ownership remained at last. The results supported the proposition that outsider private owners are more beneficent than insider owners. It has also been assessed that firm size, foreign ownership and skilled labor increase firm efficiency while soft budget constraint decreases it.

Zuobae Wei et al. (2005) tried to explore the relationship between firm value and ownership structure in China. Data has been taken from the year 1991-2001 for 5,284 partially privatized firms which were state-owned earlier. Assets, sales and return on sales are chosen variables. While ownership structures are State-owned and foreign-owned. OLS and 2SLS

methodologies have been used for the analysis. Tobin's Q and state shares proved to be significantly negatively related to each other and finally form a convex relationship. Foreign ownership and Tobin's Q relationship proved to be positive. Endogeneity between firm value and ownership has also been tested which says causality runs from foreign/state ownership type to firm's value but reverse is not true.

Roy and Billion (2005) study is focused on contractual practices and ownership's influence on efficiency by taking data of 135 French urban transport networks from 1995-2005 and applying stochastic frontier approach. Numbers of vehicles-kilometer is taken as output while inputs are capital (number of vehicles), labor (driving and non-driving) and energy (diesel) and two control variables are length of the network and residents of the city. Estimated results support the supposition that technical efficiency and regulatory constraints both are measured along each other. Technical efficiency is dependent on both ownership structure and contractual agreements. Public operators are outperformed by private operators. Technical efficiency is larger in cost-plus contracts as compare to fix price contracts. Estimates indicate that public-private partnership will prove to be a worst choice in terms of technical efficiency. Moreover, technical efficiency differs along different contracts.

Domestic and foreign firms of India are analyzed by Tripathy (2006) who found efficiency gap between domestic and foreign firms. Output is taken as dependent variable while labor, raw material and capital stock are considered as independent variable. Two techniques Stochastic Frontier Analysis (with Cobb-Douglas) and Data Envelopment Analysis (with variable returns) have been used. Panel data of the years 1991 to 2000 of the manufacturing companies of India has been used and collected from CMIE and ASI. Foreign firms turned out to be more efficient and impact of technology advancement on domestic firms is less decisive as

parent industries are incapable to absorb guest technology which is usually not in align with their own social and economic condition.

Dollar et al. (2007) examined 12,400 firms from 120 cities of China for the years 2002-2004. They tried to explore the difference in marginal returns to capital taking in account different ownership structures (state-owned, private, and foreign), regions and sectors. Variables such as capital, labor, value of output and value of raw material have been taken. Panel regression with ownership and year dummies have been used for the analysis. Results supported the property rights theory as publicly owned firms proved to be having less marginal returns as compare to their private and foreign counterparts. Same is the case with regions and sectors. Some sectors and regions have more capital returns contrary to others. Moreover, there is inefficiency in allocation of capital among different firms and regions.

Diadone et al. (2009) study is about the 108 hospitals in Italy regarding their effect in productive structure and specialization over the period 2000-2005. Data contained inputs: number of beds (proxy for capital), number of physicians and nurses and other staff (proxy for labor). Stochastic frontier approach has been used. Results showed that specialization negatively effects inefficiency while capitalization has positive impact. Capitalization refers to typical private hospital structure using their resources less efficiently as they are over staffed. Results indicated that public and non-profit hospitals are making best use of hospitals.

Dongwei Su and Xingxing (2011) they studied the impact of corporate governance on firm efficiency by considering 744 publically listed firms in china over the years 1999-2006. Four types of ownership structure, ownership concentration, characteristics of board of directors and external governance are taken as the factors affecting efficiency of the firms. SFA and DEA techniques were used having the same results almost. Cobb-Douglas production function is used

for SFA. It has been found that there is a negative relationship in state owned firms and firm efficiency while it's positive for public and employee share ownership. Ownership concentration and firm efficiency follow a u-shaped relationship as shareholders are usually engaged in suspicious undertakings. Board of directors must not be influenced by political authorities as it affects efficiency adversely. It is also evident that as ownership form changes from government to any other form then efficiency increases. Furthermore, the external government development improves efficiency. Improving the governance can improve the efficiency but partial privatization is a major source of inefficiency in China.

Amsden (2011) discussed the contribution of Privately-owned and Foreign-owned enterprises in emerging economies towards their economic development. Although theory of free competition advocated all forms of enterprises so that jobs can be maximized. But the fact is that foreign owned firms usually crowd out domestic firms from the market hence forming a hurdle in the way of country's development. They made domestic firms unable to reap benefits from their own assets. So, these foreign-owned firms are systematically dangerous for privately-owned firms. This paper argued that there is a clear difference of assets in both ownership structures in their respective evolution stages. So foreign enterprises sometime do not contribute more to the development of emerging economies as compare to private enterprises. This phenomenon has also been proved in case of India's Tata, Korea's Samsung and Brazil's Embraer.

Zhang et al. (2011) investigated the relationship between firm's value and ownership structure of Chinese partially privatized firms which were state-owned earlier. Sample size of 5,284 firms has been taken for the years 1990-2001. Institutional, state and foreign shares are taken as three main explanatory variables. Mean values of sales and assets have also been taken

as independent variable. Tobin's Q has been calculated as it is a proxy of growth opportunities of a firm and it is representative of firm's value being a dependent variable. OLS regression and different 2SLS (for endogeneity) have been used in this analysis. According to the results firm value is negatively related to state ownership and finally forms a convex curve. Same is the case for institutional ownership. However foreign ownership and firm value are positively related. So, it can be inferred that if government possess some authority even after privatizing (partially) the firms that would raise interest conflicts between different block shareholders which may decrease firm's growth. Agency problem would add to this phenomenon as managers are mostly appointed on political grounds. However, if government shares decrease this would make private owners more dominant causing an increase in firm value.

Effect of ownership forms has been analyzed by **Noor Aini (2011)** on technical efficiency in automotive industry in Malaysia by using stochastic production frontier for the years 2000-2004. Variables to be used are imports, exports, wages, capital, number of workers, size of establishment, capital to labor ratio, value added to total sale ratio, average wages and net exports to sale ratio. Degree of vertical integration, size of establishments, work force quality, high share of ownership and higher import concentration all has progressive impact on technical efficiency. Ownership alone does not improve technical efficiency unless other mentioned factors operate in full alliance. Size and vertical integration has positive impact on technical efficiency but there is a significant dissimilarity in terms of local and foreign establishments.

Mei Yu (2013) tried to find the relationship between firm's performance and its ownership structure (public). 10,639 listed firms of China during the years 2003-2012 have been examined by using panel data regression. Return on equity, return on asset and Tobin's Q have been taken as dependent variables. While ownership dummies, board salary, total profit, total

assets, debt ratio and firm's size have been chosen as independent variables. Results revealed the U-shaped ownership between firms' performance and state ownership. Political connections and government support makes the state ownership superior to other dispersed ownership structures.

Jehu Appian et al. (2014) examined Ghana's 128 selected hospitals (mission, government, private and quasi government) for the period 2005 to check the technical efficiency's impression. Four types of inputs like number of clinical and nonclinical staff, total recurrent expenditures and number of beds have been used here in this analysis. Whereas four outputs as laboratory test, deliveries, inpatient days and outpatient visits are considered. Data envelopment analysis has been used. Results exposed that about 24% hospitals were operating at the production frontier indicating the full efficiency. Quasi-government hospitals are much more proficient than others followed by public, mission and private hospitals. This difference in efficiencies can be credited to regional differences as 83% hospitals in northern region were efficient while Volta has 45% efficiency score. Moreover, Quasi-government type of ownership has progressive impact on efficiency and private has negative influence.

Gitundu et al. (2015) tried to explore the impact of ownership form on financial performance of some companies in Kenya from 2007 to 2013. ROA, Tobin's Q and cost & technical efficiency (from SFA) were computed. For cost and technical efficiency inputs like ratio of sales to material cost, total assets and total expenses are used while output is computed as total sales. Results revealed that state ownership has negative influence on cost efficiency but has a positive impact on Tobin's Q and returns on assets. Technical efficiency and ROA is positively affected by institutional shareholders while cost efficiency is improved by individual shareholders. Foreign ownership does not have any significant impact on financial performance

of the firms. Ownership structure has a little impact on technical efficiency as it cannot be determined by ownership alone. We need to consider technology and best practice in production.

