RENT SEEKING AND ECONOMIC EFFICIENCY OF SELECTED MANUFACTURING INDUSTRY IN PAKISTAN

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ALLAMA IQBAL OPEN UNIVERSITY, ISLAMABAD
2016
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Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics at the Department of Economics, Faculty of Social Sciences and Humanities, Allama Iqbal Open University, Islamabad 2016
In the name of Allah, Most Gracious, Most Merciful
Dedicated
to my loving Parents
for the Inspiration that I drew from them,
and
to my dearest Brothers
for the Contribution they have made to my
career.
DECLARATION

I, Humayun Rashid, son of Haroon Rashid, Roll No. R-842105, Registration No. 02-PRI-0195, a student of PhD at the Allama Iqbal Open University do hereby solemnly declare that the thesis entitled: Rent Seeking and Economic Efficiency of Selected Manufacturing Industry in Pakistan, Submitted by me in partial fulfillment of PhD degree in Economics is my original work, except where otherwise acknowledged in the text, and has not been submitted or published earlier and shall not, in future, be submitted by me for obtaining any degree from this or any other University or institution.

Signature:

Name: Humayun Rashid
FORWARDING SHEET

The thesis entitled *Rent Seeking and Economic Efficiency of Selected Manufacturing Industry in Pakistan*, submitted by Humayun Rashid, Roll No. R-842105, Registration No. 02-PRI-0195, in partial fulfillment of PhD degree in Economics has been completed under my guidance and supervision. I am satisfied with the quality of student’s research work.

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ACCEPTANCE BY THE VIVA VOCE COMMITTEE

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Dated: 10-02-2016.
The study attempts to empirically establish whether rent seeking diverts industries to non-maximizing direction resulting in lower efficiency scores and hence impaired performance of the economy as a whole. Technical and allocative efficiency scores of six manufacturing industries have been calculated using stochastic frontier analysis and data envelopment analysis on a pooled data for the year 1982 to 2005. Subjective evidence from previous studies about collusive rent seeking practices has been incorporated in the methodology. A hypothesis has been tested whether rent seeking causes inefficiency. The results show that industries with subjective evidence of collusive rent seeking empirically prove to be rent seekers with lower technical and allocative efficiency scores compared to fair industries.

Hypothetical results prove that Sugar, Cement, and Automobile Manufacturing industries are involved in collusive rent seeking due to which their efficiency scores are significantly lower than fair industries which include Paints, Beverages and Fertilizer industries. In industries affected by rent seeking, profit-maximization approach is replaced by rent-maximization where the entrepreneurs lose interest in increasing productivity and resources are wasted to form collusive bodies to control market factors and have supportive regulations. To offset this affect, protection as well as privatization policies may be formulized carefully and regulatory bodies may be re-structured and neutralized to ensure that rent seeking monopolistic cartels are not formed and as a result a competitive environment is developed.

The study recommends that industries may be supplied with cheaper and abundant energy sources for higher efficiency. Labor-intensive production policies may be implemented as the country is abundant in labor supply. Industrial policies by Federal Government should be based on the recommendations of Planning Commission of Pakistan and these policies should be implemented to full extent. Lastly, the public-sector manufacturing and service enterprises should be re-engineered to develop a competitive industrial environment between public and private sectors as this competitive industrial environment would outsmart non-maximizing rent seekers.
ACKNOWLEDGEMENTS

Beginning with the name of ALLAH Almighty, the most beneficent and the most merciful. I am His humble creature, indebted by His blessing of knowledge, which He bestowed upon me with this accomplishment. The everlasting quest to seek knowledge, and to excel in achieving it lies in every soul inherited from our beloved Holy Prophet MUHAMMAD (Peace be upon him), “Seek Knowledge, for even if you need to travel to China for it”.

This thesis was developed out of a series of discussions with my supervisor Dr. Usman Mustafa, as I was not confident in the beginning about what lied ahead. In fact, I am highly inspired by his scholarly intuition, logical reasoning, and his ability to interpret the thinking to his pupils. It was only Dr. Mustafa who gave tangibility to my flying ambitions. He has got, for sure, a great mind with a greater heart. This work could have never been possible if I attempted it alone, or with somebody else.

I am highly indebted to Dr. Rashid Naeem, Chairman Department of Economics, for his guidance, support, and kindness throughout my course. Being a student of the first batch of PhD Economics Program, I am highly inspired by Dr. Naeem’s tremendous leadership and his high level of dedication for development of the Department of Economics. His time to time connection with the students keeps them in right direction and ensures the quality of output. I feel myself very lucky to have been under his realm.

Higher Education Commission (HEC) supported me in an incredible way for this research work. I am very much grateful for all the support and contribution HEC extended to me with an excellent coordination and feedback. This work could never have been possible without their support.

I am highly thankful to Mr. Asif Khan, for his relentless support throughout my career. I always draw inspiration from him and his input for this work is too much to be admitted by my little words. In fact, this sea of knowledge belongs to him for his kindness, support, and encouragement. I am very much grateful to my colleague Mr. Nadeem Farooq, for his support and guidance throughout the thesis, especially for the Mathematical Modeling. I am very thankful for his ever smiling words that gave me courage to discover the unknown islands of knowledge.

I cannot forget the support and motivation of my uncle Mr. Tariq Javed, for being a source of motivation and setting the ever higher targets. It was due to his motivational words that I kept going through thick and thin, sick and sin.

I am highly grateful to all the faculty and especially the staff of Department of Economics at Allama Iqbal Open University, for their support, and encouragement. I am very much obliged to Dr. Muhammad Ilyas for his kind contribution in the final shaping and corrections.

I am really thankful to Dr. Tariq Mehmood at PIDE for his valuable guidance in the development of methodology and modeling, Mr. Javed and Dr. Usman Ahmad at PIDE for their supports. In fact these people from PIDE played a major role to refine my raw thinking. I am thankful to my friend Dr. Aamir Khan for his valuable time and support.
I am highly indebted to my class fellow Mrs. Ghazia Mahwish, for her terrific support during the preliminary development of this work and for the inspiration of being ever-positive minded even in the darkest times.

I am very thankful to my wife, son, & daughter for their vital contribution in the form of time and care. The years, it took me to write this thesis were all theirs. It was only possible due to them that I completed this work with all peace of mind. I dedicate this work to them and to all my family members, for their most sincere supports and never ending prayers.

Last but not least, my special thanks to brother Junaid Jamshed for his everlasting inspiration and support from whom I started to understand the philosophy and equation of life. This work is dedicated to him for being an example for us youth. May ALLAH bless us all with a peaceful heart.

HUMAYUN RASHID.
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<tr>
<td>A.E.</td>
<td>Allocative Efficiency</td>
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<tr>
<td>APCMA</td>
<td>All Pakistan Cement Manufacturers Association</td>
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<td>CMI</td>
<td>Census of Manufacturing Industry</td>
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<tr>
<td>DEA</td>
<td>Data Envelopment Analysis</td>
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<tr>
<td>E.E.</td>
<td>Economic Efficiency</td>
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<tr>
<td>FBS</td>
<td>Federal Bureau of Statistics</td>
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<td>FDI</td>
<td>Foreign Direct Investment</td>
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<td>LSM</td>
<td>Large Scale Manufacturing</td>
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<tr>
<td>NG</td>
<td>Natural Gas</td>
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<tr>
<td>OLS</td>
<td>Ordinary Least Squares method</td>
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<tr>
<td>PSMA</td>
<td>Pakistan Sugar Mills Association</td>
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<tr>
<td>PIA</td>
<td>Pakistan International Airlines</td>
</tr>
<tr>
<td>SFA</td>
<td>Stochastic Frontier Analysis</td>
</tr>
<tr>
<td>SNGPL</td>
<td>Sui Northern Gas Pipeline Ltd.</td>
</tr>
<tr>
<td>T.E.</td>
<td>Technical Efficiency</td>
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<tr>
<td>TCP</td>
<td>Trading Corporation of Pakistan</td>
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<tr>
<td>TFP</td>
<td>Total Factor Productivity</td>
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CHAPTER 1

INTRODUCTION

1.1 Overview

Over the last 150 years, rapid technological development in the western part of the world has triggered the industrialization process in the whole world. Industrialization can be defined as a process of social and economic change that transforms an economy from its agrarian form into an industrial form. Industrialization is part of a complete transformation process in which social change and economic development occur as a result of technological innovation with the development of large-scale energy and metallurgy production. It is a re-organization of an economy for improving the manufacturing processes (Sullivan and Sheffering, 2003).

The industrialization process that started in the western world eventually led to the industrial revolution. The industrial revolution is considered, in true sense, the phase between the 18th to the 19th century when important advancements occurred in agriculture, manufacturing, mining, transportation, and technology. These developments brought vivid effects on the socio-economic conditions and laid deep impacts on culture of the economies during that time. Apparently, the industrial revolution started in the middle of 18th century with a transition from manual labor and non-mechanized process shifting towards mechanized manufacturing. It was based on transformation in textile industries, new techniques of molding and forging metals, and use of pulverized coal. Inter regional trade
was expanded by the development of infrastructure such as introduction of canals, improved roads and railways (Morison, 1966)

This industrial revolution has entirely changed the face of developed world. Today, in these developed countries, new products and services continuously replace and substitute existing products because of extensive research and technological development. This technological development has also improved production processes and techniques bringing higher productivity and better economies of scale. However, some of the developing countries have not yet been able to take much advantage of this technological development, as in case of Pakistan where the focus primarily remained on agricultural growth despite of the preceding discussion on technological development that ultimately transforms an agrarian based economy to an industrial based economy (Islam, 2000)

Therefore, it is imperative to identify and address the hurdles on the path of industrialization process in developing countries. This study focuses on the problems associated with the industrialization process in Pakistan. Various structural problems have been identified in the studies conducted earlier to analyze the performance of manufacturing industry of Pakistan such as lack of diversification, allocative and technical inefficiencies, poor quality of products, and low levels of research and development which eventually lead to lower levels of productivity. However, the present study attempts to identify the presence of rent seeking and its negative impact on the efficiency of the manufacturing sector of Pakistan (Kemal, 2007).
Rent seeking can be defined as investment (or wastage) of resources by a group of firms (herein called a cartel) into unproductive lobbying activities, to achieve cheaper profits by controlling the market factors, instead of achieving profits by improving productivity. It is the re-distribution of resources from productive activities towards unproductive activities.

1.2 Historical Background of Industrial Sector in Pakistan

1.2.1 From 1947 to the end of 1950s

In 1947, Pakistan had practically no significant industrial base. The only products with significant levels of production were Cigarettes (240 Million in 1948-49) and Cotton Fabrics (45 Million Yards in 1948-49). The manufacturing sector of Pakistan consisted of a few units of Refined Sugar, Edible Oil, Blended Tea, Cement, Textile and Cigarette industries. The manufacturing sector contributed only 1.8 percent to GDP. However, a substantial industrial sector developed in a short period. In the 1950s, this sector grew at a rate of 7.7 percent.

This was a result of the policy of import substitution, aided by high wall of tariff and quantitative restrictions on imports, and later through the growth of domestic and foreign demand. The industry policy during this period promoted manufacturing of the products made of locally available raw material such as cotton, jute, and others, which already had a promising domestic and foreign market. This helped to develop the consumer goods industries to meet the domestic demand.
1.2.2 The 1960s

During the early 1960’s, Pakistan experienced rapid and sustained economic growth and political stability. Overall GDP growth averaged over 6% per annum, with annual growth of about 5% in agriculture and 10% in manufacturing. The manufacturing sector saw an accelerated growth of 9.91 percent. This was mainly due to liberal import policy, subsidy to exports, and other attractive schemes such as export bonus scheme, tax rebates, tax exemption scheme, etc. Protection rates were higher which resulted in excessive profits for the producer, thereby providing a strong base for industrial development. However, military regime discouraged international competitiveness and foreign investment.

1.2.3 The 1970s and 1980s

During the 1970’s, however, the performance of manufacturing sector declined. The growth rate of this sector reduced to 5.5 percent. However, during this period, the government invested a significant portion of its financial resources on nationalization of industry consisting of cement, fertilizer, oil refinery, chemicals and engineering. Moreover, the introduction of Profiteering and Hoarding Act created some barriers such as price control by the government which led to a considerable amount of uncertainty. These two major policy implications resulted in a decline of private direct investment and capital flight. However, on the whole, the political regime of 1970s gave sure footing to the manufacturing sector.

Following these policies, Pakistan was expected to be self-sufficient in cement, sugar and nitrogenous fertilizers, and was believed to have a substantial capacity to produce steel and
convert it into machines and other capital goods with the onset of 1980s. The challenge of the 1980’s lied in exploiting this potential. If these capacities had operated efficiently and at high levels of utilization, the country was expected to experience rapid industrial growth. The industrial policies continued to focus on de-regulation, de-control and de-nationalization and some other policies were also adopted to help re-gain the trust of investors. Market oriented forces were allowed to work replacing the old administrative controls. Prices were de-controlled and tariff structure was rationalized. As a result, the industrial units took sure footing in the 1980’s. Factories operated at a high utilization rate and earned profits. Public sector units were operating efficiently, and private investors invested optimistically. These market friendly policies took growth rate to 8.21 percent.

1.2.4 The 1990s

The 1990’s brought a different fate to industrial sector of Pakistan. A number of factors caused the growth of manufacturing industry to fall to an alarming 3.88 percent. These factors included global recession, which seemed to be badly hitting developing countries. Fossil fuel prices quadrupled after the U.S.-Iraq War in the Gulf. Cost of production multiplied likewise. Unstable political conditions, deteriorated security situation in the major industrial zones of the country, and reduced protectionism lead to shutting down of many industrial units. Financial crises were strong enough to force banks to pull back their credits. Many other factors included inadequate power supply with frequent breakdowns and rapidly rising prices of energy in the second half of 1990 resulted in very low levels of (Foreign Direct Investment) FDI and domestic investment. As a result, industrial estates, which were once intensive sectors of economic activity, became desolate places. Public
sector units although operated, but went under huge accumulated losses which are apparent on their income statements even as of today. International financial embargoes after atomic explosions as well as military takeover by the end of 1990s led Pakistan to deep financial crises and created domestic and external budgetary imbalances.

1.2.5 Present Scenario

The growth rate has gradually improved since year 2000 averaging around 9.4 percent up to the year 2005-06. However, the growth has not been due to FDI or domestic investment, but due to improved telecommunication sector, as well as due to increases in demand in the form of credit for purchase of consumer durables which were a result of easy credit policy. Moreover, a sharp increase in exports was seen after the quota restrictions were removed by the foreign markets (Diwan and Hamid, 1986) and (Kemal, 2007).

The situation of industrial sector in Pakistan today, needs attention. Most of the major public sector enterprises, such as State Cement Limited, Pakistan Industrial Development Corporation (PIDC), have been shut down and the rest such as Pakistan International Airlines (PIA), State Engineering Corporation (SEC), are working in the worst of conditions buried under heavy accumulated losses. There are multiple problems being faced by the manufacturing sector of Pakistan such as inappropriate industrial and trade policies, lower levels of productivity, inferior quality of products and services, high cost of production, absence of regulatory framework and a less developed infrastructure. Imported Products in the form of Chinese/Thai goods is another threat to domestic industry. Above all, energy crisis is one of the greatest problems of Pakistan’s industry. Almost all of these
factors have contributed to induce rent seeking in the manufacturing sector of Pakistan, which is focused in this study.

1.3 Statement of the Problem

Measurement of economic efficiency of industrial sector is one side of complete micro analysis. The other side is to identify and analyze the main obstacles which hamper efficient operation of firms. Many studies have been conducted to measure economic efficiency of manufacturing sector in Pakistan. However, need is felt to identify rent seeking as one of the major cause behind the poor performance of industrial sector. Besides hampering the performance of industrial sector, rent seeking also causes consumer exploitation in the form of control on market factors and regulations, as is being witnessed in the case of some essential commodities such as sugar and cement. In other words, there exists a gap between the scope of studies already conducted to measure the performance of manufacturing sector, and, the current study which identifies and captures rent seeking as one of the major reasons behind the poor performance of industrial sector.

1.4 Scope of the study

The scope of this study is vast and manifold. Economic efficiency of selected industries of Pakistan’s manufacturing sector is measured. In-efficiency is captured by the leakages in the form of rent seeking. The key objective of this research is to identify rent seeking practice in the selected industries, then to measure the impact of rent seeking and finally proving that rent seeking is seriously hampering technological development in these
industries, restricting their efficient operation and hence badly affecting Pakistan’s industrial development.

1.5 Objectives

1.5.1 General Objectives

1. To calculate economic efficiency of the following industries of Pakistan’s manufacturing sector:
   i. Sugar
   ii. Cement
   iii. Automobile Manufacturing
   iv. Beverages
   v. Fertilizers
   vi. Paints

2. To identify the current situation of rent seeking behavior in selected manufacturing industries.

1.5.2 Specific Objectives

1. To develop an appropriate method for quantification of the economic and social cost of rent seeking.

2. Based upon these evaluations suggest measures for improvement in the economic efficiency of selected industries of Pakistan’s manufacturing sector.
1.6 Hypotheses

The following hypotheses would be tested in the study:

1. All industries in selected manufacturing sector are technically efficient and no signs of inefficiency exist.

2. Technical efficiency of Fair sectors equals technical efficiency of Rent Seeking sectors.

3. Allocated Efficiency of Fair sectors equals allocative efficiency of Rent Seeking sectors.

4. Establishment of cartels leads to rent seeking behavior.

5. Industries requiring huge capital investment tend to be rent seekers as compared to those requiring small capital investment.

1.7 Organization of the study

The organization of this study is as follows. Objectives of the study and hypotheses follow immediately after this section. A detailed review with critical and comparative analysis of relevant literature on measurement of efficiency and identification and estimation of rent seeking is conducted in Chapter 2. This helped to develop a theoretical background, trace out the statement of problem and to propose a further course of action.
Chapter 3 is based on the methods and techniques to test the hypothesis in order to achieve the desired objectives. This chapter encompasses the research design, population, sample, research tools, data collection methods, and statistical tests leading to final model. A preliminary analysis has also been conducted in this chapter to analyze the structure and historical growth in each industry.