3.2. Literature at National Level

Kamal and Naqvi (1991) compared the efficiency in public and private sector by analyzing privatization of public sector in Pakistan. Data (1987-1988) regarding different firms (public and private) about their share in GDP, total assets, value of fixed assets, imports, revenue from sale of assets and avoidance of losses, opportunity cost of fixed assets, returns (on fixed assets, paid up capital, total asset, net equity), profits and sales have been taken. Results revealed that administration quality has a more influence on productive and allocative efficiency rather than ownership. Both the private and public firms have performed inefficiently depending on from which industry they belong rather than their ownership structure. They also found that only few establishments accrued losses while most of them were benefitted as a result of being privatized. That profitability was not due to industry protection rather due to high capacity utilization. They also showed that effective rate of protection was low for public establishments and they face competition from international market and private sector as well hence work at their full capacity.

Robert and Peter (1995) tried to explore whether public enterprises are more efficient as compare to their private counterparts in case of all provinces of Pakistan. Basically, they tried to prove Kamal and Naqvi (1991) proposition that public firms are more efficient by some other technique. Data has been taken from Census of Manufacturing industries (CMI) for the year 1985-1986. Data consisted of nine industrial groups and further variables from that has been constructed such as capital per labor cost, value added (per cost of labor, per firm, per worker,

per unit of capital and per industrial cost), industrial cost per unit of labor, industrial cost and capital per worker and labor cost, workers, capital and industrial cost per firm. Every variable is specified according to ownership structure (private or public). Factor Analysis has been used here. Results showed that in all Pakistani provinces private enterprises are outperformed by public enterprises. This is also supported by Kamal and Naqvi (1991). Further contribution of the study is (that it inferred from its Discriminant Analysis) that privatization in unlikely to reduce income disparities in the regions.

Muhammad Saleem (2005) tried to investigate the difference in technical efficiencies of twenty one electricity generating plants (twelve private and nine public) in Pakistan. Six year panel data (1998-2003) has been used for the analysis. Techniques to be employed are stochastic frontier approach and data envelopment analysis. Variables to be used are electricity generated by each plant, installed capacity, time dummy, plant factor, fuel type, fuel consumption and ownership dummy. Results showed that private plants are more stable as compare to public plants due to policy changes that public plants have to face more. Under SFA both trans-log production function and cobb-douglas production function has been tested and former to be proved better than later. Inefficiency explains most of the differences in plants rather to be by statistical noise. Public plants showed significant positive technical changes so that government should take care in privatizing these (although this contrast to DEA results). According to DEA results there is 8.6% decline in technical efficiencies although TFP has been increased. Not a single plant is on PPF. Although we got different results from two methodologies yet DEA results are more realistic. Further Tobit analysis has been done to check ownership impact on efficiency and it has been found that public ownership has adverse effect on it as compare to

private ownership. Production structure of both sectors is not so much divergent from each other so these two sectors can boost up each other if we adjust inefficiencies.

A Burki et al. (2006) inspected the relative efficiencies of banking sector of Pakistan (state-owned, private, and foreign) and impact of financial reforms (1990) on their performance. Data envelopment analysis has been used here to evaluate efficiencies. Data has been collected from annual reports of banks for the years 1991 to 2000. Data consist of all banks (state-owned, private and foreign) that were working at some point in time 1991-2000. Multiple outputs (loans & advances, investment, contra accounts) and inputs (labor, physical capital, financial capital, operating cost) have been used. Results discovered that state-owned banks are outperformed by private and foreign banks respectively. Results also showed that performance of foreign banks was quite better than private banks in first phase (1993-1996) of reforms but it relatively declines in second phase (1997-2000) that might be because of government action to freeze foreign currency. Moreover, it has been found that political influence (non-performing loans) badly effects efficiency and same is the case for extended bank branches.

Musleh-ud-Din et al. (2007) investigated efficiencies of Large-scale manufacturing sector of Pakistan. Two techniques (a) stochastic production frontier (b) data envelopment analysis have been used for efficiency check. Data for 101 industries has been taken from census of manufacturing industries for the years 1995-2000. Variables that are taken care: output of industry, capital, average employed persons in industry, industrial and non-industrial cost. Results showed that although efficiency score has been increased for LSM but its magnitude remains small. Some industries also showed decline in efficiency scores. These results are in line with both techniques which prove its robustness. Increased efficiency can be attributed to economic reforms which promoted imports and foreign investment. Yet there is still room for

improvement in physical, financial and legal framework of Pakistan if we really want to make Pakistan stable in competitive.

Khalil-ur-Rehman et al. (2012) investigated 138 companies listed at Karachi stock Exchange for the years 2008 to 2010. Annual data has been collected for these companies. Firms' performance (shown by Tobin's Q) is taken as dependent variable. Ownership structure (managerial and concentrated ownership) is taken as independent variable while leverage and asset turnover are considered as control variables. Common effect model (a panel data technique) has been used to check relationship between dependent and independent variables. Leverage has negative (insignificant) and asset turnover has positive (significant) impact on Tobin's Q. Results showed that firm performance is significantly and negatively affected by managerial ownership as agency problems arise due to managerial shareholdings. Concentrated ownership has insignificant positive impact on firm performance.

Above chapter has provided the study about ownership structure and its impact on efficiency scores. In light of above studies, it can be argued that ownership structure is susceptible to efficiency scores. Several studies reveal that state-ownership has negative impact on technical and other kind of efficiencies while private and foreign ownership has turn out to be having positive impact. Mostly two techniques have been used for this analysis (a) Stochastic production frontier (b) Data envelopment Analysis. Both techniques have some pros and cons of their own nature. As DAE does not require any functional form but at the same time it overestimates the results by ignoring random errors. SFA however considers random error but it need specific functional form to be incorporated. Following study will use SFA as inefficiency and error term must be separated to get accurate results rather than overestimated ones.

At international level lots of empirical work has been done in order to estimate efficiencies with special reference to ownership structure. Although in Pakistan we do not find such work and this gap must be filled. This study would contribute to the existing literature in the sense that we would examine the technical efficiencies of three-digit industries of Pakistan taking in account different forms of ownership (state-owned, private, and foreign). Since technical efficiencies provide a sound image of firms' performance so that could be used to infer that how much productivity is affected by ownership structure variability.

CHAPTER 4

DATA DESCRIPTION

4.1. Data source and Variables

Data used in this study has been taken from Census of Manufacturing Industries for the years 1991 and 2006. Pakistan Economic Surveys have also been consulted to get data of wholesale price index of these industrial units. Data covers the four provinces of Pakistan for thirty-two industrial groups. Data for Pakistan (2006) is the most recent data available. As this study aimed to calculate technical efficiencies of the manufacturing sector of Pakistan so the following variables have been selected for this analysis:

Table 4.1: Variables

Variable	Nature	Unit
Real Value of Production (1991 as base year)	Dependent	PKR in thousands
Real Value of Fixed Assets (1991 as base year)	Independent	PKR in thousands
Employed Labor	Independent	Annual persons engaged in work
Private ownership	Independent	Percentage
Public ownership	Independent	Percentage
Foreign ownership	Independent	Percentage

Value of the fixed assets has been taken as capital of the industry. It consists of the value of transport equipment, buildings, land machinery, alteration and addition of assets, book value, depreciation and furniture at the termination of accounting year.

Annual number of persons engaged in work is taken as Employed labor per annum. It includes contract labor, production and non-production labor.

Real value of production per annum is taken as proxy for output. It consists of value of all finished products, receipts of work done, by products, receipts of work completed for others and receipts of repairs.

Data for private ownership is taken as the share (in percentage) of privately owned firms in total LSM. Similarly, data of public and foreign owned firms has been included.

Furthermore, to capture the inflationary pressure from 1991 to 2006, wholesale price indices have been used. Pakistan Economic survey has been consulted to get this data. Data of 2006 has been divided by these indices to neutralize our data set.