Chapter 4 is based on the presentation and analysis of data. Results of econometric model have been calculated and a discussion is made on the results from technical and allocative efficiency analysis. After the results have been calculated, a detailed industry-wise discussion on results is presented to compare the extent of rent seeking in each industry. In Chapter 5, summary and conclusions of the study are presented. Major findings, policy recommendations and suggestions for further research are proposed.
CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction
This chapter begins by defining basic concepts on economic efficiency, as the first objective of the current study is to measure the efficiency scores of various industries in manufacturing sector. Economic efficiency is defined as a product of technical efficiency (TE) and allocative efficiency (AE). In current study, a firm is considered to be technically efficient if its productivity is higher with a given set of inputs as compared to other firms, while a firm is considered allocatively efficient if it chooses the right input mix to produce a given level of output with least set of inputs. Measurement of economic efficiency has been carried out by reviewing the studies conducted on measurement of economic efficiency. After this, the next section of this chapter focuses on various studies about identification of rent seeking to address the problems associated with measurement of rent seeking. Reviews in this study are based on the pioneering work done by the renowned scholars such as Farrell on technical efficiency and Krueger on rent seeking. However, later developments have also been focused as devised by various scholars such as Tullock, Coelli, Aigner, Chu, Forsand and Hjalmarsson.

2.2 Literature Review on Technical Efficiency
A number of attempts were made in the past to measure the productive efficiency of industrial sectors. Mehta (1950), discusses a question which is often asked whether efficiency of an industrial unit can be quantitatively measured, and if so, what should be
the standard of measurement which can be applied with reasonable accuracy. It may be
generally agreed that the absolute measurement of efficiency is neither feasible nor
practicable. However, the relative efficiency of different units can be measured with
reasonable accuracy.

The word “efficiency” as it is commonly understood, is a relative term, and a particular
unit is quoted as “efficient” or “inefficient” not absolutely but in relation to some other
units. It, therefore, pre-supposes some existing standards of valuation. Viewed in that
perspective, it is believed that such efficiency can be quantitatively measured, if not with
scientific exactitude, at least with reasonable accuracy. The serious difficulty, therefore,
arises mainly in the choice of selecting some suitable standards. The suitability of any unit
of measurement will depend much upon the significance attached to the word “efficiency”.
Labor productivity per worker, or to put in more scientific term, labor productivity per man
hour (P.M.H.) may be regarded as a satisfactory criterion for measuring industrial
efficiency.

If, however, the term “efficiency” is used in a more comprehensive sense, meaning a
“measure of securing the greatest results at least cost” then “Cost of Production per Unit
of Output” can be regarded as a most satisfactory and reliable standard of efficiency. An
industrialist will, however, view “efficiency” from some different perspective. His aim is
to produce goods with as much profit as can be obtained in the prevalent circumstances,
and from that standpoint his success will be judged by his “earning capacity”. Rate of profit
can, therefore, also be one of the standards of measuring “efficiency”. If, however, the
word “efficiency” is to be used in its widest sense, it will connote a higher standard of living for the worker, lower prices for the consumers and greater returns to investors. The following standards of measurement can be used for comparing the industrial efficiency of different units: i) Earning or “Profit-making” capacity of different units, ii) Labor Productivity Per-Man-Hour (P.M.H.), and iii) Cost of Production per Unit of Output, the lower the cost, the greater is the industrial efficiency.

However it was not until Farrell (1957) that methods for measurement of productive efficiency were devised for the first time. Farrell argues that the need for measurement of productive efficiency was highlighted that for a better economic development in industrialized economies, it should be known as to how much output can be expanded only with a change in efficiency without increasing inputs. Farrell has further stated in the paper that a linear homogenous production process is assumed and using only two factors, capital and labor to produce a single output. If the technology is represented with an isoquant, it allows one to measure productive efficiency relative to the standard set by the isoquant.

The Figure 2.1 shows a unit isoquant denoted $QQ'$. The isoquant $QQ'$ represents the various input combinations of two factors of production that a perfectly efficient firm may use to produce a single unit of output. Any point to the right above $QQ'$ such as $J$ is infeasible, while any point to the left below such as $D$ is inefficient. The point $R$ represents the inputs of the two factors of production per unit of output for the observed firm.
The point $E$ represents an efficient firm that uses two factors of production in the same ratio as the observed firm $R$. The firm at point $E$ also produces the same level of output, but by using a fraction $OE/OR$ as much of each factor. Hence the ratio $OE/OR$ is defined as the technical efficiency of the firm $R$. The technical efficiency index (bounded between 0 and 1) is an input based measure that is the ratio of best practice firm’s input usage, to the actual usage of subject firm, subject to the output held constant.

Figure 2.1 Technical and Allocative Efficiency Measures

Considering the figure depicted above, and assuming that a competition exists in the input market, it is seen that the relative factor prices can be represented by isocost line $PP’$. The inputs set analogous to $E’$ minimizes the cost of producing the unit output. Farrell defined and provided a measure for the allocative efficiency (AE) of a production organization which is independent of technical efficiency. Allocative efficiency involves the selection
of an input mix that allocates factors to their highest valued uses. In the figure, allocative efficiency can be defined by the ratio \( OB/OE \).

At the isoquant \( QQ' \), the most efficient production point is \( E' \) due to the fact that the distance \( BE \) (cost) can be eliminated without compromising in quantity of output. Economic efficiency is a product of technical efficiency and allocative efficiency and can be defined as:

\[
EE = TE \times AE = (OE/OR) \times (OB/OE) = OB/OR
\]

2.1

Where

- \( EE \) is Economic Efficiency
- \( TE \) is Technical Efficiency
- \( AE \) is allocative Efficiency.

Forsund and Hjalmarsson (1974) in their study on the “Measurement of Productive Efficiency” with the objective to base efficiency measurements on specified theoretical concepts to ensure correct interpretations for economic policy. However, the problem is not to bring the existing structure close to the best practice structure at some point in time, but to optimize a process that is going on continuously. The concept of efficiency moves around the performance of the process of transformation of inputs to outputs. However, it is a relative concept, and not an absolute. First, a standard performance is defined and then a subject performance is compared to judge the level of efficiency.
The choice of specific efficiency measures depends on the purpose of measuring. Efficiency measures are usually applied at three levels: i) The macro level ii) The micro level and iii) The industry level. The production functions can be conceived of as describing observed technologies of the establishments or hypothetical production possibilities. A natural reference or standard for efficiency measures within the industry is the best-practice or frontier production function. The frontier production function is made up of those parts of the establishments' production functions that yield maximum production (output) with a fixed level of inputs relative to establishment production functions specified for the industry (Aigner and Chu, 1968).

A special case is that one establishment function is identical with the frontier function. The frontier function is continuous if the establishment functions are continuous, but not necessarily differentiable at every point. There are three distinct types of efficiency measures: Technical efficiency, scale efficiency and price- or allocative efficiency. If the establishments' production functions all are homogeneous of degree one, the first and last measure can be studied in the input coefficient space. Assuming that the production functions have the same substitution properties (i.e. the isoquant maps coincide) ensures that one of the production functions represents the frontier function and the efficiency frontier. The transformed isoquants collapse into a single curve in the input coefficient space.

Following Farrell (1957) technical efficiency may be estimated by comparing the observed input coefficient points for an establishment with the input coefficients on the efficiency
frontier for the same factor proportions. In the study, empirical estimates were obtained using two different approaches. The first one was the Farrell’s Index and the other was developed from linear programming approximation of a frontier production function specified in the Cobb-Douglas production function. The data file was compiled primarily from Brazilian Individual firm data for 1971 assembled and published by Visão. While this survey is not exhaustive, the major firms for the Brazilian plastic and steel industries are represented. The null hypothesis was tested, that there is no significant difference in technical efficiency according to firm ownership for either the plastic or steel industries cannot be rejected. Foreign firms do not appear to be more significantly efficient than domestically owned private firms, nor do government firms appear to be less so. Evidence of substantial relative technical efficiency is revealed. It is found that in both plastic and steel industries, there were only a few firms which were producing at more than 80 percent level of efficiency.

Further, it was found that efficiency was not significantly related to ownership of the firm. However, larger firms, having larger market shares, had a tendency to be closer to frontier than the smaller firms. Results show that the intercept for the frontier is higher than for the average production function. The analysis suggests that widespread inefficiency exists in both types of industries. This can be considered as evidence of substantial X-Inefficiency. For the Brazilian Steel Industry, the measured levels of technical efficiency were quite low. The averages over all steel producing firms with the Farrell index of technical efficiency were 0.57. The case was same with plastic industry; the variances around these means were
rather higher. Firms can evidently operate in both industries with very high degrees of x-Inefficiency.

Kopp (1981) presented his paper in four sections. The first section reviewed the original contribution by Farrell, focusing on the choice of an efficiency standard. Contemporary efficiency standards derived from frontier functions are discussed in the second section. The third section proposed a series of Farrell-type efficiency measures utilizing frontier functions, and the fourth section illustrated the empirical application of the measures with a numerical example of electric power generation. Utilizing frontier functions as efficiency standards allows for the relaxation of homogeneity and homotheticity assumptions on the best practice technology and thus raises the generality of the efficiency measures. The potential applicability of the generalized Farrell efficiency measures is wide indeed. While it is clear that the original Farrell methods based upon the efficient unit isoquant are overly restrictive, the author demonstrated in this paper that the underlying measurement concept was easily generalized to non-homothetic technologies and capable of extension into several auxiliary efficiency measures. However, due to the radial nature of the Farrell measurement concept, strong input disposability was assumed for the measurement of technical efficiency and strict quasi concavity for allocative efficiency.

Anandaligam and Kulatilaka (1987) derived a technique by which production efficiency can be decomposed into three components. First one is allocative component, second is technical component and finally a structural component. The first two are within the control of firm, while the last one is determined by economic environment. The methodology was
implemented by estimating the restricted cost frontier solving a cost minimization problem to infer the efficient cost frontier and measuring all efficiencies along the same ray through the origin of the input quantity space. The paper presented a measure of efficiency that is additional to the usual Farrell indexes of production efficiency. Structural inefficiency is due primarily to the environment external to the firm’s production activities. Identifying and estimating structural inefficiency would be important for analyzing industrial performance. Because structural inefficiency was primarily due to external environment, in cases where structural efficiency was higher, it would be necessary to set up government policy to overcome these rigidities. In addition, structural efficiency measures provided an additional feature for international comparisons of industrial efficiency and productivity.

It had been believed that in the recent past that Japanese industry was more efficient than U.S. industry primarily because the former could adjust faster to changes. It would be imperative to identify structural inefficiency in order to resolve this issue. However the actual cost frontiers were recommended to be estimated in order to obtain correct inefficiency results. For purpose of illustrating efficiency, the authors used the time series data on U.S. manufacturing constructed by Berndt and Wood (1975). This data set covered a period from 1947-1971 and consisted of prices and expenditures of the four aggregate production factors which include capital, labor, energy and materials.

The authors estimated a restricted cost function using a full information maximum likelihood method technique and tested the resulting function for monotonicity and curvature conditions. For the purpose of this paper, the authors scaled several parameters
of the “practice” frontier cost function with imposed convexity to make it appear as if it were a frontier. In particular, they altered the intercept term in order to make the convex ‘hull’ (envelope) of all data points. This operation displaced the cost function in a neutral way and did not change the curvature of the cost function.

Battese and Coelli (1993) define stochastic frontier function to be a model based on panel data of firms in which technical inefficiency appears as a non-negative function of firm specific variables with means which are a linear function of firm specific variables and with constant variance. Technical efficiency is calculated using maximum likelihood estimation (MLE) and generalized likelihood ratio (LR) is tested for null hypothesis. The stochastic frontier production function accounts for inefficiencies existing in production function for producing a particular output. It is assumed that realized production of a firm lies above as a sum of parametric function having known inputs. This production is subject to some unknown parameter and random errors such as weather, strikes, etc. Therefore inefficiency is reflected when the realized production function is below the stochastic frontier model. The inefficiency frontier model depicts time varying inefficiency effects and technical change. The study concludes that inefficiency effects appear as a linear function to firm specific variables as well as time as an additive stochastic error which is assumed to be independent along time and amongst the firms.

Ghosh and Neogi (1993) examined (i) the impact of advanced technology which is proxied by rising K/L ratios in Indian industries on the efficiency of factor use, and (ii) the factors influencing labor productivities across industries. Technological change in the industry
usually includes the following: (i) Advancement in technical knowledge gained through import of capital goods, (ii) Progressive change in technology of production of the firms operating in the LDCs which import the goods and technology and convert them to suit their domestic condition, and (iii) Up-to-date skills and techniques regarding scientific management. In the LDCs there is a practice to import advanced technology from the developed nations but adaptation of this technology to local conditions requires continuous research involving huge time and other expenditures. Results show that Indian Industries embarked upon the path of technology up-gradation leading to explicit preference for capital-intensive techniques. Study suggests that in countries having industrial advancement, use of latest technology and innovative drive by leading firms brings technological change. This makes efficiency a relative concept.

However, in an LDC, since majority of the firms are inefficient, comparison with best practice firm is neither applied, nor or any use. In the present context, where one is dealing with industry level data, the concept of average production function is quite appropriate for measuring changes in efficiency between different time periods. In this study, it has been iterated that a production technique is efficient if the productivity locus moves upward due to implementation of new technology. The immediate conclusion is that Indian Industries are fast becoming more and more capital intensive without any significant positive impact on productivities. The low efficiency in the manufacturing sector of LDCs is due to a number of factors. Some of these factors are (i) Management Quality, (ii) Skill, (iii) External Factors, such as reliability and quality of Input Supply, (iv) Transportation and Communication Facilities, (v) Rate of Tariff Production, (vi) Degrees of Internal
Competition. The adoption of new technology which is essentially capital intensive might result in efficient use of resources if the appropriate technology could be found out through Research and Development. To sum up, this study suggests that unless a well-defined industrial policy in consonance with indigenous factor endowment and technological potential is launched, overall industrial development including efficient utilization of resources cannot be achieved even with moderate growth of output.

Coelli (1996) describes Data Envelopment Analysis (DEA) as a technique which involves linear programming to construct a piece wise surface on data. Technical efficiency is then calculated relative to that surface. The author introduced a computer program DEAP in the cited study to calculate technical and allocative efficiency scores. This program has been used in current research. The author states that usually the efficiency measurement methods assume that the production function is known. However, this is not the case in real world and an efficiency isoquant has to be estimated from the given data. This gap is covered by using a non parametric piece wise linear convex isoquant constructed in a way that no observed point is missed. This is called data envelopment analysis technique. The aforementioned computer program can be used in three situations (i) to estimate DEA models for calculation of efficiency under constant returns to scale (CRS) or variable returns to scale (VRS), (ii) To further extend these models for measurement of scale and allocative efficiencies and (iii) To calculate Malmquist index on panel data capturing changes in total factor productivity (TFP). In current study the DEAP program has been used for the first and second options.
Coelli (1996) describes a computer program FRONTIER which calculates maximum likelihood estimates for all commonly used stochastic frontier and cost functions. The main idea about stochastic frontier analysis has already been elaborated earlier, however this paper focused on using FRONTIER program, which has been used in current study to estimate efficiency scores. FRONTIER program is capable of handling a variety of data such as panel data, time varying and invariant efficiency scores, cost and production functions, and other functional forms employing the dependent variable in original or logged form. However, the program cannot be used for gamma or exponential distributions. The program has been used in the current study for Battese and Coelli (1995) specifications to estimate a stochastic production function for a panel data having firm effects assumed to be distributed as truncated normal random variables. The program measures efficiency scores from estimated stochastic production function. The value of calculated efficiency scores falls between zero and one, interpreted as percentage of efficiency.

Baldwin and Cave (1998), identified empirical evidence on three effects of international competition on performance of domestic industries. The first finding is that exposure to international trade (especially import competition) tends strongly to limit domestic industries departures from ideal price-cost margins while trade restrictions loosen this discipline of firm effectiveness. The other aspect is that international competition reduces inefficient production in domestic firms. Again, trade barriers allow departures from efficiency. The study also identified a third effect of international competition, the turbulence within domestic industries, measured in terms of entry and exit of firms, the turnover among incumbents, and the frequency of changes in control of business units, that
increase with trade exposure after controlling (partially) for industry and time fixed effects. It was found that the closeness of relationship varies among broad industry groups in a way consistent with the model of international competition that rests on trade in differentiated products. It was found that the North American Free trade Agreement (NAFTA) in 1989 provided the evidence of disturbance needed to induce increased turbulence. However, it was also highlighted that turbulence from international trade has welfare benefits as well, as they help bring continuous economic change, with international disturbances serving to deliver innovations in products, services, their qualities and varieties, and in managerial and organizational behaviors.

Oguchi et al. (2002) compare the total factor productivity of domestic and foreign firms in Malaysia’s manufacturing sector. They argue that it is widely recognized that foreign direct investment (FDI) caused rapid economic growth in most of the Asian countries between the 1970’s to 1990’s. Malaysia opened doors for foreign investment actively to speed up its economic growth during the same years. Transfer of technology is a major advantage of foreign investment. In countries receiving FDI, there are not only improvement in productivity but other benefits also follow. Yet no direct effect of foreign investment on productivity has been empirically proved. In this paper, the TFP of foreign and domestic firms were compared in Malaysian manufacturing industry. It was found that on average, there was no significant difference, although there was significant variation across sub-sectors. In some of the leading sub-sectors, where there has been large FDI in recent years—such as electrical and electronics, petroleum, and transport equipment—it was found that the foreign-owned firms were more efficient. Out of 28 three digit level sub-
sectors, domestic firms were more efficient than foreign firms in only six. Thus in many sub-sectors it was found that foreign firms were more efficient. From these findings, it may be concluded that FDI did improve productivity and enhance efficiency.

Heshmati (2003) wrote a paper on Productivity, Growth, Efficiency and Outsourcing in Manufacturing and Service Industries of USA. The study was on the whole a review of the development of the relationship among outsourcing, efficiency and growth in manufacturing and services and its input to the same. It aimed at providing a careful and up-to-date study that gives a considerable debate on the data and main methods of measurement of efficiency. In the first phase, diverse parametric and non-parametric approaches to efficiency estimation of the relation among innovation, the new economy and growth accounting and productivity were thrashed out. Moving on the next stage, a study was conducted on economic advance in efficiency analysis. It was preceded by a debate of the concerns relating to modeling and methods of estimation. At third stage, the association between sub-contracting and efficiency in manufacture and service sector was assessed to scrutinize a relation between employment, wage rate, research and development and on hand empirical conclusions. Instances about concerned empirical functions of different methods to area of investigation, the results thereon and impact were provided.

In conclusion, a discussion was conducted on estimation techniques employed on input and output analysis in manufacturing and services area. It was recommended by the author that analysis should rather by performed on micro-level stage and be comprised of pooled data for illustrations of a firm or producer. It is because pooled data possesses the lead that, in
addition to measurement of productivity and efficiency, it permits to analyze the unseen heterogeneity and sequential patterns of performance. In the case of measuring the performance of firms, the author proposes perfectly recognizing and evaluating the result of alterations in organization and production outline on performance, and control for particular qualities of inputs, output, production strategies and other firm/producer traits. Intimate resemblance between the manufacturing as well as service sector let for the remodeling and application of awareness concerned with the performance dimension of the goods are to service sector activities.

Baten et al. (2006) investigated the technical efficiency of choiced manufacturing industries in Bangladesh by employing the stochastic frontier production function developed by Battese and Coelli (1992) on pooled data and using Cobb-Douglas stochastic frontier production function, with time anecdotal technical inefficiency effects. Unconventional distributions have been employed to estimate unsystematic inefficiency term with a truncated normal distribution and a half normal distribution. The estimates for time-varying inefficiency parameter ‘η’ were observed positive for the truncated as well as the half normal distribution. These indicated that technical efficiency had receded in the observed period. Tests proved to be significant for different null hypotheses involved in the technical inefficiency effects for the selected manufacturing industries in Bangladesh. Computer Program Frontier 4.1 was used to obtain the estimates of technical efficiency for various industrial units.
It was found that the mean efficiency for the truncated normal distribution was 0.4022 ranging from 0.0033 to 0.6979, and the mean efficiency was 0.558 and the range was 0.017 to 0.895 for half normal distribution, implying a 40.22 percent and 55.57 percent of potential output was obtained for target industrial sectors. It was implied by the mean technical efficiency using either of the forms of distribution that these industries were not performing on full utilization. Presence of inefficiency was also confirmed by the hypothesis tests. The technical efficiency improved for either type of distributions in every type of industry. The mean efficiency increased from 1981-82 to 1999-00. Firm-wise efficiency estimates, however, show significant departures. The half-normal distribution gave higher technical efficiency estimates than the truncated distribution. Along with, it has been proposed that though the growth in technical efficiency appeared statistically significant over time as hypothesized, the pace of improvement in technical efficiency remained quite passive in Bangladesh.

Bosworth and Collins (2007) devised growth accounts for China and India to empirically compare their economic growth. The paper reveals that although China developed at an astonishing, but India’s performance has also been promising. However, the approach of both the countries has been different. China targeted consumer goods industry and hence gained high levels of development, while India focused on services industry. A Cobb-Douglass production function has been tested with fixed factor shares incorporating the contribution of labor, capital, education and total factor productivity for the three sectors of agriculture, industry and services, and the aggregate economy as a whole. The results provide evidence of almost equal division in each country between the contributions
of capital accumulation and total factor productivity to per worker growth in output between the years 1974 to 2004 and an acceleration in growth after 1990s. However, it was found that the magnitude of growth of China is double to that of India as a whole as well as on the selected sectors. The results further show that in China, 60 percent of the aggregate growth was contributed by development in industry. Whereas, in India, 45 percent of the aggregate growth has been due to growing services sector.

O’Donnell (2009) devised an aggregate price-quantity framework to reveal large classes of total factor productivity indexes which are further divided into measures of technical change, technical efficiency change, mix efficiency change and scale efficiency change. It was discovered that there are at least as many decompositions of TFP growth as there are points in the production possibilities set. However, a few of them are of significant importance. It is important to note that these decompositions do not depend upon assumptions about market structure; hence they are applied for industries where market competition or regulatory bodies fix prices, or, in case of monopoly, by the firm itself. Further, there may not be a requirement of constant returns to scale assumption. An critical finding of this article is that it questions the authenticity of Malmquist TFP Index by arguing that it is neither additively nor multiplicatively complete. The paper further throws a light that the Moorsteen-Bjurek Index can be divided into various measures of efficiency change and technical change, regardless of the returns to scale and scope properties in the given technology of production.
O’Donnell (2010) further proceeded on the work O’Donnell (2008) using a methodology to divide Lowe Indexes of TFP change in U.S. Agriculture for the years from 1960 to 2004 on spatial and temporal basis. DEA technique was applied for estimation of separate production frontiers a data of ten farm level production regions marked by USDA-ERS. It was found that the main drivers behind TFP change over the time series of 45 years were technical change, scale and mix efficiency change. California and Florida states were discovered as highest productive as well as profitable, while Texas went through 40 percent rise in productivity because of technical change and 32 percent increase in productivity because of economies of scale and scope. This resulted in total productivity increase of 85 percent. In Tennessee, a net increase of 70 percent was observed wherein technical progress increased by 122 percent, technical efficiency improvement increased by one percent, while diseconomies of scale and scope amounted to -24 percent.

O’Donnell (2011) recommends the use of Multi-Factor Productivity Change Index (MFPI) that provides answers to all economically relevant tests from index theory and they may be separated to measure technical and efficiency change. Findings of paper reveal that the prime reasons behind change in productivity are scale and mix efficiency change. This supports the theory that most firms are technically efficient and rationally change production plans with changes in prices. Results of the study show that the U.S. manufacturers experienced technical progress at an average annual rate of only 0.189 percent, while most sectors were technically efficient but scale-mix inefficient. Other results show that productivity in Machinery and Electrical Equipment, Appliances and Components sectors fell by 4.5 percent and 9.4 percent respectively over the sample period,
whereas productivity in these sectors increased by 9.9 percent and 13.5 percent respectively. Fare-Perimont MFP Indexes were used while coherent estimates of the components of productivity change were introduced. These estimates were named coherent because they can be combined to form a recognizable MFP Index.

### 2.3 Studies on Efficiency from Pakistan

Kemal (1978) examined that there were considerable differences in the growth rates of productivity in different manufacturing industries during the 1970s. There were a few sectors wherein productivity declined which include paper, chemicals and non-metallic mineral products. Whereas, some sectors came up with exceptionally high growth rates of productivity which include leather, rubber and miscellaneous industries. The paper concluded that since Pakistan pursued import substitution policy in the 1960s, it lead to improvement in productivity and enabled domestic producers to compete in the world market. The productivity gains mainly increased the returns to production factor especially the return to capital. To analyze the hypothesis that protection results in the persistence of inefficiency, the authors estimated growth rates of productivity, using the ratio method and production function. Inefficiency was defined as excess of social costs of production over prices. A model was estimated which equaled normal profits, depreciation, shadow wages and value of non-traded inputs in the absence of protection.

The results proved a positive relationship between effective protection rates and inefficiency, but the relationship between inefficiency and concentration did not appear to be statistically significant. It was deduced that in Pakistan excessive protection might have
resulted in X-inefficiency. The results of the paper found sugar industry to be inefficient as compared to world sugar industry in the selected sample. The author argued that sugar industry may not be technically inefficient but since it uses domestically produced sugar cane for which Pakistan had a comparative disadvantage. This result was inline was other studies conducted at that time.

Kemal (1996) examined transitions in the level of efficiency of firms due to privatization policy of Pakistan. It has been stated in the paper that privatization may lead to inefficiency because in some cases public intervention is necessary to regulate the monopolist. A model has been tested to check whether privatization has led to an increase or decrease in productivity. In the model, growth rate of output in the post privatized period of industrial sectors is regressed to growth rate of same industrial sectors in pre-privatization period. It was found that to some extent, the growth rate in these industrial sectors fell due to privatization.

The study explains that in equilibrium state, even if the private sector enjoy lower cost curves against public sector, at various output level, public sector may possibly be having lower cost. In view of that, the regulation of the monopolistic practices in private sector, particularly in services, was deemed essential. Nevertheless, if regulation means insecurity and lesser cushion for private sector firms as compared to public sector firms, then regulated private sector firms will possess lower levels of productivity.
It is also suggested that a better substitute can be the perfect contestability representation which lets the firm gain a handsome profit and gives it a power to make decisions. A more efficient intercession may be the price caps in line with changes in productivity and the general inflation rates. The divestiture policy of Pakistan though thriving with the logic that 86 manufacturing units, two commercial banks, and one development financial institution, ten percent of the shares of PIA, and about 12.0 percent of telecom shares etc. has not helped in elevating efficiency levels. Privatization elevated efficiency levels of the privatized units only if it comes about in a competitive market configuration.

The evidence on growth of output and change in prices in the activities so far privatized is the producers’ exercise of monopoly power. It implies that efficiency may have declined while prices have increased. For privatization, these upshots are dispiriting. Even if monopoly has been exercised in the industries which produce tradable goods, the privatization of non-traded activities would definitely result into monopolistic exploitation.

The best possible solution appears to be regulation of industry to force a competitive solution on the monopolist along with a careful policy of privatization. On the other hand, if regulation has uncertainty factor for the producers and the producers have even lower flexibility in decision-making even as compared to public sector enterprises, it may be counter-productive because perfect competition model may result into solvency problems. This is required to be substituted with perfect contest-ability model wherein firms are allowed to make sufficient profits and are relatively free to take decisions. It may be
deduced that price caps along with productivity and general inflation rate can be categorized as effective intervening measure.

Kemal (1997) emphasized Pakistan’s industrial policy and practice that went before, and likely to continue in future directions by recording the growth as well as production and investment levels in Pakistan for the last 50 years from 1947 to 1997. The author also examined the industrial strategies adopted in the past and the levels of efficiency and protection in the manufacturing sector. The results show that the manufacturing sectors experienced a growth of eight percent up to the 1980s, which receded to around three percent during the 1990s. The prevailing passive output growth and insufficient investment in the industrial sector compel to recommend that Pakistan needs to follow an effective and efficient industrialization policy. In order to gain triumphant industrialization, Pakistan needs to follow a single objective of accelerating the levels of industrial investment activities and there is a need to change the tariff structure.

In addition, a need is felt that the government may influence the structure of incentives, which are being controlled with reference to protection policy. Necessary physical and social infrastructure for efficient industrialization is the dire need of time. The private sector has science and technology apparatus. Hence there is a need for bringing up the public sector research institutions up to the international standards, and streamlining of technology creation, absorption and diffusion systems are essential to bring production pattern towards new technology-based industries. Cluster approach (i.e., an agglomeration
of key industries, supporting sectors, infrastructures, and institutions that are interlinked and interdependent) can be quite useful in the development of vendors.

It has also been recommended that the regulatory framework needs to be streamlined. It has been proposed that outdated laws about the industrial sectors may be revised. HRD is required to enhance efficiency of industrial sectors through innovative drives. It has also been proposed that to develop a strong industrial base in Pakistan, a long run policy plan and stability are essentially required. In this article, the author concluded that the most puzzling of the changes is the sharp decline in the rate of growth since the late 1980s. It was during the 1980s that many reforms were implemented to promote greater efficiency: direct interventions were changed to market-oriented reforms; import policies and tariff rates were reviewed and maximum tariff rate was drastically curtailed; export taxes were removed and incentives for exports improved; market forces were allowed the principal role in the determination of the exchange rate; and many public enterprises were privatized. The effect of these measures was to reduce inefficiency. It is however puzzling that, despite all the reform of the trade regime, the effective protection rate between the two years actually increased significantly. Further, all the reform and the presumed increase in efficiency tailed to prevent a drastic fall in industrial growth.

Hassan and Ahmad (2005) estimate technical efficiency of wheat farmers in mixed farming system of Punjab by using stochastic frontier production function, by including technical in-efficiency effects model. A Cobb Douglass function adequately represents the sample, given the specification of the proposed translog frontier model. It was found that the
technical inefficiency effects are linearly related to various firm specific variables. The mean technical efficiency of wheat farmers averages at 0.936 at a range from 0.580 to 0.985. The estimates show that an increase in wheat area, weedicides, cultivations and fertilizer increases wheat production. Further, it was found that technical inefficiency declined with timely crop sowing, improving education of the farmers, by extending debt facility to the farmers and drill sowing method. The results showed that shortage of canal water increased the inefficiency of the wheat farmers in the mixed farming system of the Punjab.

Mahmood et al. (2006) state that the large scale manufacturing sector in Pakistan has gained distinction over the years with its output rising to about 13 percent in 2005-06 from 5.67 percent in 1959-60. Despite rapidly transforming policy environments, arraying from import substitution in the early years to a more deregulated and moderate environment in the recent years driven largely by concerns to improve the efficiency of the industrial to attain a better competitiveness the sector has operated within. Despite the fact that domestic enterprises have been rendered to greater internal and external competition, by industrial and trade policy reforms in recent years, most of these endeavors look for benefaction and have yet to relocate themselves so that they can face the global market sure footedly. Additionally, the trade policy still has an import substitution bias for some critical sectors whose imports are questioned by tariff peaks and this hampers their efficiency production.

The study aimed to assess the efficiency of large scale manufacturing sector in Pakistan drawing on the production frontier approach. Some betterment in the efficiency of the large
scale manufacturing sector has been identified as a result of this study, though the magnitude of improvement remains trivial. The results are mixed at the disaggregated level: whereas a majority of industrial groups have gained in terms of technical efficiency, some industries have shown deterioration in their efficiency levels including, for example, transport equipment, glass and glass products, other non-metallic mineral products, and other manufacturing. It was concluded that many factors are responsible for the fall in the technical efficiency of such firms, including the trade policy environment that may have protected such industries from the competition prevailing outside. A further study was recommended to focus on the specific determinants of technical efficiency including the macroeconomic and trade policy environment.

Kemal (2007) investigated about the problems in the manufacturing sector. It was observed that manufacturing sector suffers from various structural problems such as lack of diversification, allocative, technical and X-inefficiencies, poor quality of products and low levels of R&D activities, which result in sluggish changes in productivity which makes Pakistani products uncompetitive in the world market. It was also emphasized that although Pakistan has pursued import substitution industrialization policy, yet it failed to diversify the industrial sector because the producers did not venture into new import substitution industries. Therefore, domestic and foreign demand has been a major contributory factor to the growth observed in manufacturing sector. It was also discovered that manufacturing industries with very high growth rates coincide with falling investment levels. These declining levels of investment may be due to various reasons such as high production costs, transaction costs, policy continuity risks, skills and wages, and changes
in the demand structure. It has also been described that due to very high protection rates, value added of manufacturing sector at world prices has been very minute as compared to value added at domestic market prices. Low levels of productivity continue to be present in manufacturing industries making it increasingly difficult for Pakistani producers to compete in the world market. Various other problems such as low quality of products, lack of standardization, low value added products sold without any brand names, lack of innovation and low levels of productivity continue to be practiced in the import substitution industrialization and indicate the need for major re-structuring of the manufacturing sector.

Akmal and Saleem (2008) used a sample of 30 banks including 4 banks from public sector, 18 from private sector and eight foreign owned banks. A two stages Data Envelopment Analysis (DEA) was employed with a purpose to give empirical proof on the impact of macroeconomic and bank specific variables and other factors on efficiency levels of banks. In first stage, DEA was used for measuring technical and scale efficiency and then Tobit regression approach to find out the impact of several bank-specific and macroeconomic factors. The results indicated two aspects. First, that banking efficiency has improved since the year 2000. Second, that the foreign owned banks showed higher levels of efficiency than domestically owned private and public banks. Data in the years 1995-2005 show technological and total factor productivity growth. The main cause behind inefficiency was found to be over employed use of input. The banks employ higher levels of input than what should be used to achieve a given level of output. The result showed that there technological growth improved the last ten years which led to a 5 percent total factor productivity escalation, which is lower when matched to other sectors. If efficiency on the
basis of ownership is compared, the results propose that the state owned banks possess lowest levels of technical efficiency in the study at 88 percent. On the other hand foreign owned banks possess maximum levels of technical efficiency by touching 93 percent. It can be deduced that the foreign banks are more efficient than the state owned and local private banks. As far as TFP growth is concerned, the state owned banks have the highest TFP growth at 8 percent and the foreign banks have lowest TFP growth 1 percent.

Raheman et al. (2008) argue that Manufacturing sector of Pakistan is the second largest sector of economy because it constitutes about 19.1 percent of GDP. However in 2007 it grew at a declining rate of 8.4 percent against 10 percent in 2006. The manufacturing industry possesses a major place in large scale manufacturing (LSM) and concerns about 70 percent of total manufacture activity. There was sluggish pace of expansion during 2006-07. It displays signs of moderation due to higher capacity utilization, difficulties in the textile sector and lower than expected scale of operations of oil refineries. Quite a few other dynamics have also caused the slow pace of expansion in manufacturing including a nil percent growth in raw cotton production which is an important input for the textile industry, vegetable ghee and cooking oil which comprise about 5.5 percent of the large scale manufacturing sector, showed uninspiring performance due to unparalleled rise in international palm and soybean oil prices. The automobile sector has exhibited dismal performance during 2007 as compared to its performance in previous five years. It is due to a declining domestic demand for cars on because of increasing rates of automobile financing. The higher imports of used cars in the beginning of fiscal year 2006-07 also affected the performance of domestic Automobile Manufacturing mobile sector. This study
carried out a detailed analysis of different industries in the manufacturing sector with a view to sort out the efficient sector in terms of total factor productivity, technical efficiency change and technical change using aggregate firm level data and variables. DEA approach was applied to estimate the total factor productivity growth, technical efficiency change and technological progress in Pakistan’s manufacturing sub sectors using panel data for eleven selected industries from 1998 to 2007. Productivity growth was estimated using Malmquist Index. The paper decomposed the Malmquist productivity index into technical efficiency and technical change component. This decomposition helped to identify improvement in efficiency and contribution of technological progress and innovation to productivity growth in manufacturing sector. The results were important. Overall manufacturing sector improved technical efficiency by 1.2 percent while technological change put a negative effect on the productivity. Resultantly, the overall total factor productivity increased by a mere 0.9 percent from the period 1998 to 2007. A divergent trend is seen in the total factor productivity and its components in individual years for overall manufacturing sector.

Javed et al. (2010) estimated technical efficiency and identified the determinants of technical inefficiency of rice and wheat farming system in Punjab using the non-parametric data envelopment analysis (DEA) technique. Tobit regression model was estimated to investigate factors that determine technical inefficiency of the system. The results showed that mean technical efficiency of the system was 0.830 with minimum level of 0.317 and maximum of 1.00. This revealed the existence of substantial technical inefficiency in the rice and wheat system of Punjab. The article further indicated that if farms included in the
sample operated at full efficiency level, input usage could be reduced by 17 percent without compromising with output, with existing technology. Results of the Tobit regression model showed that years of schooling, number of contacts with extension agents and access to credit facility had negative impact whereas farm size, age of farm’s operator and the distance from farm to market had positive impact on technical inefficiencies of rice and wheat system in Punjab. It is suggested that government should focus on attracting young and educated people in farming by providing incentives in the form of soft loans.