Summary statistics of the variables used are as follows:

Table 4.2. Descriptive Statistics for the year 1991

	N	Minimum	Maximum	Mean	Std. Deviation
Y(000,rs)	32	38474.00	91736298.00	11745578.1562	19078797.81981
L(daily)	32	24600.00	71478000.00	5844187.5000	12893982.49186
K(000,rs)	32	5402.00	39504464.00	3925620.5313	8236933.94366
Valid N (listwise)	32				

Source: Census of manufacturing industries, 1991

Table 4.3. Descriptive Statistics for the year 2006

	N	Minimum	Maximum	Mean	Std. Deviation
Y (000,rs)	32	19125.00	571259775.00	91504844.2813	124793706.90730
L(daily)	32	16200.00	75364200.00	8314471.8750	15196505.06803

K(000, rs)	32	23828.00	254640831.00	34938608.3125	58889542.72833
Valid N (listwise)	32				

Source: Census of manufacturing industries, 2006

Table 4.4. No. of Establishments

ownership Form	No. of establishments	
	1991	**2006**
Publically owned	186	419
Privately owned	4441	17996
Foreign controlled	21	93
Others (Joint Ventures)	144	873
Total	4792	19382

Source: Census of manufacturing industries, 1991, 2006

Following are the ownership structures of establishments being used in this study:

1. Public Ownership: It is an ownership form in which government completely owns some property, industry or company. Government operates the productive facility for the purpose of provision of foods and services to the citizens.

2. Private Ownership: It is a legal designation for the ownership of property by non-governmental entities. These can be private individuals or organizations.

3. Foreign Ownership: Foreign ownership refers to the state in which resources are owned by the individuals who are not citizens of that country or by the companies whose headquarters are not in the country.

CHAPTER 5

THEORETICAL FRAMEWORK AND EMPIRICAL MODEL

This chapter comprises of two sections. First section provides the theories that testify the relationship between performance and ownership. The proposed methodology is explained in the second section.

5.1. Theoretical and Empirical Framework

Theoretical framework deals with the following issue: How one form of ownership is better in performance than others? Which theories explain why one form of ownership may improve efficiency of firms?

Literature is deep-rooted with the theories providing indication about effect of ownership on organizational performance. Debate on this issue is available in varying conclusions that whether ownership plays vital role in determining efficiency or not? As Tullock identifies the difficulties in recognizing the role that ownership might be important in affecting organizational performance. As by Tullock (1977): "Viewed as black boxes within black boxes, the operation of bureaucracies (governmental or not) is difficult to analyze because it requires identifying and measuring the specific constraints actually faced by the managers of (and within) these nested black boxes". However, two concepts are found in literature- monitoring and property rights – that supports the proposition of differences in performance and efficiency of the organizations is attributed to their relevant ownership structure.

5.1.1. Property rights theory

Efficiency and other performance indicators are affected by ownership structure: this idea is grounded in property rights theory. This approach is related to the law and economics

literature. This was initiated by Coase (1960) following the neoclassical school of thought and further developed by Demsetz (1967). PRT can be defined as a framework of social bodies that describes or delimits the privileges granted to an individual or group of people who owns some specific resources (Kim and Mahoney, 2005). Allowing property rights create profit inducements and different incentives (Alchian, 1965). Profits flow towards the shareholders in for-profit organizations. So, they are inclined to get larger share in revenue by showing great performance by working more efficiently. While on the other side non-profit organizations are restricted from making such disseminations to those who control it (Hannsmann, 1980). Public organizations also have no explicit residual profit claimants. Thus, public and non-profit organizations both have attenuated implication of property rights theory. Said another way profit organizations, or here we can say private enterprises; have incentive to get dividend from revenues so they are bound to perform more efficiently as compare to others. Moreover, Property rights offer "incentives to invest and innovate" that are absent in public sector (Schleifer, 1998).

5.1.2. Monitoring

Idea of ownership and efficiency also comes up from principal agent theory. Behavior of agents is observed more proficiently in private organizations as compared to public enterprises which is used to be possessed with complex political system. Both a weak monitoring and no profit motive end up with insufficient performance in public sector. Discretionary budgets are maximized by bureaucrats rather than the profits that lead to incompetence, overproduction, or some combination thereof (Niskanen, 1975). Bureaucrats usually pursue some other goals - such as greater capital and larger staff - that cause a decline in efficiency. Leibenstien(1966) also developed the concepts of X-efficiency and addressed the issue that some organizations perform below the production possibility frontier because of ineffective monitoring. Theories about

superior performance from public and foreign sector are not explicitly available in literature yet it can be logically supposed that difference of goals in these sectors as compared to private sector can be a reason to take private sector more efficient. At the same time this result contradicts with Greenaway (2009) who explored foreign firms to be more productive.

5.2. Estimation of Technical Efficiencies:

Economic efficiency is defined as ability of the firm to generate an established amount of output at least cost given a state of technology (Farrel, 1957). Economic efficiency has two components; productive efficiency and technical efficiency. Producing output at minimum cost is referred as productive efficiency. While to produce maximum level of output from given inputs is known as technical efficiency (output oriented). There are also some other types of efficiency such as allocative, cost and scale efficiency. Allocative efficiency considers input prices and the best combination of inputs to be used. Cost efficiency is a combination of technical and allocative efficiency. Scale efficiency is a component of technical efficiency, if there are constant returns to scale then it is a competitive outcome which signifies perfect scale efficiency. But if there is increasing or decreasing trend then it's not scale efficient.

Koopsman (1951) presented a formal technical efficiency by defining that a producer is technically efficient if a one-unit increase in one output requires at least one unit decrease in other output or one-unit increase in input and if a one unit decrease in one input entails one-unit increase in other input or a decrease in at least one output.

Likewise, technical efficiency is defined by Debreau (1951) and Farrell as one less maximum equiproportionate decrease in given inputs that still permits continuous production of certain outputs (or equiproportionate increase in outputs with given inputs). Producer is said to be technically efficient having score of unity and technically inefficient if score is less than one.

Farrell (1957) did the pioneer work in estimating the technical efficiency. This method involves the estimation of a frontier against which the performance of productive units can be compared. Following the early work of Farrell many writers devised different techniques to measure technical efficiency. Broadly, these techniques are classified in two groups:

- Parametric Techniques

- Non-Parametric Techniques

Parametric techniques are based on econometric regression models. Usually a stochastic production frontier is used and efficiencies are estimated with reference to that frontier. These techniques require a proper functional form and random errors are allowed in the model. Usual significance tests can be applied to these models. On the other hand, non-parametric techniques do not require any functional form; do not allow for random factors; and all deviations from the frontier are considered as inefficiencies. Consequently, inefficiencies in non-parametric techniques are expected to be higher than those in parametric techniques.

Most common parametric techniques are:

(a) Stochastic Frontier Analysis (SFA)

(b) Thick Frontier Approach (TFA)

(c) Distribution-free approach (DFA)

Some non-parametric techniques are

(a) Data Envelopment Analysis (DEA)

(b) Free Disposable Hull (FDH)

Due to the problem of lack of input substitutability and fail to provide individual efficiency score in some of the above-mentioned techniques, SFA and DEA are the most suitable techniques for our data but we shall go for SFA. Before explaining this measure, we shall first take brief review of input and output-orientation of technical efficiency measurement.