2.4 Summary of cited studies on measurement of efficiency

The above cited studies on measurement of economic efficiency have provided with two popular approaches to calculate efficiency scores. The first approach is econometric approach called the stochastic frontier analysis (SFA) and the other is non-parametric approach called data envelopment analysis (DEA). The current study employs both of these approaches to endorse the obtained results. The studies from Pakistan reviewed in section 2.3 have highlighted the problems associated with measurement of efficiency scores in Pakistan. These studies have also provided with diverse and detailed efficiency analyses of the manufacturing and service industry in Pakistan, which helps to draw accurate conclusions based on comparative analysis in the current study.

2.5 Literature Review on Rent Seeking

Rent seeking is disastrous activity, which involves sophisticated methods of corruption. Producers indulge in rent seeking, thereby “hiring” regulatory bodies to get unrealistic and
unjustifiable protection. The result is multi-tier. It not only creates consumer losses but hampers economic development because resources are not utilized to improve technical efficiency, rather utilized to influence regulatory bodies to attain common interest objectives for a few privileged ones keeping the old inefficient levels of productivity (Krueger, 1974).

In other terms, rent seeking is an investment/wastage of resources into unproductive activities such as lobbying by a group of firms (coalition) to achieve cheaper profits by controlling the market factors, rather than to achieve profits by improving productivity. This is modest definition of rent seeking. In other words, rent seeking is the redistribution of resources from productive activities towards unproductive activities. This redistribution of resources is attractive because it offers higher and cheaper profit to producers.

The concept of Rent Seeking was introduced by Krueger, (1974) by stating that in many market-driven economies, governments usually put regulations on free economic activities. These regulations conceive rents of various types, and a competition between interest groups arises for these rents. The nature of such a competition may be legal. However, in some examples, rent seeking appears in the form of bribe, corruption, and black marketing, etc. Purpose of the paper was to show some of the ways in which rent seeking is competitive, and to develop a simple model of competitive rent seeking for the important case when rents originate from quantitative restrictions upon international trade. In such a case 1) Economy lies inside the transformation curve due to rent seeking; 2) Welfare losses arising due to quantitative restrictions are usually higher than the losses from tariff
equivalent of these quantitative restrictions; and 3) Competition for rent creates a
difference between private and social costs of economic activities. Although the analysis
is general, the model has particular applicability for developing countries, where
government interventions are frequently all-embracing. The paper tried to investigate the
impact of competition for import licenses under a quantitative restriction of imports.
Empirical evidence suggests that the value of rents to obtain import licenses is often on
very high side and welfare cost of quantitative restrictions is equal to welfare cost of tariff
equivalents and the value of these rents. Hence it can be deduced that government
interventions create rents. Fair trade laws result in firms of less-than-optimal size.
Minimum wage legislation generates equilibrium levels of unemployment above the
optimum with associated deadweight losses.

Kemal (1978) tested a hypothesis that, at the earlier stages of establishment, manufacturing
industries in developing countries may have a cost disadvantage but that, over the time,
productivity increases and the cost disadvantages are overcome. However, he explained,
that high rates of protection allowed in earlier stages continue even though they are no
longer required. Because of the monopolistic market structure, the productivity gains do
not lead to a reduction in prices but are used to increase prices, instead. To test the
hypothesis, the author decomposed the effective protection rate into their various
components, computed the growth rates of productivity and finally determined the impact
of productivity gains on returns of production factors. The results included that Pakistan
pursued an import substitution throughout the 1960’s. It led to an improvement in
productivity, which in turn enabled domestic producers to compete in the world market.
However, consumers suffered because domestic prices exceeded world market prices significantly. The productivity gains mainly increased the returns to production factors, especially the return to capital. Protection has been mainly an instrument for increasing profits.

Foster (1981) stated that consumer preferences are used as a basis of project evaluation in most of the cost-benefit analyses. The opportunity cost for government project is not only derived with reference to the supply prices of the inputs for the project, but by also valuing the output lost when those inputs are removed from the private sector. From this point of view, monopoly profits, taxes or external economies can raise the opportunity cost of resources and therefore their shadow prices, above the market price. Conversely, the author states that involuntary unemployment, government subsidies, or external diseconomies can lower the opportunity cost of resources and therefore their shadow prices below their market prices. Externalities aside, the phenomena that give rise to a gap between the supply price of resources and the value to consumers of what they produce generate flows of income. The author refers these flow of income as ‘rents’ whether received by private agents or public agencies. So rents in this context refer to monopoly profits, tax receipts, or wages that are higher than the supply price of labor, for example. Application of this principle applied above lead the author to a conclusion that the opportunity cost of a factor of production being withdrawn from the private sector exceeds its market price to the extent that it generates rents, so it should be valued at a shadow price that reflects the rents.
Bhagwati (1982) proposed Directly Unproductive Profit seeking activities (DUP) as a general concept that encompasses a wide range of economic activities such as rent seeking activities. The study provides composition and specification of welfare based and theoretic implication of such activities by introducing a theory on four types of cases based on the levels of economic distortion that happen prior to and after the DUP activity. It has been stated that profit can be earned by performing activities which are apparently unproductive, i.e. they yield financial returns but such goods and services are not produced which lie in a utility function directly or indirectly. These activities use up real resources, they result in contraction of the availability set open to an economy. Examples of such activities may be tariff seeking lobbying, tariff evasion, and premium seeking for given import licenses are all privately profitable activities. On the other hand, in terms of the flow of goods and services entering a conventional utility function, their contribution is non-existent.

Hartle (1983) defined rent as investment of resources undertaken by individuals or groups of individuals with similar interests in the expectation of obtaining an increase in their income wealth as a result of securing changes in legal rights, or, maximizing the benefit of earlier policy changes that created non-exclusive rights. The primary concern of rent seeking is the establishment of interest group power to control the government in order to obtain the desired benefits. This is extended by the concept that rent seeking actually takes into account the policies and strategies of interest groups and use of their influence to manipulate the government so that they achieve special advantages. There is a verdict by the normative side of the theory that the resources used in seeking these advantages are wasted in reality, because they result in the redistribution of income and wealth rather than
its creation. The positive side of the theory is concerned with interest groups: under what conditions do they form and when are they most successful? The normative issues raised are fundamentally too conservative to be persuasive. The positive issues are unproven. And, the author says, that there is another way of viewing these issues that has considerable appeal. It involves the interaction among a number of intersecting games. The author concludes that most of the time most markets adjust reasonably well to changing circumstances. However, these adjustments are rarely costless in resource terms. One has to be concerned with the enormous resources particularly human talent, devoted to lobbying and tax minimization, submission of grant and subsidy proposals, regulatory interventions, federal-provincial negotiations, and like this.

Formby et al. (1988) attempted to observe the changes in cost functions under the conditions of monopoly and regulatory market structure affected by $x$-inefficiency and rent seeking. It has been found that rent seeking brings bigger social costs than $x$-inefficiency. Under $x$-inefficiency, changes in cost are mostly due to lack of competition. Therefore, the monopolistic firm may put a part or all of rent to the factor inputs, which causes allocative cost of inefficiency. However, social costs due to rent seeking are of three types. In first place there is allocative welfare loss due to allocative inefficiency. Secondly, cost are risen due to expenditures incurred for the right to receive the transfer, and lastly, there are constant flow of costs to continue the existing rent seeking arrangement. These implications served as a foundation in the current study and rent seeking has been observed keeping in view all these three aspects. The authors suggest that it is therefore imperative
for the regulatory authorities to distinguish between the welfare costs related to x-inefficiency and those related to rent seeking.

Looney (1989) pointed out that the a common characteristic of modern third world with military regimes is their being of ultra-conservatism with the support of military to suppress organizations with popular expression. Such organizations decline the process of economic growth by indulging in rent seeking activities. Although no empirical support could be found for this line of argument since it is difficult to estimate the costs suffered by an economy due to rent seeking activities. Nevertheless, it can be seen that these modern third world regimes are not suitable. There are two regimes that are way different in terms of economic management. In military regimes such policies are adopted that military expenditures correlate positively with economic growth. On the other hand, civilian regimes have lesser control over rent seeking groups are also not able to merge rent seeking activities with military expenditures in such a way that is favorable to national economic growth. The paper concluded that several choices may be opted by developing countries. One option is to stick to pure version of economic efficiency, where organized groups are dismantled, and income is transferred via price disturbances. This may mean a military regime to most of the third world countries. The other option is a civilian regime which may opt to reduce defense expenditures but may be influenced by the pressures of organized groups, such as industrialists, politicians, labor unions, or rent seekers, allowing them to influence economic policies in favor of their respective interests.
Congleton (1989) demonstrated that a one-owner firm tends to over-monitor its employees. Since monitoring is imperfect, and imposable penalties on detected rent seekers are limited by the opportunity cost wage, employees have incentives in rent seeking activities which both reduce and re-distribute the firm’s residual. Since owner monitoring will be partly motivated by concerns over the distribution of the firm’s residual, a sole owner tends to monitor beyond the level that maximizes a firm’s residual. Appropriately, diffuse ownership can reduce monitoring effect to efficient levels by diluting incentives for rent seeking activities. The study proposes that the rent seeking approach also offers a possible explanation of the existence of diffuse ownership. In many industries, diffuse ownership may promote firm efficiency by reducing the losses from intra-firm rent seeking. The basic logic of the rent seeking approach to intra-firm activities is that a firm’s management and owners have incentives to invest resources in socially fruitless disputes over the firm’s residual. Losses accrue from these rent seeking activities in so far as scarce economic resources are consumed by a process of distributional competition. No new wealth is created by rent seeking activities, rather a firm’s residual declines as managers and owners invest resources in rent seeking activities. Moreover, rents actually realized may involve compensation schemes which cost the firm more than gained by employees or owners. The author concludes that a single firm owner or residual claimant is likely to commit to many resources to monitoring firm’s management. This conclusion contrasts with the usual emphasis on under-monitoring by firm owners.

Nitzan (1991) describes that the social costs of rent seeking can be inferred by observing the value of rent itself. In collective rent seeking setting, the evaluation of social cost
associated with rent seeking depends on the value of rent but as well as on the number and size distribution of the contesting groups and the rule adopted by these groups for allocating the rent among their members. This means that the extent of rent dissipation has a positive correlation with the number of groups participating in the contest. For given individual utilities and a given sharing rule, there exists a constant tradeoff between the number of these competing groups and the number of potential rent seekers which keeps the extent of rent seeking unchanged. Collective rent seeking has certain characteristics such as (i) a number of groups of individuals who compete for a target rent, (ii) the rent is indivisibly allocated in a sense that a group secures the entire rent, (iii) the rent exhibits characteristics of a private good and therefore it can be shared by the members of the winning group, and, (iv) group members decide this share on the magnitude of their rent seeking efforts.

Ellingsen (1991) points out three effects of buyer participation in rent seeking games on the social cost of monopoly. The first one is direct and destructive effect of one extra player’s expenditure, the second one is indirect effect on opponent’s expenditures and the final one is the saved consumer’s surplus. The author has tested the conviction that under certain conditions the buyer lobbying is socially beneficial. Overall these conditions are weak. When the highest bidder certainly wins, voluntarily buyer spending is always beneficial. If the impact of spending is uncertain, the impact on welfare of costly buyer activities is ambiguous. However, when buyers only need to fight an incumbent monopolist, lobbying is very likely to be beneficial. The study showed that if there is costly competition for a transfer from some pre-designated group and there is some loss associated with the transfer, then society will often gain if this group spends resources in
order to avoid the transfer altogether. The author concludes that (i) under the assumption of a perfectly discriminating contest, buyer lobbying is always strictly beneficial from a social point of view. (ii) In a lottery model, it is more likely to be beneficial if the monopoly profit is small, if the deadweight loss is large, and if there is a large number of potential producers. (iii) lobbying on part of buyers usually increases welfare if it occurs after one seller is established than if it happens at the stage of rent seeking. A sufficient condition for costly post-entry regulation battles to be socially beneficial under the assumptions of lottery model is that there are at least three potential sellers.

Murphy et al. (1993) described that prominent economists agree that poor protection of property rights is bad for growth. But why is this problem so severe? In his paper, the author explored two reasons why rent seeking, meaning any redistributive activity that takes up resources is so costly to growth. The author found that at first place, rent seeking promises increasing returns. This implies that, an increase in rent seeking activity makes rent seeking more attractive due to increasing returns, as compared to diverting resources to productive activity. This condition can lead to multiple equilibria in the economy with “bad” equilibria exhibiting very high levels of rent seeking and low levels of output. In the second place, rent seeking activities by government officials discourage innovative activities more than productive levels. It was concluded that innovation is a major factor behind economic growth therefore public rent seeking declines growth rates more than the decline in production. Arguments in this paper support that public rent seeking can put a severe tax on innovative activities and thereby move resources into established production of the public rent seeking sector. The result would be a sharp decline in economic growth.
Hazlett and Michaels (1993) reviewed the U.S. Federal Communication Commission (FCC)’s cellular telephone license lotteries. They argue that the FCC’s telephone license lotteries are useful sources of data with which one may measure waste due to rent seeking. The data set consists of market prices of both resold licenses and for fresh applications. In these lotteries, dissipation was less possible despite the theoretical expectations that open entry and unbiasedness may lead to full dissipation. The authors highlight a possibility that a marginal rent seeker could have purchased a ticket with positive expected profits, even without possessing specific capital or inside information as traditionally defined. The marginal rent seeker may in fact have faced high information costs in discerning the returns available in a new and unfamiliar investment market. Conventional wisdom among industry insiders was that the FCC had taken three measures to limit applications: (i) It instituted a 200 Dollars per market application fee, (ii) It instituted stricter rules regarding proof of financial qualifications, and finally (iii) It eliminated pooling of applications.

The first measure of application fee was taken because the application fee is a transfer rather than a social cost, setting it so that just one application per market was received would have eliminated rent seeking altogether. The financial barrier posed by the second measure was in one way mitigated by the efforts of equipment vendors in exchange for exclusive dealing agreements making financial condition a constraint. Prohibiting individuals from mitigating risk by pooling may have discouraged some applicants because the entry involved small sums and chances were spread over 428 markets. The authors conclude that the degree of inelasticity in the supply of rent seekers is anomalous such that the dissipation ratios are highly sensitive to the particular rules that define the competition.
for rents. However, the authors state that rent seeking theory is silent about the possibility that insiders can erect barriers to entry of new seekers as such barriers have been thought to have increased efficiency possibly in the short run.

Lenway et al. (1996) conducted a study on rent seeking, protectionism and innovation in the American steel industry. The authors argue that though free trade gives the lowest prices, however, protectionism in various guises is pervasive possibly due to political rent seeking by groups that expect to lose as trade patterns adjust to innovation and altered economic conditions. These groups invest in political lobbying to secure future returns in trade protection. Empirical evidence was found in the study that trade protection returns private benefits to the shareholders, senior workers and CEO’s of lobbying firms. Disturbingly, trade protection also appears to reward less to innovative firms and may thus frustrate the Shumpeterian development of an industry. It was examined that US steelmakers are among the most active lobbyists in the 1990s. Steel firms that lobby Congress for protection tend to be larger, older, less diversified, and less profitable than non-lobbyers. They pay more to their workers and CEOs and their CEOs have longer tenure and are more likely to be risen through the ranks of their companies. The announcement of protection rises the stock prices of US steelmakers, but by much more for lobbyists than for non-lobbyers. Lobbyers cut jobs more than non-lobbyers, however, they tend to maintain or increase wages once comprehensive protection has been finally announced. Protection also leads to large pay increases for lobbyists’ CEOs. This seems consistent with rent seeking and inconsistent with protection helping lobbyists mitigate social consequences of downsizing like unemployment. The authors conclude that high past research and
development spending is negatively correlated with stock price changes when protection is announced and positively correlated with subsequent exit from the industry. This seems inconsistent with the argument that protection provides a space for re-engineering. Rather, it suggests that protection has devastating consequences beyond the losses determined in the trade theory. Rent seeking may not only be a substitute for innovation, it may actually decrease the returns from true innovation.

Cebula and Nair (2000) investigated how union rent seeking in Manufacturing Industry of United States is affected by the existing policy of import competition. It is assumed by the theory of rent seeking extraction that these unions assure to maximize rents. In this situation, establishment of unions tends to increase the rents secured by union workers, even with the policy of import competition. However, import competition also influences these unions to favor a relatively lenient strategy to keep insider employment intact. The major focus of this study was empirical investigation of the U.S. industry using the data from the years 1975 to 1984. It has been elaborated that the union wage differentials, i.e. the differential wage earned by a worker in an industry because of union membership as compared to the average worker in the manufacturing sector has been estimated empirically for each type of industry and has been included as a proxy variable for unionized rent seeking. Two issues have been empirically evaluated: (i) how import competition affects the union rents and, (ii) how import competition affects union rents with union bargaining proxied by the membership issued by union. The authors conclude U.S. manufacturing sector is positively affected by union membership, whereas, union rents are reduced by import competition. Nevertheless, there is no significant evidence that in more unionized
import competing industries, union rents are higher as compared to the less unionized industries.

Rodriguez et al. (2002) proposed a method to empirically estimate the social cost of rent seeking in declining industries based on the distance function. It has been found that factors of a particular industry face real losses and find attraction in seeking protection from import competition. If the industries are suffering an economic slump, workers may have an important role and social cost of rent seeking can be empirically estimated by the amount of loss accumulated due to strikes or other disturbances. In the model, the authors include strikes as a “bad” variable of input in the production. This method is applied to data set of Coal Mining Industry of Spain. Using the data from the years 1974 to 1997, a system of equations from input distance function and cost sharing was estimated. This helped to empirically estimate the cost impact of strikes on the industry. In further proceeding, the authors used input distance function to calculate shadow prices for non-desirable inputs.

This function has many advantages when used to estimate shadow prices of the factors which affect negatively on production. These factors are of qualitative nature and may include strikes, bribe, which have been considered as “bad inputs”. There are two implications of this procedure. Firstly, this procedure enables to estimate qualitative variables that do not have a market value, such as strikes, conflict, etc. Secondly, no assumption is required about the cost minimizing behavior of firms and it is also not assumed that input prices are exogenous to the system. These characteristics of the input
distance function proved very appropriate for the analysis of the Coal Mining Sector of Spain.