5.2.1. Output-and input-orientations

Input-oriented approach defines the proportional possible reduction in inputs while holding output constant. Whereas output-oriented explains how to increase output while holding inputs constant. Graphically it can be presented as following diagram:

Figure 5.1. Input and Output Measures of Technical Efficiency
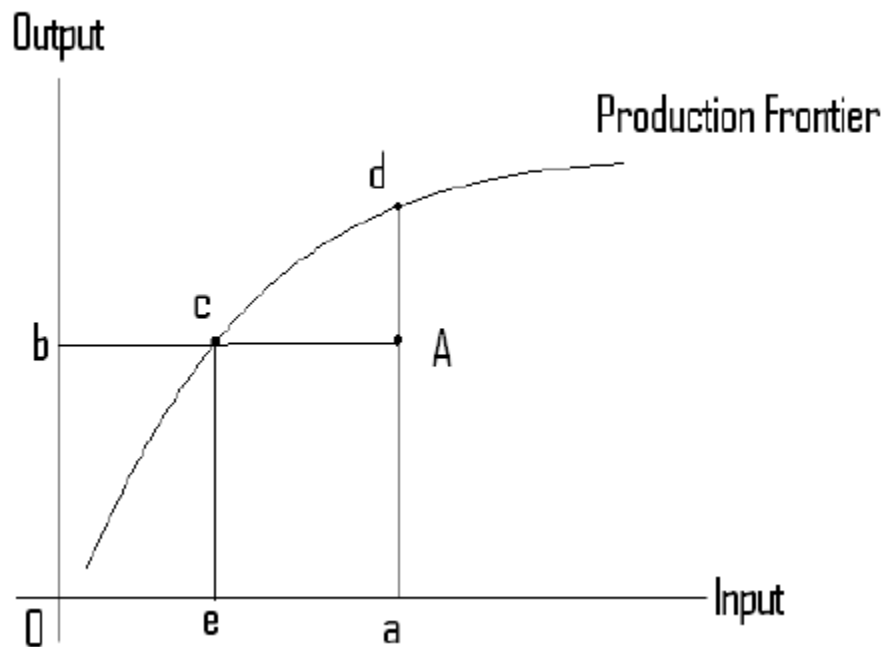
Source: (Coelli, 2005)

In figure 5.1 the curve represents the production frontier. Horizontal and vertical axis show inputs and outputs respectively. Let the actual production point of a producer is A. the

point d represents maximum possible output that can be produced with given input 0a. Output oriented measure of technical efficiency is given by:

Technical Efficiency = aA/ad

At the same time producer can minimize the inputs to produce given level of output, i.e. aA or Ob. In this case optimal production point will be c. The input oriented measure of technical efficiency is given by:

Technical Efficiency = bc/bA

These measures of technical efficiencies can also be related with distance functions in the following way (Coelli et al. 2005 pp.53 & 56):

$$TE_i = 1/d_i \text{ (x,y)}$$

Where TE_i is the input oriented measure of technical efficiency and d_i (x,y) in input oriented distance function. And

$$TE_o = d_o \text{ (x,y)}$$

Where TE_o is output oriented measure of technical efficiency and d_o (x,y) is output oriented measure distance function.

5.3. Methodology

In this study we shall follow output-oriented approach under SFA for technical efficiency measurement as we have limited resources in the form of inputs and have to increase output remaining in that input requirement set.
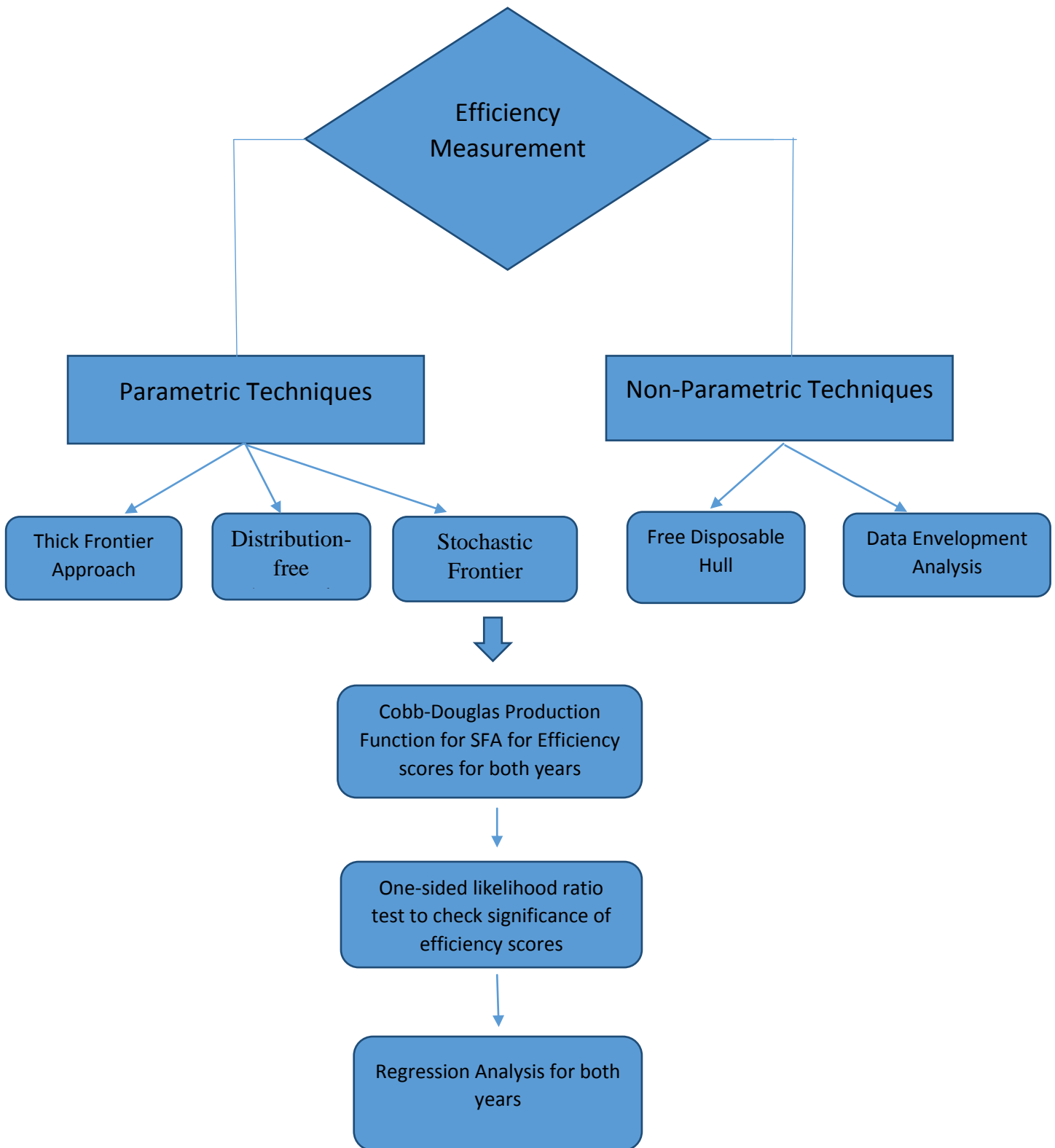
Source: Methodology developed from studying literature

5.3.1. Stochastic Frontier Analysis

The SFA is an econometric technique introduced independently by Aigner, Lovell, and Schmidt (1977) and Broeck (1977). This technique allows the error term to be the part of measurement and all deviation from frontier is not attributed to inefficiency (Bravo-Ureta and Pinheiro 1993, Afriat 1972). Error term of model is divided into two components namely random noise and inefficiency component. SFA requires a functional form, and usual tests of significance can be performed in this technique.

General form of stochastic production frontier is as under:

$$y_i = f(x_i, \beta) + v_i - u_i$$

Where:

y_i is the observed scalar output of the producer i, i=1,.....,I,

x_i is a vector of N inputs used by the producer i,

$f(x_i \beta)$ is the production frontier,

β is a vector of technology parameters to be estimated.

v_i is the random error with usual white noise properties, and

u_i is the non-negative random variable associated with technical inefficiency.

Figure 5.2. Stochastic Production Frontier
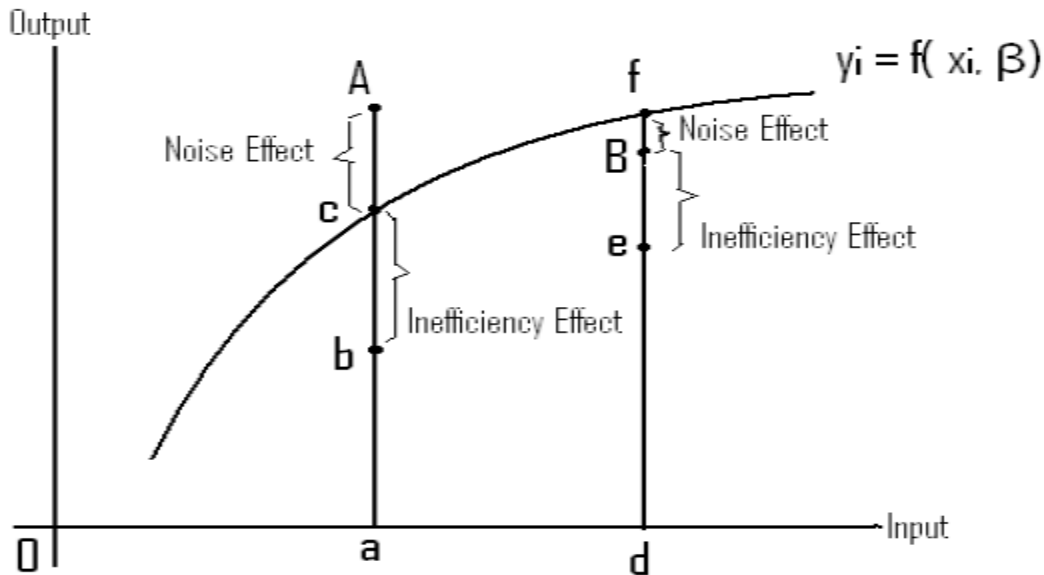
Source: J. Coelli (2005)

The figure 5.2 depicts the stochastic production frontier. The curve in the figure is deterministic part. Actual production points of two producers are point A and B. noise effect is positive at point A, while it is negative at point B. technical efficiencies of the producer A and B will be the ratios ab/aA and de/eb respectively.