Rodriguez (2004) presented a non-median voter model of redistribution which assumes that greater income inequality leads to lower distribution. It has been discussed that if there is a bargaining between interest groups and politicians, this implies that under the conditions of equilibrium, taxes will not be paid by high salaried individuals. Hence tax rates may be set lower enough that incentives for rent seeking are controlled. By increasing income of individuals, the income inequality increases and this brings exemptions which lower equilibrium re-distribution. It has been recommended by authors that this technique may be used to estimate negative relationship between income inequality and growth.

This provides a new explanation to the fact that poor classes do not leave rich democracies. Explanation of the negative relation between income inequality and growth is also given by the model. It is found that if investment is negatively affected by rent seeking, income inequality plagues the growth by encouraging unproductive activities which divert resources from productive activities. Hence a redistribution of resources is caused by inequality which slows down growth. In economies with greater income inequality, resources are not diverted for betterment of the poor, but these resources are either transferred to the rich or exhausted in rent seeking activities instead of being utilized for production process. The author argues that policy makers increase their bargaining power due to inequality as compared to capitalists and this extracts more resources from them by
raising the share of income of those individuals who will be benefitted from bargaining with the government.

Baylis (2006) studied the Canadian system of production controls which provides rents to the Canadian dairy farmers. This system is kept in place by ongoing “lobbying efforts” i.e. rent seeking activities. Producers are able to successfully lobby to keep tariff levels sufficiently high to block dairy imports for a foreseeable future. This paper measured the cost associated with such rent seeking. The author states that industrialists ‘lobby’ both the federal and provincial government to ensure that they remain a part of supply management system. If both the levels of government favor the lobbyists, the quantity of national production (and subsequent rent) is determined at the federal level as per the consumer demand and capacity of processors. The production quota is then divided between the provinces (for agricultural products) and industrialists (for manufactured products) based on the demand and historical production. A dilemma arises here that the producers do not know exactly how much rent seeking activity is needed to ensure that the governments choose to keep the lobbyists as a part of the supply management system. Instead, the amount of rent seeking affects the probability of keeping the lobbyists a part of supply management. Hence the amount of rent seeking affects the probability of expected profit.

Matthews et. al. (2008) conducted a study on Chinese banking system which was made open to foreign competition since 2006. The link between privatization and efficiency improvement in government owned banks was worked out. The study demarcated the cost inefficiency into technical inefficiency and rent seeking inefficiency in Chinese Banks. The
study probed that protected banking environment in China not only encouraged weak management resulting into technical inefficiency but induced bureaucratic rent seeking. The study used non-parametric approach to conduct analysis of efficiency in the sample of Chinese banks. The estimates were tested for statistical inference by using boot-strap technique. The cost inefficiency was partitioned into technical inefficiency and rent seeking inefficiency. The results showed that bureaucratic rent seeking in more prevalent in the state owned banking sector than in the joint-stock commercial banks. It has been elaborated that bureaucratic rent seeking is a rational response to a particular set of incentives based on protectionist policy.

Gilani and Javed (2009) investigated the collusive practices in sugar industry of Pakistan. The report shows that there exists an extensive institutionalization of collusive behavior appears in the refined sugar industry. The report concludes that under the protection of Pakistan Sugar Mills Association (PSMA), the sugar mills, instead of competing in the open market prefer a closed and protected market which is managed collusively and collectively by PSMA. It has been proved that PSMA apart from being in breach of its mandate appears to be acting as a front runner of rent seeking cartel in sugar industry. The sugar mills which are member undertakings of PSMA follow the policies which reduce competition at various levels inter alia in matters of purchase of sugarcane, production of sugar, sale of trade of sugar. The report clearly shows that PSMA is involved in collusive rent seeking behavior while its individual member mills are involved in rent seeking non-maximizing behavior. However, empirical analysis is made on this statement in the current study.
2.6 Summary of literature review on rent seeking

In current study, performance of manufacturing industry has been analyzed in the purview of obstacles on the path of efficiency. Therefore, identifying those obstacles behind inefficiency will complete the analysis leading to final results. Since rent seeking is a major cause of inefficiency as it induces non-maximizing behavior in the entrepreneurs and causes waste of resources. Therefore review of literature on rent seeking is essential. The reviewed studies introduced the conceptual background of rent seeking mechanism and its grasping effects on the plagued sectors of industry. The studies showed that in case of developing countries (including Pakistan), over-protection of local industry lead to inefficiency and ultimately these industrial sectors exhibited rent seeking behavior.

The reviewed studies however leave are silent about empirical method to identify or calculate the impact of rent seeking. However, the after-effects of rent seeking can be witnessed on efficiency scores can help to empirically calculate the impact of rent seeking. A significant study published by Competition Commission of Pakistan highlighted the presence of collusive rent seeking in sugar industry. This report provided with the subjective evidence of rent seeking in sugar industry which is tested empirically in current study.

It may be assumed that the collusive rent seeking practices reported in the study of Competition Commission of Pakistan are generally applicable to all rent seeking industries in the current study because almost every rent seeking industry in Pakistan has a collusive body established to control the market factors such as prices, supply of output, and
regulatory framework such as number of firms in the sector and import substitution policy, and a need is felt to empirically capture the social and economic losses occurring in Pakistan’s economy due to these rent seeking practices, which has been attempted in the current study.
CHAPTER 3

METHODOLOGY AND MODEL

3.1 Introduction

Chapter 3 focuses in detail on the engine of this study i.e. methodology and modelling. In Section 3.2, a discussion on the selection of appropriate industry is made, along with a brief introduction and economic performance of manufacturing sector in the past. In Section 3.3, a detailed discussion is made about various approaches to measure technical and allocative efficiency scores. Section 3.4 is based on a preliminary analysis conducted to analyze the structure, and historical growth in each industry. In Section 3.5, introduction to the data set is presented. In Section 3.6, the theoretical model is presented and discussed along with a detailed discussion on the selected variables selected in this study. In section 3.7, a discussion is made on the relationship between Economic Inefficiency and Rent Seeking with special reference to Pakistan.

3.2 Selection of the Industry

The industrial sector of Pakistan is multifarious. It has the capability and capacity to not only meet the domestic demand of economy but to export the surplus. Pakistan has been exporting many final and intermediary goods such as Cotton and Textile, Construction Machinery such as Road Rollers and Cranes, Cement and Electrical Goods such as fans, transformers. However, today, the country is bound to import commonly used domestic items mainly due to two reasons: (i) due to closure of a huge number of industrial units, and (ii) due to higher price of locally manufactured product that too with inferior quality
than the imported products in the market. These two reasons apparently account for the inefficiency of the manufacturing sector as a whole. However, it cannot be hypothesized that all the industries in manufacturing sector posses inefficiency as some of the industries have grown in numbers, are earning profits and have strong financial base. The real problem is to identify the industries infected with rent seeking. So far, a number of studies have been conducted on the topic of rent seeking and its social costs, on national as well as international level, yet, in Pakistan no study has been conducted to measure and empirically prove the presence of rent seeking in an Pakistan’s industrial sector.

The study at hand tries to establish empirical evidence on the presence of rent seeking in selected industries, on the basis of subjective evidences about the presence of rent seeking mainly focusing on cartels. Six industries of Pakistan’s manufacturing sector have been selected for analysis. Three of them, which include Sugar, Cement and Automobile Manufacturing, have usually been criticized of being controlled by cartels. The other three industries, which include Beverages, Fertilizers and Paints, have deliberately been selected in this study as they have been assumed to be relatively fair industries and having lesser chances of rent seeking neither cartels exist, nor are possible to exist due to competitive environment.

Therefore, this study attempts to empirically prove the presence of rent seeking due to cartels in suspected rent seeking industries, by comparing the efficiency scores of these industries with those obtained from relatively fair industries.
3.3 Measurement of Economic Efficiency

To find out economic efficiency of selected manufacturing industries, there are two popular approaches. The first is called Stochastic Frontier Analysis (SFA) and the other is called Data Envelopment Analysis (DEA). A brief comparison of both the approaches is given in this section while the detailed discussion on each follows in the proceeding sections of this chapter.

SFA is an econometric approach, whereas DEA is a non-parametric approach, hence SFA has a stochastic frontier with a probability distribution while DEA is based on non-stochastic frontier. In SFA, a particular shape of function is assumed, as in this study, a Cobb-Douglass Production function has been assumed, whereas, in DEA, it is not necessary to assume a particular shape of function that suits the requirements. In SFA, an equation showing the general relationship between inputs and outputs is obtained, which is not available in DEA approach. Therefore, each approach has its own advantages and disadvantages.

This study is based on both the approaches because of the difficulty in identifying the effect of rent seeking on an industrial sector. Hence the methodology is based on three stages. In the first stage, technical efficiency of manufacturing sector is calculated for six industries using SFA approach. This step is necessary to prove the significance of variables being tested. In the second stage, technical efficiency is calculated using DEA approach based on the variables and data used in SFA approach. This step is necessary to re-confirm results
obtained from SFA approach. In the final step, the allocative efficiency scores are calculated using DEA approach.

### 3.3.1 Stochastic Frontier Analysis

In first stage, SFA approach is discussed here. Stochastic Frontier Analysis (SFA) is a method of economic modeling. This method was used in stochastic production frontier models which were introduced by Aigner et al. (1977). The production frontier model without random component can be written as:

$$y_i = f(x_i; \beta) \cdot TE_i$$  \hspace{1cm} (3.1)

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,
- and $\beta$ is a vector of technology parameters to be estimated.

In equation 3.1, $TE_i$ denotes the technical efficiency defined as the ratio of observed output to maximum feasible output. The notion $TE_i = 1$ implies that the $i$-th firm is operating at the maximum feasible output, whereas the notion $TE_i < 1$ estimates the shortfall of the observed output from maximum feasible output.

A stochastic component is added that describes random effects that affect the production process. These random effects are not directly related to the producer or the existing
technology. These shocks may be due to weather disturbances, economic crises or random individual factors. These effects are denoted by \( \exp\{v_i\} \)

Each producer faces a different shock, but it is assumed that the shocks are random and they are described by a common distribution. The stochastic production frontier becomes:

\[
y_i = f(x_i; \beta) \cdot T E_i \cdot \exp\{v_i\}
\]

Here, it is assumed that \( T E_i \) is also a stochastic variable, with a specific distribution function, common to all producers.

This can also be written as an exponential \( T E_i = \exp\{-u_i\} \), where \( u_i \geq 0 \), since it is required that \( T E_i \leq 1 \). Thus, the following equation is obtained:

\[
y_i = f(x_i; \beta) \cdot \exp\{-u_i\} \cdot \exp\{v_i\}
\]

Now, if it is also assumed that \( f(x_i, \beta) \) takes the log-linear Cobb-Douglas form, the model can be written as:

\[
\ln y_i = \beta_0 + \sum \beta_n \ln x_{ni} + v_i - u_i
\]

where \( v_i \) is the “noise” component, which is mostly considered as a two-sided normally distributed variable, and \( u_i \) is the non-negative technical inefficiency component. These
two parts make a compound error term, with a given distribution to be found, therefore this is often called a “composed error model” (Aigner, et al., 1977).

Efficiency scores through SFA approach have been estimated by using computer program FRONTIER® developed by Coelli (1996). The FRONTIER program is used to estimate technical efficiencies of an individual firm from an estimated stochastic production frontier, and prediction of individual firm cost efficiencies from estimated stochastic cost frontiers. The measure of technical efficiency relative to the production frontier is defined as:

\[
\text{EFF}_i = \frac{E(Y_i^*|U_i, X_i)}{E(Y_i^*|U_i=0, X_i)}
\]

where \(Y_i^*\) is the production of the i-th firm which equals to \(Y_i\) when the dependent variable is in original units and is equal to \(\exp(Y_i)\) when the dependent variable is in logs. In case of production frontier, \(\text{EFF}_i\) takes a value between zero and one. The ordinary least square estimates, the estimates after grid search and the final maximum likelihood estimates are all presented in the output file (Coelli, 1996)

3.3.2 Data Envelopment Analysis

The other method to measure technical efficiency score is a non-parametric approach called Data Envelopment Analysis (DEA). Data envelopment analysis (DEA) is a nonparametric method for estimation of production frontiers. It is used to empirically measure productive efficiency of decision making units (or DMUs). Non-parametric approaches have a benefit
that a particular functional form or shape for the frontier is not assumed. Nevertheless, an equation showing a general relationship between output and input is absent in DEA.

While parametric approaches are used for the estimation of production frontiers. However, under these approaches, the shape of the frontier is assumed to be known before by first specifying a particular function relating output to input. The framework has been adapted from multi-input, multi-output production functions and applied in many industries. DEA identifies and estimates a function based on the most efficient firms in the sample. On the other hand, Ordinary Least Squares (OLS) estimates function is compared with average and not most efficient producers.

Data Envelopment Analysis (DEA) has been widely used recognized as a practical and useful approach for management decision making. DEA approach is simpler and better in a sense that a complete specification for the functional form of the production frontier is not required as well as the distribution of inefficient deviations from the frontier. Instead, DEA technique is based on assumptions related to general production and distribution. However, if those assumptions are too weak, inefficiency levels may be systematically underestimated in small samples. Further, inaccurate assumptions may create inconsistency bias over the frontier. Therefore, DEA approach depends highly on the ability to change, estimate and choose production assumptions is essential. However, presently used DEA models are based on limited selection of alternative assumptions of production (Tofallis, 2001).
Efficiency scores with the use of DEA analysis are calculated with the use of computer program DEAP® developed by Coelli (1996). In DEA approach linear programming technique is employed to develop a non-parametric piece-wise surface, which may be called a frontier, on the given data-set, to estimate efficiency levels with reference to this frontier. Three main options have been built in the computer program. The first involves the standard CRS and VRS DEA models (that involve calculation of technical and scale efficiencies). The second option considers the extension of these models to include cost and allocative efficiency scores. The third option considers the application of Malmquist DEA methods to panel data to estimate total factor productivity (TFP) index change, technological change, technical efficiency change, and scale efficiency change (Coelli, 1996).

3.4 Preliminary Overview of the Selected Industry

3.4.1 Number of Firms in the Industrial Unit:

It has been witnessed throughout in the economy that manufacturing sector faced severe crisis and saw downfall in the past years. However, there are some industries which have shown steady growth in number. It may be assumed that these sectors survived through rent seeking. Reportedly, the growth in these sectors is not because of the free entry into industry, as a free entry would eliminate barriers to entry and would reduce monopoly profits by creating a competitive environment. Rather, the growth is steady but continuous, providing profitable business only to the already established rent seeking group. (Gillani and Javed, 2009).
It is also pertinent to mention that some of these industries receive subsidy wherein loss-making firms receive support while profit making firms are taxed. This practice of penalizing the better performer is against the basic principles of economics and disturbs the market balance.

This condition appears to be true for the industries being suspected for rent seeking which include Sugar, Cement and Automobile Manufacturing. The line graphs shown in the next section show growth in these industries.

The sugar industry grew at a steady rate. Initial investment requirement is very high in the sugar industry, and only a few investors consider investing in a sugar mill. Therefore, the growth may be assumed to be relate to those already in this business. Sugar industry trend is plotted in Figure 3.1

Figure 3.1 Growth in Sugar Industry of Pakistan

![Sugar Industry Graph]

Source: CMI
The sugar industry is also wholly dependent upon agricultural raw material which is subject to weather conditions. Pakistan has also experienced semi-drought conditions in the last decades, yet the steady growth of sector may only be explained by the rent seeking behavior of the industry. Sugar industry in Pakistan is being run by certain families that restrict barriers to entry and build strong cartels. It has been commonly experienced in Pakistan that sugar supply is reduced and sugar is dumped in warehouses till prices escalate to extraordinary levels.

According to the enquiry report published by Competition Commission of Pakistan (2009), the Pakistan Sugar Mills Association (herein referred to as PSMA) advocates those rules and regulations which implement restrictions on new entrants. The aim of such policies is to control the number of firms in the product market so that it benefits its own members. This enables PSMA to manage the business interests of its members in a secure manner.

The PSMA also attempts to control the regulatory and legislative mechanism whereby it tries to influence government policies in its own interest. Hence it can be deduced that sugar sector comprises of rent seekers that influence the barriers of entry in the industry. Therefore, the growth shown in the industry in Figure 3.1 is an outcome of collusive network in sugar industry wherein new entrants closely relate to existing rent seeking members of PSMA.

The next industry suspected for rent seeking is Cement industry which also shows steady growth at times when the national economy and overall industry were having a slump. This
is depicted in Figure 3.2. Cement plants also require heavy initial investments. However, a growing trend despite of national and international recession appears to be an outcome of higher profitability which in turn may be due to rent seeking.

**Figure 3.2  Growth in Cement Industry of Pakistan**

Cement Industry also has strong cartels. There is a private body called APCMA (All Pakistan Cement Manufacturer’s Association). There are barriers to entry as in the sugar sector. Rent seeking apparently exists in the form of regulations for ban on import of cement, planned supply and demand creation, and other factors which include price control. A severe price fluctuation is commonly be observed in a few days. This fluctuation cannot be caused by changes in cost of production, as the cost does not vary at such a high frequency. Cartels made by rent seekers affect the import policy, control price decisions and determine the supply levels in cement industry.

Source: CMI
The Automobile Manufacturing industry also shows a steady growth over time, as expected, on the same reasons as explained in preceding paras. This industry has always been identified as the one over-protected by import restrictions. A few major companies locally manufacture cars and sell on a very high price and low quality as compared to the imported options. Barriers to imports are a strong cause behind this rent seeking behavior.

**Figure 3.3  Growth in Automobile Manufacturing Industry of Pakistan**

![Graph showing growth in automobile manufacturing industry](image)

**Source:** CMI

In the year 2005-06 a gap was identified in the supply and demand of passenger cars in the domestic automobile market. To decrease prices and fill the gap of demand and supply the government permitted the import of three-year-old cars under transfer of residence, personal baggage and gift schemes which was later relaxed to five years. The Engineering Development Board did not support the proposal for import of used cars. It was said that a large amount of foreign exchange would outflow from the country to buy imported cars. The officials said that expatriates would send such vehicles from their foreign earned
money. Venders said auto parts industry would lose business due to import of used cars. Jobs will be reduced and production of parts would be affected, besides many other possible losses. On the other hand, the Competition Commission of Pakistan encouraged the imports to discourage the collusive rent seeking practices carried on in automobile manufacturing sector. This clearly shows interests of various stakeholders in Automobile industry (The Daily Times Website, 2011).

After addressing the industries suspected for rent seeking, the next section focuses on the sector being assumed as fair. The first to come in discussion in this sector is Beverages industry.

**Figure 3.4  Growth in Beverages Industry of Pakistan**

![Figure 3.4](image)

Source: CMI

The trend line of Beverages industry shown in Figure 3.4 clearly shows a decline in which is in harmony with the declining performance of the manufacturing sector as a whole. To
setup a beverage firm, no huge initial investment is required. Despite of this easy entry, the industry is showing a normal declining trend which means that shrinkage in industry may be associated with non-profitable business and the overall national economic recession.

The next discussion is on Fertilizers industry. Although it has been added to fair sector in this study, however, its final results intimate about any suspicion of rent seeking in this sector.

**Figure 3.5  Growth in Fertilizer Industry of Pakistan**

![Graph showing growth in Fertilizer Industry](image-url)

Source: CMI

The growth pattern in fertilizer industry remained static with average of 10 units from the 1980s to 2000s. Growth is seen from the year 2000-01 to 2005-06 mainly due to expansion of existing facilities. Fauji Fertilizer Company (FFC) being the largest fertilizer production facility started its second plant Fauji Fertilizer Bin Qasim Plant (FFBL). Likewise, the second biggest industrial unit, Engro Fertilizer has also doubled its capacity by adding a
second plant. The static condition of this industry in the past does not lead to any conclusion regarding its fairness or involvement in rent seeking activities. However, a detailed discussion in Chapter 04 leads to final judgement in this regard.

Finally, the Paint Industry is analyzed. As assumed, this sector is also showing a negative growth trend in consonance with the national industrial trend. A Paint firm also does not require huge initial investment. However, despite of the easy entry and exit, the trend shows that investors were discouraged and they abstained from investments in paints sector during recession. Hence there is very little chance of rent seeking in this sector which could attract investment by promising higher profitability.

Figure 3.6 Growth in Paint Industry of Pakistan

A preliminary analysis has been conducted in this chapter based on the time trend of number of industries in each industry compared with the general economic conditions of
the country. Growth trend in six selected industries, including Sugar, Cement, Automobile Manufacturing, Beverages, Fertilizer and Paint, has been analyzed and it has been seen that despite of overall national economic recession, the three industries suspected for rent seeking, have shown steady growth. These signs show that these sectors remained attractive for business due to monopolistic conditions and profitability assurances.

The other three industries which have been assumed to be fair (Beverages, Fertilizers and Paint) show normal trends in their growth. Although Fertilizer Industry is showing upward trend in growth which is in consonance with rent-seeking sectors, however, it is pre-mature to pass a verdict about this industry at this stage.

It is preliminarily hypothesized in this chapter that increase in the number of firms in an industry during recession is a sign of attractiveness (higher profitability due to monopolistic environment in an industry) which may be due to rent seeking practices by cartels in these sectors. Due to the social losses arising because of rent seeking activities in these industries, national economy has not benefitted in the past. Moreover, the growth trend has been slow and steady and not normal which shows controlled barriers to entry (a typical sign of cartels).

### 3.5 The Data

Secondary Data has been used in this study, collected from various publications of Census of Manufacturing Industry (CMI) published by Federal Bureau of Statistics (FBS). Data has been collected from six publications of CMI starting from year 1981-82 to the
publication available for year 2005-06. Data has been collected for six Industrial Sectors each comprising of different number of firms. The FBS publishes CMI after every five years based on the data collected through questionnaire.

Census of Manufacturing Industry is conducted by FBS in accordance with the Industrial Statistics Act 1942. The survey covers those establishments which engage in manufacturing activities either full time or for some part of the year. These establishments may have joint or single ownership and must be registered under Factories Act 1934. The survey also includes some of the establishments which qualify for registration but are not registered yet. However, it is made sure that separate returns are collected for the enterprises which are engaged in more than one activity and separate accounts are maintained for each activity.

3.5.1 Collection of Data by FBS

CMI questionnaires are floated to the establishments that are covered under the category of manufacturing establishments maintained by the Provincial Chief Inspectors of Factories, Directorate of Labor Welfare of the provinces. The census is conducted through postal enquiry followed by field visits. An agency is appointed for this purpose under the Industrial Statistics Act 1942 for collection of requisite data. The provincial government is empowered by the Industrial Statistical Act 1942 to appoint officers for collection of data for the census. The returns are passed on to provincial bureaus of statistics for further processing after successful collection by the local statistics authorities.
3.5.2 Scope and Coverage of CMI

The CMI covers level of production, structural developments in large scale manufacturing industry, gives data on quantity and value of input employed and output produced, census-value-added, contribution to national income (GDP), fixed assets, and stock possessed by industry, level of employment and employment costs borne by a particular industry. It captures recent developments in the production methods employed in industries, captures new products, and estimates new weights for production index of manufacturing (Federal Bureau of Statistics, 1981 to 2006).

3.6 Model

This study is based on Farrell’s approach to technical efficiency. Farrell introduced a method for measuring two forms of productive efficiency and hypothesized that efficiency could be bifurcated into two sub-components. One reflects the physical efficiency of the input-output production transformation, called the technical efficiency and the other is efficiency related to optimal factor allocation called price (allocative) efficiency.

Farrell (1957) developed this approach using a simple example involving a firm which uses only two inputs, Labor (L) and Capital (K) as depicted in Figure 3.7 to produce a single output (Y). Assuming constant returns to scale, a fully efficient firm lies on the isoquant \( QQ' \) in the figure that provides the benchmark for measurement of technical efficiency. If another firm uses quantities of inputs defined by the point R to produce a unit of output (Y), the technical inefficiency of that firm is represented by the distance \( ER \), which is the amount by which the inputs could be proportionally reduced without any reduction in
output. This may be expressed in a ratio form $ER/OR$, which represents the percentage by which all inputs could be reduced without compromising on output. The Technical Efficiency (TE) of a firm, is hence denoted as:

$$TE_i = OE/OR$$

which is equal to one minus $ER/OR$. The TE measures takes the value between zero and one and hence provides an indicator of the degree of technical inefficiency of the firm. A value of one indicates the firm is fully technically efficient. For example, the point E is technically efficient because it lies on the efficient isoquant $QQ'$. 

Figure 3.7  Farrell’s Approach to Technical and Allocative Measures of Efficiency
The input price ratio is represented by $PP'$ and if this is known, the Allocative Efficiency (AE) may also be calculated. The allocative efficiency of the firm operating at point R is defined as

$$AE_i = \frac{OB}{OE}$$

3.7

The distance $BE$ represents the reduction in costs that occur if the production occurs at the allocatively and technically efficient point $E'$ instead of at the technically efficient but allocatively in efficient point E. The total Economic Efficiency denoted by $\Phi$ in hypothesis, is defined by the ratio

$$EE_i = T.E \times A.E.$$ 

i.e.

$$EE_i = \frac{OB}{OR}$$

3.8

Tyler (1979) argues that Farrell’s procedure possesses three important attributes. First, it is not necessary to specify a functional form for the underline production function. This is a major advantage since the specification of a functional form may introduce a bias into the technical efficiency measure. Second, the individual observations (i.e. firm) specific measures of technical efficiency can be computed. Third, the procedure can be easily generalized to include more than two inputs.

Farrell’s (1957) procedure is also beset with some significant deficiencies. It fails to take non constant returns to scale into consideration. Constant returns are assumed under this approach. This problem is solved by segmenting by size, as we have divided the industry
is divided into several segments. This procedure in effect measures different frontier production functions for each size group. Second, the Farrell technique possesses great sensitivity to extreme observations as possibly owing to measurement error. A third limitation of the Farrell technique involves a problem as one approaches the un-economic areas of the production function; for those areas, the efficiency index is undefined.

Although the approach of Farrell (1957) in the estimation of technical efficiency needs to be followed basically, however, in the meantime, various authors have improved and elaborated further the work of Farrell. These writers include Aigner & Chu (1968) and Timmer (1971). They have devised a method for estimating a frontier production function using programming techniques. The cost of handling non-constant returns to scale comes out as the reduction in the generality of Farrell’s technique by specifying a functional form of the production function. For reasons of clarity, comparability and general credibility the Cobb-Douglass function form has been chosen. The Cobb-Douglass production function to be estimated is written as

\[ Y_i = A K_i^a L_i^\beta \]

Where

\begin{align*}
Y_i & = \text{observed output for the } i\text{th firm} \\
A & = \text{a technological progress (knowledge)} \\
K & = \text{Capital} \\
L & = \text{Labor}
\end{align*}
the function is linearized by taking log

\[ \ln Y_i = \ln a + \alpha \ln K_i + \beta \ln L_i \]  \hspace{1cm} (3.10)

Now the equation can be written as

\[ y_i = a + \alpha k_i + \beta l_i + e_i \]  \hspace{1cm} (3.11)

Here, the lower case notations indicate the logarithms of variables indicated in Equation 3.10. When estimated with OLS, the Equation 3.11 represents an average production function. The error term \( e_i \) is a stochastic error for \( i \)th firm.

To refine further, Timmer (1971) and Aigner, et al., (1977) have devised approximation of the production frontier in a way that disturbance term \( e_i \) assumes a different context. It is presumed to reflect efficiency differences, while all measurement errors are assumed to be negligible. By constraining all \( e_i \)’s to be non positive, the estimated production surface depicts a best practice frontier. Thus following the Timmer’s derivation, the Equation 3.11 is estimated subject to the condition that:

\[ \hat{a} + \alpha k_i + \beta l_i = \hat{y}_i \geq y_i \]  \hspace{1cm} (3.12)

where \( e_i \)’s are non positive, this means that the term \( y_i \) gets a subtraction effect due to the presence of these \( e_i \)’s. Thus, in the estimated equation, \( \hat{y}_i \) is greater than original
function $y_i$. Only in case of efficient firms operating on the best practice frontier, the maximum output $\hat{y}_i$ is equal to observed output $y_i$. This can be expressed as

$$\hat{a} + \alpha k_i + \beta l_i - \hat{e}_i = y_i \quad 3.13$$

Once the parameters $\hat{a}$, $\alpha$, and $\beta$ have been estimated, their values can be used to compute the maximum possible $\hat{Y}_i$ for each observable combination of $K_i$ and $L_i$. Comparing the observed output $Y_i$ with efficient use output $\hat{Y}_i$, an index can be computed. Thus the index of technical efficiency derived from the non-stochastic Cobb-Douglas frontier is $Y_i/\hat{Y}_i$ and is computable for each firm, group or cluster, it can be written as:

$$e^{ei} = \frac{Y_i}{\hat{Y}_i} \quad 3.14$$

hence,

$$e^{ei} = \frac{Y_i}{(\hat{A}K_i^\alpha L_i^\beta)} \quad 3.15$$

To find out economic efficiency of selected manufacturing sector two approaches have been widely used. The first one is Econometric approach called Stochastic Frontier Analysis (SFA) and the other is Non-Parametric approach called Data Envelopment Analysis (DEA). This study at hand uses both of these two approaches because of the difficulty to identify effect of rent seeking on industrial sectors. In the first stage, technical efficiency of manufacturing industry is calculated for six selected sectors using SFA approach. The model used in this research is based on Battese and Coelli (1992) Specification Model-1. The variables selected are in consonance with Mahmood, et. al.,
except for Electricity and Natural Gas usage. The stochastic frontier function is in loged form of Cobb-Douglas production function represented below:

\[ \ln Y_{it} = \beta_0 + \beta_1 \ln(N_{it}) + \beta_2 \ln(K_{it}) + \beta_3 \ln(L_{it}) + \beta_4 \ln(NG_{it}) + \beta_5 \ln(EL_{it}) + v_{it} - u_{it} \]  

where

- \( Y_i \) is the output of \( i \)th industry,
- \( N_i \) is the number of firms in \( i \)th industry,
- \( K_i \) is the amount of capital used in \( i \)th industry,
- \( L_i \) is the average number of labor engaged in the \( i \)th industry,
- \( NG_i \) is the amount of Natural Gas used by the \( i \)th industry,
- \( EL_i \) is the amount of Electricity consumed by the \( i \)th industry,
- \( v_i \) is the random error term associated with measurement errors, or other random effects such as weather, strikes, unstable political conditions, etc which are assumed to be i.i.d. \( N(0, \sigma^2_v) \) and independent of \( (u_i) \)
- and
- \( u_i \) is the non-negative technical in-efficiency component of the \( i \)th industry distributed independently with half normal distribution i.e. \( N(0, \sigma^2_u) \)

The subtraction effect due to disturbance associated with in-efficiency \( u_i \) implies that the firm can lie on or below the best practice frontier and such deviation is due to the factors under the control of firm such as technical and allocative inefficiency as elaborated by Aigner et. al. (1977). However, assuming the frontier itself to be stochastic, with random
disturbance \( v \) due to factors beyond the firm’s control such as droughts, floods, labor strikes, etc., it is possible to estimate the variances of \( u \) and \( v \) to observe their relative proportion in the compound error term \( e \) obtaining \( \gamma \) being a ratio of \( \delta^2 / \delta^2 \) which would determine the proportion of inefficiency component \( u \) in the composite error term \( e \).

The variables included in the model are briefly described under, starting with the dependent variable and moving the discussion towards independent variables.

3.6.1 Output

Many output variables with little variations are reported in CMI. The output variable \( Y \) taken in above model 3.16 is contribution to GDP which observes total value of production after adjusting for industrial costs (cost of production) and non-industrial costs (overheads).

3.6.2 Number of Firms in the industry

The variable \( N \) records the number of firms in the industry.

3.6.3 Capital

The capital \( K \) variable depicts fixed assets (land and buildings), plant and machinery, transportation equipment, and other assets having an expected productive life of more than one year and being used by the industry for manufacturing of goods.
3.6.4 Labor

Represented by notation L, the labor includes employees, working proprietors, including unpaid family workers.

3.6.5 Natural Gas

The variable NG depicts the value of natural gas (in Pak Rupee) used by the industry for production of goods.

3.6.6 Electricity

The variable EL denotes the value of electricity (in Pak Rupee) used by the industry for production of goods.

The variables selected by Mahmood et al. (2006) included Industrial Cost (IC) and Non-Industrial Cost (NIC) which have replaced in this research with Natural Gas (NG) and Electricity (EL). This is due to the fact that measurement of allocative efficiency requires price information which has been obtained for NG and EL and cannot be exactly accounted for industrial and non-industrial cost.

The method of Maximum Likelihood is proposed in simultaneous estimation of parameters of stochastic frontier model. The estimated model forms the basis for predicting technical efficiencies through SFA technique (Baten, et al. 2009). Battese and Coelli (1988) describe the predictor of technical efficiencies as following:
Equation 3.17 measures the distance between frontier and the observed firm that lies below the frontier due to technical in-efficiency after accommodating the random errors.

Given the production function as per equation 3.9, the next step is to construct a null hypothesis about the inefficiency existing in the model. This hypothesis is defined as $H_0$ that no-inefficiency exists in the model and all the firms lie on frontier production (i.e. all the firms are technically efficient). It is defined as

$$H_0: \gamma = 0$$

The test statistic used for this hypothesis is defined as

$$-2\{\ln L_R - \ln L_{UR}\} = -2\{\ln L(H_0) - \ln L(H_A)\}$$

The null hypothesis $H_0$ is rejected if $LR > \chi^2 2(\alpha)$

**3.7 Inefficiency and Rent Seeking**

The basic purpose of the study in hand is not to capture the inefficiency leakages only but to determine a relation between inefficiency leakages and rent seeking. This relation is to be supported with empirical evidence. Matthews et al. (2008) presented a paper that decomposes cost inefficiency in Chinese banks into X-inefficiency (or technical inefficiency as cited in this study) and rent seeking inefficiency. It has been justified in the cited paper that while the under-utilization of resources lead to technical inefficiency, the wrong factor mix leads to rent-seeking inefficiency.
A non-parametric approach is used to conduct analysis of inefficiency in a sample of Chinese banks. The results, show that bureaucratic rent-seeking is more prevalent in the state owned banks than in the joint stock banks. Figure 3.8 shows an isoquant $qq$ producing a given output with factor inputs $x_1$ and $x_2$ and isocost $pp$, which traces the ratio of factor prices. The efficient cost minimizing position is shown at $e$ where $pp$ is tangent to $qq$.

If a factor combination denoted by point $c$ is used, which falls the right of the isoquant $qq$, this implies that the firm is technically inefficient. Efficiency measurement comprises of two parts, the technical efficiency (TE) and allocative efficiency (AE). Technical efficiency may be estimated by the ratio $Oa/Oc$. The cost faced by a firm is shown by $p''p''$ which appears parallel to the isocost $pp$ and passes through point $c$. Cost efficiency (CE) is measured by $Ob/Oc$ while AE is calculated as $Ob/Oa$.

In Figure 3.8 the point $e$ shows an optimal factor-mix given the observed factor prices, but point 'a' is the optimal position for the rent-seeking manager although it is allocatively inefficient. A firm can organize its input factors to be on its production frontier but by using the wrong factor mix. Rent seeking in monopolistic public departments (such as Railways, PIA, Sui Gas Department, etc.) involves over-staffing, elaborate offices and a lot of official trips, or expensive restaurants subsidized (McKenzie and Tullock, 1981). The rent seeking in private industries involves establishment and maintenance of cartels, and links with bureaucracy for imposition of tariffs, quotas, and other regulatory measures which can influence the supply and price mechanism of these industries.
The management of these industries may reduce technical inefficiency by moving the cost frontier from $p''p'$ to $p'p'$, but would still remain cost inefficient as shown by the gap $ab/Oa$. The gap between the minimum cost optimal factor mix and the technically efficient minimum cost associated with the efficient production frontier with the sub-optimal factor mix (or allocative inefficiency) can be interpreted as the inefficiency associated with ‘rent seeking’ (Matthews et. al. 2008).

In the study at hand, a fair sector is defined to be a sector practicing profit maximization approach and not diverting availed subsidies to malpractice, while a rent seeking sector is defined to be a sector availing subsidies from the government and adopting rent maximization approach by departing from profit maximization approach.