Applying OLS to the above model provide consistent estimates of slope but not of intercept. Moreover, we cannot obtain inefficiency scores through OLS (Kumbhakar and Lovell, 2000). This issue can be resolved by applying Maximum Likelihood Estimation Technique to obtain consistent parameters as well as inefficiency scores. The estimates of technical inefficiency will be obtained as a mean of the conditional distribution of u_i given ε_i, where $\varepsilon_i = v_i + u_i$ (Kumbhakar and Lovell 2000).

This study will use the Cobb-Douglas production function for Stochastic Frontier Analysis. The Cobb-Douglas Stochastic Frontier model takes the form:

$$\text{Ln } Y_i = \beta_1 + \beta_2 \ln K_i + \beta_3 \ln L_i + \beta_4 (\text{Public})_i + \beta_5 (\text{Private})_i + \beta_6(\text{Foreign})_i + v_i - u_i$$

Where,

Y= Output

K= Capital

L= Labor

Public= Pubic ownership in percentage

Private= Private ownership in percentage

Foreign= Foreign ownership in percentage

V= error term

U= inefficiency term

By using this model maximum likelihood estimates and inefficiency scores will be calculated for each separate industry. Later on, these inefficiency scores will be checked to be correlated with specific form of ownership.

Different assumptions can be found in literature about the distribution of u_i (inefficiency term). Gamma distribution is proposed by Afriat(1972), Stevenson (1980) used truncated normal distribution while exponential distribution was used by Aigner, Lovell and Schimidt (1977).

However, pointed by Coelli et al. (2003) technical efficiencies are often robust to distributional choice. Error term v_i is normally distributed.

Next step would be then to check the significance of inefficiencies estimated by the model. As suggested by Coelli (1995), a one-sided likelihood ratio test ($\overline{\chi^2} = \frac{1}{2}\chi^2{}_0 + \frac{1}{2}\chi^2{}_1$) with a mixed chi-square distribution will be appropriate. Therefore, Null hypothesis will be rejected if LR> $\overline{\chi^2}$.

Once inefficiency scores are estimated we will check either ownership structure has impact on these scores. For this purpose, we will use Regression Analysis. We have to regress calculated inefficiency scores on forms of ownership to check the impact of these different structures on industry's efficiency:

$$E_i = \alpha_i + \beta PVT_i + \gamma PBL_i + \delta FOR_i + \epsilon_i$$

Where, E=inefficiency scores

 PVT=Private ownership

PBL=Public ownership

FOR= Foreign ownership

α = constant term

ϵ = Error term

CHAPTER 6

RESULTS AND DISCUSSIONS

In this chapter we are deducing our results through Stochastic Frontier Analysis (SFA). The findings of this study based on estimation of Cobb-Douglas of the stochastic production function and estimation of technical efficiencies of different industrial groups by using maximum likelihood statistical procedure. This chapter consists of three sections. Section 6.1 consists of model estimation through SFA, efficiency scores of LSM and regression results for efficiency scores. Graphs of ownership structures are presented in section 6.2 and section 6.3 presents the summary of the results.

6.1. Results

The model is estimated through maximum likelihood estimates and results are presented in the table 6.1. The table 6.1 infer the coefficient values for capital, labor, public, private and foreign ownership structures along with values of error terms (u and v) and gamma(depicting variability in output due to inefficiency) for 1991 and 2006. In row 1 of table 6.1 it is clear that capital significantly and positively affected output both in the years 1991 and 2006 (Gitundu et al. 2015, Din et al. 2007, and Dongwei, 2011). However, the value of coefficient has been increased in the year 2006 (0.2701) as compare to 1991(0.1598) at 5 percent level of significance. This result may indicate that the technological developments made in this era like more capital spent to purchase more advanced machinery which enhanced the output. This result is also endorsed by Burki and Khan (2014) analysis: "traditional labor-intensive technologies have gradually been replaced with more state-of-the-art efficient technologies". For second variable, labor, the values of coefficient are 0.2551 in 1991 and 0.2015 in year 2006 expressed in

second row of table 6.1. Which means influence of labor on output has been decreased in year 2006 and there are some other factors impelling the output. Labor's positive impact on output is also supported by Noor Aini (2011), Musleh-ud-din et al. (2007) and Jonatha Cowie (1999). Although there is a slight difference in coefficient of labor for both the years but it's still positive.

Rest of table explains the ownership structure with respect to its impact on output level. Both private and public ownership structures as compare to joint ventures have negative impact on output of the industry. For public ownership this impact has been decreased from -0.03701 in 1991 to -0.03191 in 2006. Which means public ownership is now having less adverse impact on industry output in the year 2006 as compare to joint ventures. Surprisingly impact of private ownership has become much worse in 2006 as compare to 1991. It was -0.04590 in 1991 and increased to -0.05182 in 2006. This means in the year 2006 privately owned firms have now become more incompetent as compare to joint ventures. This can be inferred that both domestic ownership structures could not fully absorb the adjustments caused by some external events happening around (Sahoo, 2006). Foreign ownership proved to be more profitable as compare to joint ventures in the year 1991 since there were lots of policy relaxations were given to international investors. While it is less profitable in the year 2006. For 1991 its magnitude turned out to be 0.0739 while for 2006 it is -0.0251. for 1991 this coefficient is also larger than the above two coefficients signifying that at that time only foreign owned firms were positively impacting output after joint ventures. Reason being that in this era GOP also initiated market-based reforms through which fiscal and trade incentives were given to foreign investors specifically in manufacturing sector (Khan, 2011). For the year 2006 it is again foreign ownership structure that is comparatively good for LSM after joint ventures.

Magnitude of gamma for both years shows that technical inefficiencies are causing variation in output of industries. The likelihood ratio test gives the value of 21.77 and 19.91 for the year 1991 and 2006 respectively. Both are statistically significant at 5 percent level of significance which implies that stochastic frontier is justified. So, the diagnostic for SFA is fully satisfied.

Table 6.1: Maximum likelihood estimates of Stochastic Production Frontier of Large Scale manufacturer of Pakistan for the years 1991 and 2006

Variables	Coefficient for 1991	Coefficient for 2006
lnK	0.1598** (0.015825)	0. 2701** (0.12901)
lnL	0.2551** (0.13399)	0.2015** (0.0916)
Public	-0.03701** (0.01473)	-0.03191*** (0.01555)
Private	-0.04590** (0.00947)	-0.05182** (0.01253)
Foreign	0.07391*** (0.02964)	-0.0251 (0.98237)
Sigma-U	0.15947 (0.31411)	0.28564 (0.7257)
Sigma-V	0.54584** (0.06878)	0.68086 (0.29432)
Gamma	0.2921** (0.0323)	0.41953** (0.0087)
Likelihood Ratio Test	21.77**	19.91**
Constant	2.45013 (1.58702)	6.5987 (1.62995)

Note: ** and *** denotes significant at 5 percent and 10 percent level of significance.

Table 6.1 shows technical efficiency scores of selected industrial groups, 32, forming large scale manufacturers. It is evident that efficiency has been increased in almost all industries except ginning and bailing of fiber, glass and glass products and scientific and measuring instruments and optical goods. Taking in account ginning industry, remained the most neglected component in textile industry, use of old and inadequate machinery, unfavorable government policies and many other challenges made it inefficient. However, 18 out of 32 industrial groups turned up with sharp increase in efficiency at least more than 30%. While considering the whole LSM it is evident that on average efficiency of this sector has been increased (Musleh-ud-Din, 2007). In our analysis the mean value of efficiency was 19.08 for the year 1991 while it has been increased to 53.0354 for the year 2006 indicating an improvement in efficiency of LSM. This can be attributed to the reforms initiated in late 1980s which were aimed at creating a better business environment for foreign and domestic investors.

Table 6.2: Efficiency scores of Large Scale Manufacturers of Pakistan for the 1991 and 2006

Industry	Efficiency score for 1991	Efficiency score for 2006	Industry	Efficiency score for 1991	Efficiency score for 2006
A. Efficiency increased					
Food Mfg.	35.1	76.01	**Other chemicals**	28.52	31.91
Beverage industry	5.95	29.57	**Petroleum refining**	41.08	90
Tobacco Mfg.	0.13	5.71	**Products of petroleum and coal**	57.42	70.82
Mfg. of Textile	21.81	35.36	**Rubber products**	27.64	82.51

Wearing Apparel	31.36	33.41	Plastic products	31.43	57.22
Leather and leather products	0.99	54.57	Pottery, china and earthen wear	15.49	70.74
Footwear except rubber and plastic	4.01	23.511	Other non-metallic products	18.72	53.27
Wood and cork products	0.04	56.1	Iron and steel	17.5	72.51
Furniture and fixture not metal	0.13	35.03	Non-ferrous metal basic industries	4.58	84.61
Paper and paper products	0.76	74.98	Fabricated metal products	19.43	69.92
Printing and publishing	0.66	79.52	Non-electrical machinery	27.32	60.42
Drugs and pharmaceutical products	0.17	82.87	Electrical machinery	25.82	80.74
Sports and athletic goods	27.63	64	Transport equipment	15.78	87.38
Industrial chemical	11.26	35.46	Handicrafts	10.99	24.01
Other manufacturers	26.19	38.53			
B. Efficiency decreased					

Ginning and bailing of fiber	55.81	9.5	Scientific and measuring instruments, optical goods	33.15	20.57
Glass and glass products	13.74	6.22			
Mean Efficiency					
1991	19.0836		2006	53.0354	

For the year 1991 top five most efficient firms are products of petroleum and coal, ginning and bailing of fiber, petroleum refining, food manufacturing and scientific and measuring instruments. While least efficient firms are wood, wood and cork products, tobacco manufacturing, furniture and fixture not metal, drugs and pharmaceutical products and printing and publishing, however, the situation is somewhat different in year 2006. Top five industries are petroleum refining, transport equipment, non-ferrous metal basic industries, drugs and pharmaceutical products and rubber products. The least efficient industries are tobacco manufacturing, glass and glass products, ginning and bailing of fiber, scientific and measuring instruments and footwear except rubber and plastic. It's quite surprising that ginning and bailing was among top five in 1991 but deteriorated in 2006. Among these groups petroleum refining improved marginally in 2006. This improvement can be attributed to the marvelous steps taken by the government in last quarter of 2004 and onwards for taping the hydrocarbon resources and speedy promotion of the petroleum sector. Moreover, increased foreign ownership in this sector can also be a reason of this much progress.

Now we check the impact of ownership structure on efficiency scores of LSM. Following regression model has been used for this purpose:

$$\ln E_i = \alpha_i + \beta PVT_i + \gamma PBL_i + \delta FOR_i + \epsilon_i$$

Where, E=inefficiency scores, PVT=Private ownership, PBL=Public ownership, FOR= Foreign ownership, α = constant term, ϵ = Error term

Table 6.4 shows impact of ownership structure specifically on the efficiency scores. For the year 1991 all three ownership structures have negative impact on efficiency. Week institutional arrangements made these structures almost redundant. While for the year 2006 these ownership structures are positively affecting efficiency scores of LSM. 1 percent increase in private ownership causes 0.051 percent increase in efficiency in the year 2006. And for public and foreign ownership these are 0.05 and 0.10 respectively. So, it can be inferred that in 2006 efficiency of the firms were increased as compare to 1991 since coefficients turned to be positive and ownership structure have implications for this increased efficiency.

Table 6.3: Regression results for efficiency scores

Lneff	1991	2006
PVT	-0.0222***	0.05135**
	(0.01244)	(0.0204)
PBL	-0.01585***	0.05012***
	(0.00718)	(0.01067)
FOR	-0.1543***	0.10543**
	(0.07521)	(0.049822)

Constant	4.3016 (5.02452)	2.4652 (2.0233)
R-Square =	0.4561	0.5682
Adjusted R-Square =	0.4021	0.4921
Root MSE =	0.3812	0.5012
P > F =	0.5579	0.0900
No. of observations	32	32

Note: ** and *** denotes significant at 5 percent and 10 percent level of significance

6.2. Transition of ownership Structure from 1991 to 2006:

Since 1991 to 2006 lots of transition has been taken place in manufacturing sector of Pakistan. As privatization embarked upon in late 80's and still it is going on. Following graphs show that how ownership structure in selected industrial groups has been changed during 1991-2006.

Fig 6.1. Private ownership
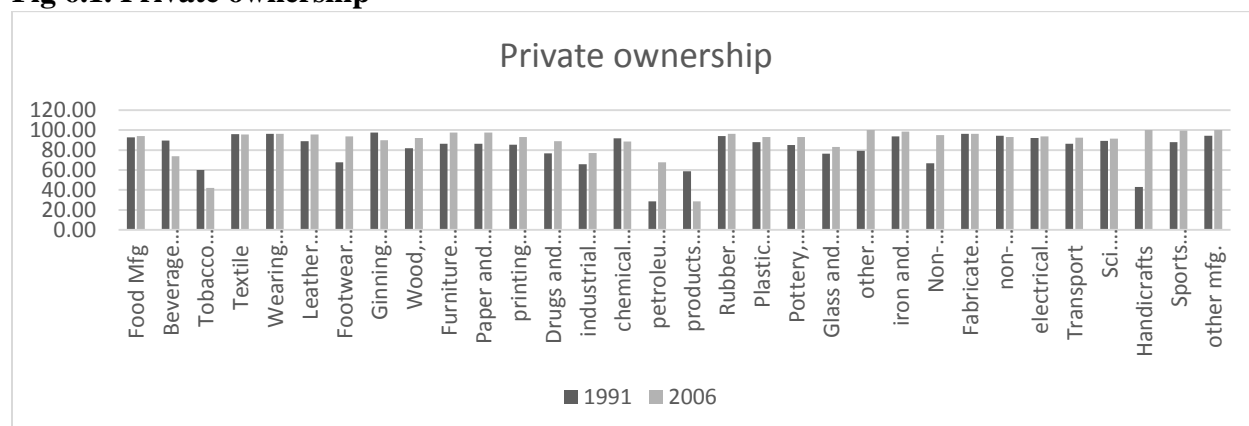
Source: Census of manufacturing industries, 1991, 2006

According to the figure in most of the groups private ownership has been increased however this increase is not a major one. Only beverage industry, tobacco, ginning and bailing of fiber, industrial chemical and products of petroleum and coal showed decline in private ownership.