Therefore, we can assume that rent seeking lowers the efficiency scores of infected firms. This serves as the foundation of second hypothesis that fair sectors have higher efficiency.
scores as compared to rent seeking sectors. This is tested in the second hypothesis defined as

\[ H_0: \Phi_{FS} = \Phi_{RS} \]

i.e.

\[ H_0: \Phi_{FS} - \Phi_{RS} = 0 \]

against the alternative hypothesis:

\[ H_A: \Phi_{FS} - \Phi_{RS} > 0 \]

where

\( \Phi_{FS} \) is the economic efficiency of fair sectors

and

\( \Phi_{RS} \) is the economic efficiency of rent seeking sectors

The test statistic used for this hypothesis is

\[
t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{4/1/n_1 + 4/1/n_2}}
\]

This test statistic is used to find significant difference in the economic efficiency scores of two samples. One sample (sector) comprises of industries assumed to be ‘fair’ and the other sample (sector) is composed of those alleged to be ‘rent seekers’. If the null hypothesis is accepted, that there is no difference in the efficiency scores of both samples, it implies that rent seeking causes no adverse impact on the economic efficiency of selected sectors. If, however, the null hypothesis is rejected (and alternative hypothesis is accepted), this may provide with a new concept about empirical measurement of the impact of rent seeking on economic efficiency of selected manufacturing sectors. By proving that economic
efficiency of fair sectors is higher than the efficiency of rent seeking sectors, the alternate hypothesis captures the impact of rent seeking on affected sectors.

In Pakistan, rent seeking has affected industrial sectors in three ways as discussed in the following section.

3.7.1 Cartel on Price
The rent seeking industries set up collusive seller cartels that actively control the output prices and allocate regional quotas for different prices. It is ensured in the cartels that there is no internal competition within each industry.

3.7.2 Collusive Supply Control
The rent seeking cartels are also involved in controlling the supply of output in the market, price fixing and collusion to maintain price levels of output in the market. These cartels set the targeted price of output for each of geographic zones.

These cartels influence Trading Corporation of Pakistan (TCP) and other regulatory bodies to their advantage by proposing to stock up the inventory and export the output when a high supply of product in domestic market is likely to reduce price level.
3.7.3 Collusive Procurement Cartels

The collusive rent seeking bodies also influence the backward channel to control the input market. By exploiting the farmers to reduce price at the time of purchasing sugarcane during crushing season is a commonly witnessed example in Pakistan. These rent seeking cartels eventually succeed in controlling the input prices. These cartels also govern the procurement quotas in regions to maintain a fixed supply of output.
CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

The objective of this research is the analysis of selected industries in manufacturing sector therefore, a detailed discussion on results followed by industry-wise results is made in this chapter. According to the scheme of this chapter, in Section 4.2, the Econometric Model and Maximum likelihood Estimates are discussed. Section 4.3 is based on the discussion on efficiency scores calculated through Stochastic Frontier Analysis approach and Data Envelopment Analysis approach. In section 4.4, industry-wise results and discussion are presented.

4.2 Results of Econometric Model

The model as reflected in equation 3.16 is estimated econometrically by SFA approach using FRONTIER 4.1 Software developed by Coelli (1996). The results are presented in the table 4.1

The results are in consonance with Mahmood, T, et al. (2006). The coefficient of Capital (K) is 0.426 which shows that a one percent increase in capital usage by an industrial sector, increases the output by 0.426 percent. The results for labor (L) show a lower coefficient having the value 0.414.
Table 4.1  MLE Results of selected industries for the Years 1981-82 to 2005-06

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.654</td>
<td>0.73</td>
</tr>
<tr>
<td>Number of Firms (N)</td>
<td>-0.268</td>
<td>-0.37</td>
</tr>
<tr>
<td>Capital (K)</td>
<td>0.426</td>
<td>1.63 *</td>
</tr>
<tr>
<td>Labor (L)</td>
<td>0.414</td>
<td>1.56 *</td>
</tr>
<tr>
<td>Natural Gas (NG)</td>
<td>0.559</td>
<td>3.83 **</td>
</tr>
<tr>
<td>Electricity (E)</td>
<td>-0.476</td>
<td>-0.57</td>
</tr>
<tr>
<td>Sigma Squared ((\delta_k^2 = \delta_u^2 + \delta_v^2))</td>
<td>0.145</td>
<td>0.48</td>
</tr>
<tr>
<td>Gamma ((\gamma = \delta_u^2 / \delta_v^2))</td>
<td>0.603</td>
<td>3.34 **</td>
</tr>
</tbody>
</table>

LR test of one sided error = 3.119

* Significant at 0.10 level of confidence
** Significant at 0.01 level of confidence

The next two variables are Natural Gas (NG) at 0.559 and Electricity at -0.476. The coefficient of natural gas is highly significant which may suggest that in current sample the industries are natural gas intensive. The results show that a one percent increase in the usage of natural gas increases the output by 0.56 percent. Industries need to take advantage of this favorable factor as natural gas is relatively cheaper and abundant source of energy in Pakistan and its supply is relatively more reliable and consistent as compared to electricity.

The reason for negative sign of electricity is that the dependent variable Y in the model actually represents the contribution of that industrial sector to economy after adjusting for industrial and non-industrial costs. Therefore, an increase in the usage of electricity may increase costs more than the value added thereby reducing the contribution of that sector.
in economy. A one percent increase in the use of electricity reduces the contribution of that sector to economy by about 0.476 percent. This shows that use of electricity may not be recommended for efficient production under these circumstances. It is due to this fact that the industry has switched over to natural gas for power needs. The coefficient of natural gas is 0.559 which supports the proposition that natural gas is replacing the use of electricity for power needs of the manufacturing industry in Pakistan.

The reason for negative sign with number of firms in the sample is again that the dependent variable Y in the model actually represents the contribution of that industrial sector and an increase in number of firms can reduce the contribution of that sector in economy. The coefficient shows that with a one percent increase in number of firms in selected sectors, the contribution of these sectors to economy comes down by 0.26 percent. This implies that the selected sample of industries is more skewed to rent seekers and inefficient production patterns are dominant in the selected industrial sectors, therefore an increase in their number increases the inefficiency coefficient and hence reduces the contribution to the economy.

The LR (likelihood ratio) test of error gives a value of 3.119 which is significant at 95 percent implying that Cobb-Douglass production function adequately represents data. The magnitude of gamma parameter γ is 0.603 indicating that inefficiency is a major component of the composite error term. Hence the first null hypothesis that there is no inefficiency and all firms are operating fully efficiently, is rejected.
4.3 Technical and Allocative Efficiency Scores

Prices of the products of suspected rent seeking industries (such as sugar, cement and locally assembled vehicles) have been reported for being unjustifiably high by the domestic consumers in Pakistan. The extreme hike in price as well as severe fluctuation in the price of these products in Pakistan apparently seems to be a result of demand and supply imbalance primarily. This can be assumed because of the fact that cost of production and government taxes do not fluctuate in such a pattern. For example, price of sugar is Rs. 70 per kg one day and it escalates to Rs. 110 per kg the next day. Likewise, price of one sack of cement hovers around Rs. 250 per bag one day and it reaches to Rs. 450 per bag the next day. Locally assembled vehicles are available on cash by paying a premium of Rs. 40,000 per vehicle to Rs. 80,000 per vehicle as an illegal tax for ready supply. Otherwise the customers who have booked these vehicles have to wait for at least three to four months. The quoted examples are mainly due to imbalance between demand and supply of these products, and not due to changes in cost of production.

The demand-supply imbalance can be explained by taking into account the other side of equation i.e. short supply. However, the difference between demand and supply (in the form of shortfall of supply) does not seem to appear due to increased consumption behavior. Short supply can be attributed to two main reasons: lesser production, or, controlled supply. The first reason may not be supported because the data shows an increase in production of all industries over the years. Hence on final reason which explains this price hike, is controlled supply. Controlled supply is only possible under (a)
Contraction in Industrial sector (b) Cartels. Since these sectors appear to be growing in the number of firms (vide Section 3.4) therefore, the first assumption may be overruled. Cartels appear to be a major reason behind controlled supply.

The results presented in Table 4.2 conform to this assumption. Establishment of cartels has two impacts on the industry. First, is the loss of technical efficiency. This can be explained by the non-maximizing behavior theory which states that when profit seeking (or rent seeking) is higher and easier (through a cartel and having a free ride on the resources), then the entrepreneur does not invest in the technological upgradation of the firm. This makes the firm become in-efficient. Rent seeking causes allocative in-efficiency by employing higher inputs above those used in the optimal factor mix.

A rent seeking firm can still be technically efficient while being allocative in-efficient. An industry can organize its input factors to remain on its production frontier but by using the wrong factor mix. This causes it to have allocative in-efficiency. Therefore, measurement of only technical efficiency is just one side of the picture while measuring the allocative efficiency can depict the actual cost efficiency of an industry. The gap between minimum cost optimal factor mix (associated with the efficient production frontier) and the sub-optimal factor mix can be interpreted as the in-efficiency associated with rent seeking.

Cartels approach bureaucracy and get decisions/ regulations of the government in their favor. Costs are increased due to establishment and management of cartels and by paying bribes to Law makers, Control Authorities, Enforcement agencies and others who can
influence the supply and price of sugar. The wrong factor mix may also arise when optimal resources are not being utilized for profit maximization, rather, diverted to bribes and other undue financial benefits to policy makers who influence the national economic policies/regulations in favor of these rent seekers.

Almost all of these effects are reflected in the results where technical and allocative efficiency scores have been calculated through both Stochastic Frontier Approach (SFA) as well as Data Envelopment Analysis (DEA). The efficiency scores obtained from SFA Approach using FRONTIER 4.1 Program and from DEA Approach using DEAP 2.1 Program, are summarized in the following.

**Table 4.2**  
T.E. and A.E. Scores of selected industries using SFA and DEA for the Years 1981-82 to 2005-06

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>T.E. using SFA*</th>
<th>T.E. using DEA</th>
<th>A.E. using DEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>0.634</td>
<td>0.501</td>
<td>0.046</td>
</tr>
<tr>
<td>Cement</td>
<td>0.637</td>
<td>0.607</td>
<td>0.111</td>
</tr>
<tr>
<td>Automobile Manufacturing</td>
<td>0.549</td>
<td>0.500</td>
<td>0.256</td>
</tr>
<tr>
<td>Beverages</td>
<td>0.738</td>
<td>0.735</td>
<td>0.433</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>0.687</td>
<td>1.000</td>
<td>0.056</td>
</tr>
<tr>
<td>Paint</td>
<td>0.778</td>
<td>1.000</td>
<td>0.909</td>
</tr>
</tbody>
</table>

* Average Technical Efficiency scores calculated over the time series data.

The difference in T.E. scores using SFA and DEA is due to the difference in procedure, already discussed in detail in Section 3.2. The results conform to the theory presented in
preceding paras. Establishment of cartels in suspected rent seeking industries causes lower technical and allocative efficiency scores. All three suspected industries which include Sugar, Cement and Automobile Manufacturing are having very low allocative efficiency scores. The other three industries, assumed to be fair, including Beverages and Paints show higher efficiency scores because their profits (and survival) rely on efficient production. The case of fertilizer sector is different and is discussed in detail in Section 4.4.4

The second hypothesis about the impact of rent seeking on efficiency, has been tested using the test statistic as depicted in Equation 3.22 about the difference of means between sample of rent seeking sectors and fair sectors. The value of \( t_{cal} \) comes out to be 3.630 which does not fall in the acceptance region against \( t_{tab} \) value of 1.691 at 95 percent level of confidence. Hence hypothesis, that there is no difference between efficiency scores of fair and rent seeking sector, is rejected which implies that technical as well as allocative efficiency of rent seeking sectors is significantly higher than the efficiency of rent seeking sectors. This is significant contribution to knowledge that for the first time in Pakistan, the impact of rent seeking has been empirically identified on the efficiency of selected manufacturing industry.

It has been proved that rent seeking adversely affects the economic efficiency of industries, primarily due to non-maximizing behavior as presented in the theory earlier. This may pave the way for further research in other sectors, such as service sectors, and may help to identify the adverse effects of rent seeking. The results of hypotheses formalized in Section 1.6 are represented in Table 4.3
Table 4.3  Tests of Hypotheses for Economic Inefficiency and Impact of Rent seeking on Efficiency of selected sectors of Manufacturing Industry of Pakistan

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Description</th>
<th>Result</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>( H_0: \gamma = 0 )</td>
<td>All firms are technically efficient and no signs of inefficiency exist</td>
<td>Reject ( H_0 )</td>
<td>Alternate hypothesis is accepted that inefficiency exists in the selected industrial sectors.</td>
</tr>
<tr>
<td>( H_0: \Phi_{FS} = \Phi_{RS} )</td>
<td>Economic Efficiency of fair sectors equals economic efficiency of rent seeking sectors</td>
<td>Reject ( H_0 )</td>
<td>Economic efficiency of fair sectors is significantly higher than the efficiency of rent seeking sectors.</td>
</tr>
</tbody>
</table>

4.3.1 Price of Inputs

The measurement of allocative efficiency requires price information about the inputs to be incorporated into the model. A total of five inputs have been taken into the model. Therefore, price of each input is required to be calculated. The price for each input is estimated on the analogy presented below:

a) Price of Labor (L) or wage has been calculated by dividing the total wage bill by the number of labor employed in the particular industry

b) Price of Fixed Capital has been calculated as suggested by Matthews et al. (2008). It is obtained as operating expenses less personnel expenses divided by fixed assets (adjusted for depreciation). In Pakistan, the value of Depreciation of assets is 15% according to Section 22 of Income Tax Ordinance 2001, rate formulated in Part 1 of Schedule 3.
c) Price of Natural Gas and Electricity has been obtained from the quantity used and expenditure incurred by industries on each input (based on the CMI data). This method proved to be very beneficial as it also enabled to find price of each input actually faced by a particular industry as well as input selection pattern of each industry. Moreover, with this information, price variation in inputs can be observed over time series.

d) The last problem is to determine the price for the input variable Number of Firms in industry (N). This has been solved by assigning weights to each industry. Number of firms in an industry depends upon many factors which include barriers to entry, initial investment costs, cartels and risk involved etc. Therefore the heavier the magnitude of these factors, the greater the weight assigned. In this research largest weight of 7 points has been assigned to Fertilizer industry due to heaviest initial investment posing a heavy barrier to entry. Usually larger corporations (such as Fauji Fertilizers) or multinationals (such as Engro Group) invest in fertilizer industry.

The second heaviest weight of 5 points has been assigned to Sugar Industry. It is due to strict barriers to entry controlled by elite feudal and political families in Pakistan. Strong cartels are found restricting entry of new competitors/investors. FDI could never be attracted towards sugar industry due to this political clout despite of abundant raw material.
Next level has been assigned to Cement Industry with a weight of 4 points. This is based on the fact that cement industry requires specific geographic locations where raw material is abundantly available (sometimes, mountains are to be acquired like land). Moreover, initial investment costs are also higher. Therefore, the weight is justified as a per unit ‘price’ to increase a unit in industry.

Automobile Manufacturing industry has been assigned a weight of 3 points. This is due to the fact that in Pakistan, the automobile consumers have specific preferences and are brand loyal. Some specific brands such as Toyota, Suzuki and Honda lead the market therefore restricting the entry of other brands. In 2000, Dewan Group introduced other brands KIA and Hyundai but both of the brands got flop and the ventures were abandoned. Therefore, a weight of 3 points is justified to the Automobile Manufacturing sector.

The remaining two sectors, Beverages and Paints have been allotted a weight of 2 points because the initial investment is lower in both the industries, there are apparently no barriers to entry and easy exit is possible.

4.3.2 Labor and Capital

The data collected on sample of industries also provided with information about average manpower employed in the selected industries as well as the average capital used by the
industries. This helps to establish a comparison of the selected industries, whether they are relatively capital or labor intensive based upon the data of these two variables. The data is shown in Table 4.4 and drawn in Figure 4.1 and Figure 4.2.

**Table 4.4  Capital and Labor base of selected industries**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Average No of persons employed (per firm per day)</th>
<th>Unit Labor Cost faced by each industry (Rs.)</th>
<th>Average Capital (Rs. Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>38,408</td>
<td>110.50</td>
<td>25.244</td>
</tr>
<tr>
<td>Cement</td>
<td>12,253</td>
<td>215.68</td>
<td>22.407</td>
</tr>
<tr>
<td>Auto. Manuf.</td>
<td>8,062</td>
<td>226.31</td>
<td>11.373</td>
</tr>
<tr>
<td>Beverages</td>
<td>6,150</td>
<td>121.28</td>
<td>5.217</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>6,216</td>
<td>319.20</td>
<td>17.503</td>
</tr>
<tr>
<td>Paint</td>
<td>1,354</td>
<td>235.07</td>
<td>1.342</td>
</tr>
</tbody>
</table>

Source: CMI

The graphs in Figure 4.1 and Figure 4.2 show that amongst the selected sectors, Sugar industry provides maximum employment and possesses broadest capital base. Cement Industry is next to sugar sector in employment as well as in capital base. Automobile Manufacturing industry comes at third place in employment but fourth place in capital. Fertilizer industry comes at fourth place in labor but third place in capital. While the beverages and paint industries come fifth and sixth in employment as well as in capital, respectively. Unit labor cost faced by each industry has also been depicted.
Figure 4.1.1 Average employment in various industries of Pakistan

Figure 4.1.2 Unit Labor Cost in various industries of Pakistan
4.4 Industry-Wise Results

4.4.1 Sugar Industry:
Performance of sugar industry has always been questioned and criticized. Main reason behind this is the observed sudden fluctuations in the retail price of refined sugar. The open market price of sugar in Pakistan, compared with the international price of sugar over the years, is tabulated and graphed in Table 4.5 and Figure 4.3 respectively which show substantial hike in the price of sugar in Pakistan. If the prices are compared with those prevailing in the international market, national prices appear to be on higher side despite of the fact that Pakistan is self-sufficient in the production of sugar cane (the primary raw material of sugar).
Table 4.5  Comparison of fluctuation in Sugar Prices in Pakistan and International Market

<table>
<thead>
<tr>
<th>Year</th>
<th>Open Market Retail Price of Sugar in Pakistan (Rs. per Kg) *</th>
<th>International Retail Price of Sugar (Cents per Pound) Converted to (Rs. per Kg) **</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981-82</td>
<td>10.48</td>
<td>26.53</td>
</tr>
<tr>
<td>1985-86</td>
<td>8.35</td>
<td>6.63</td>
</tr>
<tr>
<td>1990-91</td>
<td>11.33</td>
<td>18.25</td>
</tr>
<tr>
<td>1995-96</td>
<td>16.76</td>
<td>17.97</td>
</tr>
<tr>
<td>2000-01</td>
<td>27.11</td>
<td>11.35</td>
</tr>
<tr>
<td>2005-06</td>
<td>35.16</td>
<td>12.47</td>
</tr>
<tr>
<td>2010-11</td>
<td>77.00</td>
<td>26.50</td>
</tr>
</tbody>
</table>


** Source: London International Financial Futures and Options Exchange. (LIFFE)

*** Currently prevailing retail rate taken from market survey

Figure 4.3  Comparison of fluctuation in Sugar Prices in Pakistan and International Market
To associate such price hike with increased demand by consumers is also not appealing as sugar it is not considered an essential food item (like wheat) and substitutes in the form of raw brown sugar (Shakar) and jiggery (Gurr) are available. Moreover, increase in demand cannot vary in such a frequency as the price movement is observed.