Fig 6.2. Public Ownership
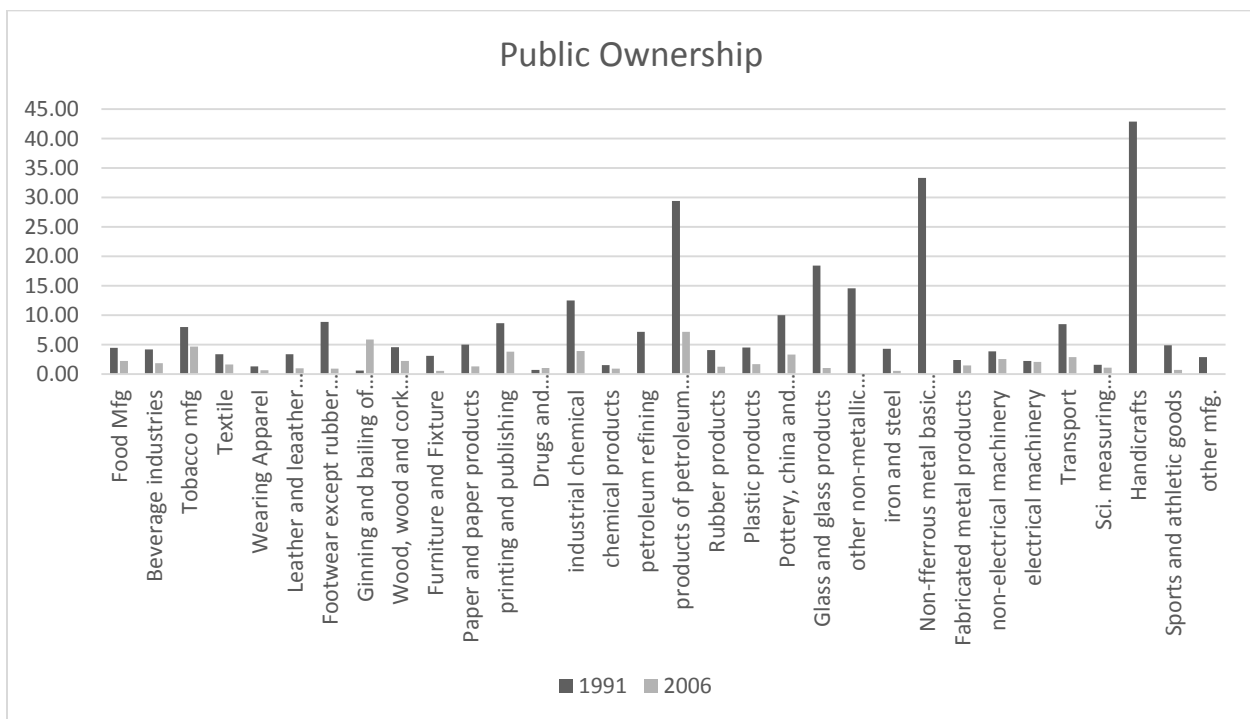
Source: Census of manufacturing industries, 1991, 2006

Public ownership has been decreased in almost all industries in LSM. It has been increased only in Ginning and Bailing of fiber. Reason could be that, this sector was going in loss to that extent that no private sector was ready to own it.

Fig 6.3. Foreign ownership
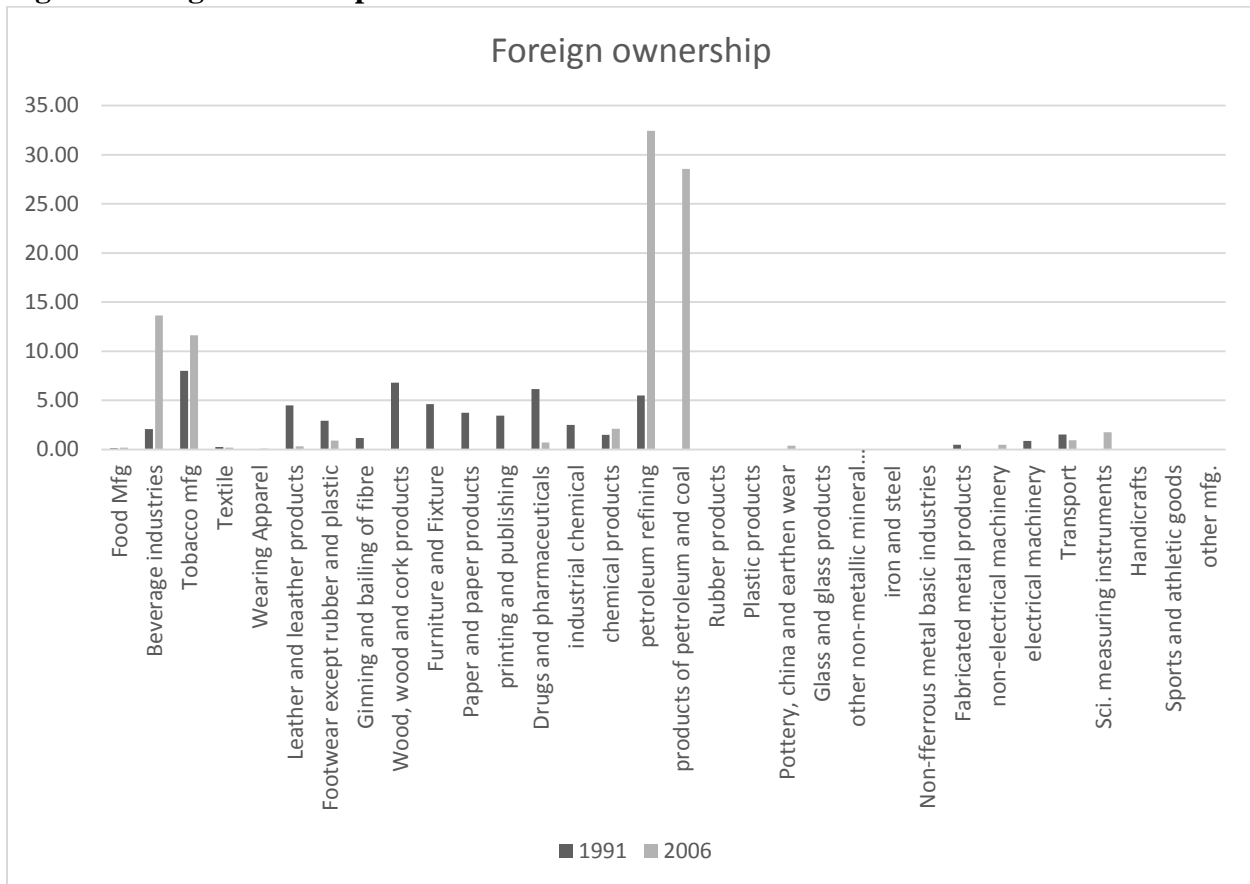
Foreign ownership

Source: Census of manufacturing industries, 1991, 2006

Graph shows foreign ownership is absent in some of the firms. Whereas manufacturing plants having increased foreign ownership also experienced increased efficiency.

6.3. Summary

The whole analysis exercised above can be summarized in a nut shell by saying that efficiency has been increased in LSM. Total 32 groups were analyzed and 29 out of them turned out to be having increased efficiency. Whereas efficiency has been decreased in only three groups.

Table 6.4: Efficiency Account

Total Industrial Groups	Efficiency Increased	Efficiency Decreased
32	29	3

Taking in account the ownership structure this could be inferred that private ownership has been increased with slight differences. Public ownership has been decreased while foreign ownership is absent in most of the groups. While those having increased share of foreign ownership also experienced increased efficiency. Furthermore, these ownership structures thus have some implications for LSM. They are impacting performance of LSM.

CHAPTER 7

CONCLUSION AND POLICY RECOMMENDATION

7.1. Conclusion

The main objective of this thesis is to determine whether industrial efficiency is affected by ownership structure or not. Furthermore, it has been checked that how the ownership structure has been changed over the years in Pakistan. For this purpose, Maximum likelihood estimation technique has been used for stochastic frontier Cobb-Douglas production function to estimate technical efficiency.

To achieve the objectives of the study data for 32 Large Scale Manufacturers (LSM) has been collected from Census of Manufacturing Industries for the years 1991 and 2006. Regression analysis for the years 1991 and 2006 reveals that private, public and foreign ownership structures significantly affect output of the industry. Maximum likelihood estimates explored the positive impact of capital on output for both years although this impact has been improved over the years. This may be due to the reason that more availability of capital led to purchase of advanced machinery causing output to grow. Similar is the case for labor that is positively affecting the output but its magnitude has been decreased in 2006 indicating that capital intensive techniques have been replaced labor intensive methods. All ownership structures came up as an important determinant of industry's output but surprisingly private and public ownership are negatively impacting the output as compare to joint ventures. Although for public ownership structure, this impact has been decreased over the years but in case of private ownership this has become much worse. In all this scenario foreign ownership is just like a relief and depicting a better picture of LSM as it is performing better than private and public sector and positively impacting output.

This research also explored that efficiency has been increased in almost all industries except three (ginning and bailing of fiber, glass and glass products and scientific and measuring instruments and optical goods) out of total industries. Use of old and inadequate machinery, unfavorable government policies and many other challenges made ginning and bailing industry inefficient. However, 18 out of 32 industrial groups turned up with sharp increase in efficiency at least more than 30%.Among these groups petroleum refining improved marginally in 2006. This improvement can be attributed to the marvelous steps taken by the government in last quarter of 2004 and onwards for taping the hydrocarbon resources and speedy promotion of the petroleum sector. Moreover, increased foreign ownership in this sector can also be a reason of this much progress. While considering the whole LSM on average efficiency of this sector has been increased. Mean efficiency for the year 1991 remained at 19.08 while it has been increased to 53.0354 for the year 2006 indicating an improvement in efficiency of LSM. This can be attributed to the reforms initiated in late 1980s which were aimed at creating a better business environment for foreign and domestic investors.

Regressing efficiency scores on ownership structures revealed that all structures are negatively impacting efficiency in 1991 whereas for the year 2006 these coefficients turned out to be positive for 2006. So, increased efficiency scores for the year 2006 are quite justified here. So it can be inferred that in 2006 efficiency of the firms were increased as compare to 1991 since coefficients turned to be positive and ownership structure have implications for this increased efficiency.

Private ownership has been increased in almost all of the industrial groups except beverage industry, ginning and bailing of fiber, tobacco, industrial chemical and products of

petroleum. Public ownership has been decreased in all industries while foreign ownership structure has also increased.

7.2. Policy Recommendations

Our analysis about ownership structure regarding efficiency reveals that ownership structure affects the efficiency level of LSM in Pakistan. The results of table6.33 Endorse ownership structure have mixed results on efficiencies. As in 1991 it negatively affects efficiencies of LSM while in year 2006 all the ownership structures turned out to be positive. So, we may recommend following policies for the ownership structure that might affect efficiencies as well as output of LSM:

- Since lots of privatization has already been done in LSM and its impact on productivity has also improved over the time, so now there is a need to focus monitoring and evaluation of this sector which would ensure better utilization of resources.

- Public sector is to be made more responsible for the releases that they are being provided since a soft budget constraint is the main reason behind their negligence that's why their performance is not at their optimum level.

- Since foreign ownership structure turned out to be most efficient among all the ownership structures. So joint ventures may be initiated to reap maximum benefit from international skills and resources that they have already practiced.

- Another important aspect being neglected by local industries from many folds is trust level which has been practiced by international companies not only in case of employees' incentives but also quality of products. So local industries may enhance their trust level for their employees as well as for the products that they are being producing.

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Appendix

A.1. List of the industries included:

1. Food manufacturing

2. Beverage industries

3. Tobacco manufacturing

4. Manufacturing of textile

5. Wearing Apparel

6. Leather and leather products

7. Footwear except rubber and plastic

8. Ginning and bailing of fiber

9. Wood, wood and cork products

10. Furniture and fixture not metal

11. Paper and paper products

12. Printing and publishing

13. Drugs and pharmaceutical products

14. Industrial chemicals

15. Chemical products

16. Petroleum refining

17. Products of petroleum and coal

18. Rubber products

19. Plastic products

20. Pottery, china and earthen wear

21. Glass and glass products

22. Other non-metallic mineral products

23. Iron and steel

24. Non-ferrous metal basic industries

25. Fabricated metal products

26. Non-electrical machinery

27. Electrical machinery and supplies

28. Transport equipment

29. Scientific and measuring instruments, photographic and optical goods

30. Handicrafts

31. Sports and athletic goods

32. Other manufacturer

A.2 Ownership structure of establishments:

Table A.1. Private Ownership Share in %

	1991	2006		1991	2006
Food Mfg.	92.78	93.96	**products of petroleum and coal**	58.82	28.57
Beverage industries	89.58	73.64	**Rubber products**	93.88	96.3
Tobacco mfg.	60	41.86	**Plastic products**	88.06	93.03
Textile	95.88	95.74	**Pottery, china and earthen wear**	85	92.94
Wearing Apparel	96.15	96.37	**Glass and glass products**	76.32	83.17
Leather and leather	88.76	95.54	**other non-metallic**	79.09	100

Industry	1991	2006	industry	1991	2006
products			mineral products		
Footwear except rubber and plastic	67.65	93.58	iron and steel	93.58	98.38
Ginning and bailing of fiber	97.65	89.89	Non-ferrous metal basic industries	66.67	95.12
Wood, wood and cork products	81.82	92 0.18	Fabricated metal products	96.21	96.17
Furniture and Fixture	86.15	97.66	non-electrical machinery	94.21	93.03
Paper and paper products	86.25	97.42	electrical machinery	92.04	93.85
printing and publishing	85.34	93.18	Transport	86.15	92.4
Drugs and pharmaceuticals	76.71	88.91	Sci. measuring instruments	89.23	91.49
industrial chemical	65.83	77.11	Handicrafts	42.86	100
chemical products	91.79	88.53	Sports and athletic goods	87.8	99.34
petroleum refining	28.57	67.53	other mfg.	94.29	100

Source: Census of manufacturing industries, 1991,2006

Table A.2   Public Ownership Share in %

Industry	1991	2006	industry	1991	2006
Food Mfg.	4.42	2.19	products of petroleum and coal	29.41	7.14

Industry	Value 1	Value 2	Industry	Value 1	Value 2
Beverage industries	4.17	1.82	**Rubber products**	4.08	1.23
Tobacco mfg.	8	4.65	**Plastic products**	4.48	1.68
Textile	3.33	1.63	**Pottery, china and earthen wear**	10	3.29
Wearing Apparel	1.28	0.62	**Glass and glass products**	18.42	0.99
Leather and leather products	3.37	0.96	**other non-metallic mineral products**	14.55	0
Footwear except rubber and plastic	8.82	0.92	**iron and steel**	4.28	0.54
Ginning and bailing of fiber	0.59	5.83	**Non-ferrous metal basic industries**	33.33	0
Wood, wood and cork products	4.55	2.23	**Fabricated metal products**	2.37	1.44
Furniture and Fixture	3.08	0.52	**non-electrical machinery**	3.86	2.54
Paper and paper products	5	1.29	**electrical machinery**	2.21	2.05
printing and publishing	8.62	3.79	**Transport**	8.46	2.85
Drugs and pharmaceuticals	0.68	1.02	**Sci. measuring instruments**	1.54	1.06
industrial	12.5	3.87	**Handicrafts**	42.86	0

chemical					
chemical products	1.49	0.93	**Sports and athletic goods**	4.88	0.66
petroleum refining	7.14	0	**other mfg.**	2.86	0

Source: Census of manufacturing industries, 1991,2006

Table A.3. Foreign Ownership Share in %

Industry	1991	2006	Industry	1991	2006
Food Mfg	0.12	0.19	**products of petroleum and coal**	0	28.57
Beverage industries	2.08	13.64	**Rubber products**	0	0
Tobacco mfg	8	11.63	**Plastic products**	0	0
Textile	0.26	0.21	**Pottery, china and earthen wear**	0	0.4
Wearing Apparel	0	0.1	**Glass and glass products**	0	0
Leather and leather products	4.49	0.32	**other non-metallic mineral products**	0	0
Footwear except rubber and plastic	2.94	0.92	**iron and steel**	0	0
Ginning and bailing of fiber	1.18	0	**Non-ferrous metal basic industries**	0	0
Wood, wood and cork products	6.82	0	**Fabricated metal products**	0.47	0

			non-electrical machinery	0	0.47
Furniture and Fixture	4.62	0	non-electrical machinery	0	0.47
Paper and paper products	3.75	0	electrical machinery	0.88	0
printing and publishing	3.45	0	Transport	1.54	0.95
Drugs and pharmaceuticals	6.16	0.73	Sci. measuring instruments	0	1.77
industrial chemical	2.5	0	Handicrafts	0	0
chemical products	1.49	2.11	Sports and athletic goods	0	0
petroleum refining	5.49	32.43	other mfg.	0	0

Source: Census of manufacturing industries, 1991,2006