The discussion may be focused on the efficiency scores obtained for the sugar industry from SFA as well as DEA approach. Using the SFA, the average technical efficiency score of sugar industry comes out to be 0.634 and using DEAP this score is 0.501.

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>T.E. using SFA</th>
<th>T.E. using DEA</th>
<th>A.E. using DEAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>0.634</td>
<td>0.501</td>
<td>0.046</td>
</tr>
</tbody>
</table>

* Average T.E. scores calculated over time series data

The results show that sugar industry has average level of technical efficiency. However, the effect of rent seeking through cartels is particularly apparent in the score of allocative efficiency. Allocative efficiency score of sugar industry is very low at 0.046 which clearly indicates that sugar sector is highly allocative in-efficient. On the other hand, number of firms in sugar industry grew at a fast rate as depicted in Figure 3.1. This contradiction needs detailed discussion as to why there is an attraction in sugar industry to expand despite of being in-efficient.
The results tabulated above indicate presence of rent seeking in sugar industry. This rent seeking has been unveiled and establishment of cartels has been exposed in a report published by Gilani and Javed (2009) on the instructions of Competition Commission of Pakistan. According to the findings of this report, the perusal of the documents shows excessive institutionalization of collusive behavior in the refined sugar industry. These collusive activities on part of Pakistan Sugar Mills Association (PSMA) are so aggressive and extensive that the association does not appear to be a representative body of the sugar mills but it works as a strategic business decision making body for sugar sector. PSMA has exceeded its mandate with the consent of its members and it has developed its footings like the old “business trusts” of the United States that developed in the 19th century.

It has also been reported that sugar mills under the strategy devised by the association indulge in rent seeking activities such as sugar cane price setting, sugar cane procurement based on territorial division, collusive and maneuvered bidding in TCP tenders, creating barriers to entry by proposing restrictions on establishment of new mills, and indulging in collective price negotiation. The report shows that PSMA controls seller’s cartel on behalf of its member mills. It has been shown that PSMA is indulged in setting sugar price, and proposes and allocates quotas, and engages in collective bargaining for price. The PSMA regulates sugar sector, and ensures that there is no real internal competition within member firms. Further, the correspondence between PSMA and member mills indicates PSMA controls the supply of sugar in open market, fixes price and maintains collusive setup to maintain desires sugar price in the market.
On the backward channel, i.e. input side, the PSMA attempts to propose a starting date of crushing season, sets a particular date of payment to sugarcane producers, to maintain a certain price of sugar in market. The findings of this report clearly show rent seeking behavior on part of sugar sector through its collusive body PSMA. A further investigation may be conducted with the cost break-up of refined sugar manufacturing:

**Table 4.7  Cost Break-up of Refined Sugar Manufacturing**

<table>
<thead>
<tr>
<th>Cost Head</th>
<th>%age of Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Material</td>
<td>93.00</td>
</tr>
<tr>
<td>Personnel Expenses</td>
<td>2.33</td>
</tr>
<tr>
<td>Depreciation /Overheads</td>
<td>1.89</td>
</tr>
<tr>
<td>Repair and Maintenance</td>
<td>1.23</td>
</tr>
<tr>
<td>Packing</td>
<td>1.13</td>
</tr>
<tr>
<td>Fuel &amp; Power</td>
<td>0.48</td>
</tr>
</tbody>
</table>

Source: Cost Audit Reports of misc. sugar mills for the year ended 2011

The cost break-up depicted in Table 4.7 reveals that sugar industry has some advantages over other industries which can bring it to highest levels of efficiency. First, the consumption of raw material takes about 93% cost of refined sugar, while other sectors, such as Cement (Table 4.9) and Fertilizer (Table 4.13) have larger cost shares for power and electricity. Secondly, this sector has an advantage that raw material is locally produced and abundantly available. In view of these facts, this sector should have highest scores of technical and allocative efficiency in this sample of industries.
However, the results are totally different from expectation. Therefore, the results in Table 4.6 and Table 4.7 provide the empirical evidence of rent seeking cartels in the sugar sector of Pakistan’s manufacturing industry. The collusive body PSMA diverts the industry from profit maximization approach to rent-maximization approach. PSMA involves in rent seeking activities which are costly and the cost is charged to member firms for their advantage. Result is a high cost production pattern and hence inefficiency apparent in technical and allocative efficiency scores.

The results based on the other data collected show that on average, the sugar industry employed 38,400 daily employees. The wage rate for sugar remained at an average of Rs. 110 per day per labor. This means that mostly unskilled labor (such as labor coolies) is employed at sugar industry. The sugar sector had an average capital of Rs. 25.244 million and faced price of Capital at 1.09 percent. The average price of NG faced by sugar remained at Rs. 3.17 per Cubic Feet. The price of Electricity faced by sugar industry remained at an average of Rs. 4.62 per unit.
4.4.2 Cement Industry

The next industry suspected for rent seeking is cement industry. Consumers have long complained about the unstable price of cement in Pakistan. Cement industry is spread geographically on certain locations where its basic raw material (which is usually limestone, and gypsum) is abundantly available. The efficiency score of Cement industry is also not convincing, though better than Sugar Industry.

Table 4.8  T.E. and A.E. Scores of Cement Industry using SFA and DEA for the Years 1981-82 to 2005-06

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>T.E. using SFA*</th>
<th>T.E. using DEA</th>
<th>A.E. using DEAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>0.637</td>
<td>0.607</td>
<td>0.111</td>
</tr>
</tbody>
</table>

* Average Technical Efficiency scores calculated over time series

The score using SFA is 0.637 and using DEA is 0.607. These scores reveal the fact that at least cement industry is performing technically better than sugar industry. One of the reasons behind this technological advantage is emission regulation. Most of the cement industries have improved their plants by installing advanced filtering mechanism to minimize the byproduct wastes. About 15-20 years ago, cement factories in Pakistan were famous for their heavy soot and smoke in the vicinity. However, now the situation has entirely changed. Environmental regulations as well as efficient production techniques have regulated the cement sector to fairly reduce the emission problem and in turn reduce waste.
However, pricing Policy of Cement industry has always been criticized. The presence of cartels and their influence on pricing was also highlighted in a report published by Hussam (2010) wherein the pricing and costing policy of cement industry was discussed in detail. It has been stated that in April 2009, price of cement was Rs. 310 per 50 kg bag, which was decreased to Rs. 270 per bag due to a large stock of cement left with the cement manufacturers. All Pakistan Cement Manufacturers Association (APCMA) reduced prices to dispose of its huge stock, which was left with them, as India cancelled an order of over 25,000 tons of cement. The other reason of this reduction was that the Government slashed its development budget by Rs. 118 billion which showed a clear decline in construction work in future. The cement prices also fluctuate due to market circumstances.

The costing formula indicates that price of raw material has only a mere 10 percent influence on the costing policy of cement. The other main factors include fuel at 41 percent, power at 18 percent and, other Costs influencing 22% of the cost.

**Table 4.9 Cost Break-up of Cement Manufacturing**

<table>
<thead>
<tr>
<th>Cost Head</th>
<th>%age of Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Material</td>
<td>10</td>
</tr>
<tr>
<td>Fuel</td>
<td>41</td>
</tr>
<tr>
<td>Power</td>
<td>18</td>
</tr>
<tr>
<td>Packaging</td>
<td>09</td>
</tr>
<tr>
<td>Other costs</td>
<td>22</td>
</tr>
</tbody>
</table>

Source: Hussam, (2010)
The break-up is important in one aspect that it depicts a major share of other costs which may include the overhead costs incurred for establishment and maintenance of cartels. Or in simpler terms, rent seeking costs.

**Figure 4.5  Costing Formula of Cement Industry in Pakistan**

A pricing model has also been developed by Hussam (2010)

\[ P(x) = C(x) + ED + GST + FR + C(d) + MP \]  

where

- \( P(x) \) is Price of Cement per ton
- \( C(x) \) is Cost of production of cement per ton or the base price
- \( ED \) is Excise Duty per ton. The FED was Rs. 900/T in 2008 (at the time when the report was prepared).
- \( GST \) is General sales tax (at the rate currently applicable) on the duty-paid price of cement.
- \( FR \) is Freight charges per ton depend upon the distance of the end-user from plant.
- \( C(d) \) is Wholesaler/dealers commission. Producers sell 50kg paper sack bags of cement to wholesale dealers for cash payment in advance. In this way, manufacturers can
recover their working capital and, in the process, pass off the title and risk to dealers who bear all costs related to transport, insurance, in-carriage damage, if any, and stock spoilage due to lack of use. Dealers’ margins range around Rs 175-200 per ton or Rs. 4.50-Rs. 5.00 per 50 kg bag. Retailer margin is a relatively low Rs. 2-3 per 50 kg bag, and

MP is Manufacturers Commission. It has been stated that the overall demand-supply matrix allows some cement manufacturers to earn 10 percent return on equity, which ensures sufficient profitability to continue to manufacture and sell cement.

The average industry cost of cement bag was Rs.193 per 50 kg in 2010 while the average ex-factory price of cement bag was Rs.235. However, before a debate is made on the cited report, it is useful to watch the price of cement over the last 05 years. The average price of cement per bag over the last 05 years is as depicted in Table 4.10

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Retail Price of Cement per 50 kg sack</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>335</td>
</tr>
<tr>
<td>2006</td>
<td>430</td>
</tr>
<tr>
<td>2007</td>
<td>315</td>
</tr>
<tr>
<td>2008</td>
<td>220</td>
</tr>
<tr>
<td>2009</td>
<td>270</td>
</tr>
<tr>
<td>2011</td>
<td>* 450</td>
</tr>
</tbody>
</table>

Source: APCMA
* Open market rate.
The data as in Table 4.10 is plotted in Figure 4.6

**Figure 4.6  Fluctuation in Open Market Retail Price of Cement in Pakistan**

The figure shows extreme variance in the price of cement over the last 5 years. According to the costing formula derived in previous section the major factors of production are fuel, power and other costs.

The industry, on average faced the price of NG to the tune of Rs. 3.27 per cubic feet, and an average price of electricity equaling to Rs. 4.24 per unit. These results show that cement industry, on average, faced rather cheaper natural gas and electricity as compared to other industries.
Therefore, the claim of industry for rise in cost of production cannot be caused by rise in input prices. The rise in cost of cement is mainly due to rise in overhead costs which appear to be associated with rent seeking as the investigative report cited in previous section points out to the presence of strong cartels (namely APCMA) and this fact can empirically be supported by efficiency scores quoted in table 4.6 showing rent seeking inefficiency causing low levels of allocative efficiency.

Presence of rent seeking cartels can be associated to lower efficiency scores. APCMA tries to control the supply-demand balance with a favorable price, which is usually practicable as cement is a necessity in the developing economies. Regulations to ban import of cement are often passed in the name of protecting the domestic industry. Resultantly, domestic consumers as well as public departments are bound to pay whatever the price being charged strengthening the rent seekers and diverting their motive from profit maximization to rent-maximization. Therefore, the industry, through technically better than sugar industry, yet scores disappointing points in allocative efficiency.

The results obtained from the data collected in the study show that cement industry employed around 12,253 employees per firm per day at an average wage of about Rs. 215 per labor per day which means that cement industry mostly relied on semi-skilled labor (such as technicians, supervisors etc). The industry had average capital base of Rs. 22.407 million and faced price of capital at 0.560 percent. The industry, on average faced the price of NG to the tune of Rs. 3.27 per cubic feet, and an average price of Electricity equaling to Rs. 4.24 per unit.
4.4.3 Automobile Manufacturing Industry

The automobile industry in Pakistan enjoys strong brand loyalty and rigid preferences by the consumers. The automobile manufacturing industry has exploited this situation and has evolved into a monopolistic industry by reportedly engaging in rent seeking activities. The leading brands include Suzuki, Toyota and Honda in cars portfolio, Hino in commercial Trucks and Buses sector, and Honda and Yamaha in motorcycles market. These companies are enjoying leading shares and produce popular and heterogeneous products. For example Pak Suzuki Company enjoys monopoly in compact cars which range in engine displacement of 800cc to 1000cc. Toyota and Honda offer medium to large cars having displacement from 1300cc to 1800cc.

There are barriers to entry for new investors as these main companies have a good hold on local technicians and advisors, car mechanics, maintenance workshops, and spare parts vendors. These stakeholders do publicity for these brands and influence the prospective customer to select one of these brands. In return, they enjoy business and fringe benefits from these companies. All major workshops, technicians and vendors refuse to provide backup of repair maintenance and parts for other niche brands such as Daihatsu, Land Rover, Mitsubishi etc. These rent seeking policies have helped the major companies to develop a strong hold in the domestic market of Pakistan although quality of products offered is disappointing as compared to equivalent specification imported cars. On the contrary, price of locally produced vehicles is very high as compared to available imported options. These local companies also influence the Federal Government on two issues
(i) Procurement of locally produced vehicles for public sector programs, and (ii) imposing tariffs and quotas on imported vehicles which pose a direct threat to local manufacturers.

After receiving serious complaints about the poor quality and high price of the locally assembled products, import tariffs and quotas were lowered in 2005-06. As a result, huge number of imported cars and motorcycles flooded in Pakistan and these products got highly popular due to extremely superior quality and higher value for money. The ban on import was once lifted during the year 2005. The total number of imported vehicles reached to 72,000 units during 2005-06 when import of 10 years old vehicles was allowed. The number went down to 42,000 units during 2006-07 when condition to import of not more than 5 years old vehicles was imposed. This condition was further tightened during 2007-08 when import of only 3 years old vehicles was allowed. The government also imposed 50% regulatory duty followed by followed by 12.5% customs duty. These measures appear to be a result of collusive rent seeking strategy opted by automobile manufacturing industry in the name of protection of local industry (The Daily DAWN Website).

Rent seeking practice may easily be seen in automobile sector. Taking the example of motorcycle market, Atlas Honda Company were selling 70cc motorcycles at a price of Rs.70,000 per unit and 125cc motorcycle at a price of Rs. 87,000 per unit in year 2005-06. However, when Chinese motorcycles were introduced they averaged around a price of Rs. 35,000 to 45,000 per unit for 70cc while Rs. 55,000 per unit for 125cc motorcycles. Further, these imported motorcycles offered luxury accessories such as electric self-starter, hydraulic disc brakes and attractive shapes with a comfortable and firm ride. A huge
number of customers abandoned purchase of locally assembled motorcycles which were being designed on the blue print of early 1980’s design as the local manufacturing companies changed the sticker marquee on fuel tank and side covers but the frame design and specifications of these motorcycles were same as per old design. However, import pressure influenced these companies to introduce new models. Atlas Honda Company introduced a new better quality 100cc motorcycle named Honda CD-100 and a sporty Honda CG-125 Deluxe offering all new and luxury accessories. Dawood Yamaha Company introduced 100cc 4-stroke motorcycle YD-100 and a custom shaped Yamaha Junoon. Introduction of these new models was deemed necessary to counter the overwhelming image of new model imported motorcycles.

Moreover, prices of major product line were dropped dramatically with Honda CD-70 coming down to worth Rs. 62,000 per unit and Honda CG-125 dropping to Rs. 75,000 per unit (reducing by Rs. 8,000 and Rs. 12,000 per unit respectively). This shows that these companies had to cut their super-normal rents being earned under the cover of protection policies. The efficiency scores of automobile industry presented in Table 4.11 depict the adverse situation mentioned above. The results show that the automobile industry is technically efficient around 50% which is quite low in case of engineering industry. The scores should go well above 70 percent as automobile industry relies on latest technological advancements. The score with SFA is 0.549 while with DEA is 0.500.
Table 4.11  T.E. and A.E. Scores of Automobile Manufacturing Industry using SFA and DEA for the Years 1981-82 to 2005-06

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>T.E. using SFA*</th>
<th>T.E. using DEA</th>
<th>A.E. using DEAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobile Manufacturing</td>
<td>0.549</td>
<td>0.500</td>
<td>0.256</td>
</tr>
</tbody>
</table>

* Average Technical Efficiency scores calculated over time series

This means that Automobile Manufacturing industry is technically disappointing. This can be seen practically as old model vehicles are manufactured and delivered for at least 10 to 15 years implying that old manufacturing plants are used to continue models. It is evident in case of Suzuki. The model Suzuki Mehran is being built on current chassis and engine since 1989 to date while the Suzuki Bolan (Carry) since 1982. Other companies also do not change models for long. Toyota Corolla introduced new model 2010 after ten years while Honda CG-125 is based on Model year 1979. It is also pertinent to mention here that selective vendors and original equipment manufacturers (OEM) are providing parts to these automobile industries without any competitive bidding environment and hence these parts are of poor quality brittle plastic or weak metal.

Moreover, as in the case of sugar and cement, the automobile manufacturing industry is also very weak in allocative efficiency. Any of the rent seeking practices by automobile manufacturing sector bring the industry to allocative inefficiency conditions. Having bureaucracy links for import ban, connections with competitive commission and regulatory authorities, the automobile manufacturing industry seems to invest too much to enjoy monopolistic environment. Vehicles are sold at high rates, with low quality of
manufacturing. Customer exploitation always goes unchecked. There is no feedback mechanism. Hence performance of automobile manufacturing industry is disappointing on national level.

Other results reveal that the automobile manufacturing industry, on average employed 8,062 employees per firm per day. This means that this industry employed semi skilled labor (such as technicians, painters, welders etc). The industry, on average, faced wage rate of Rs. 226 per day per labor. The industry had an average capital base of Rs. 11.373 million and had to face the price of capital being 6.28 percent which shows that price of obtaining capital is quite higher for automobile industry. The price of natural gas faced by this industry remained at an average of Rs. 3.28 per cubic feet, while the price of Electricity averaged at Rs. 4.82 per unit.

4.4.4. Fertilizer Industry

Before the discussion focuses on Beverages and Paints industry, the fertilizer industry needs a careful discussion. It is because the efficiency scores obtained are contradictory with the theoretical knowledge and available subjective reports. The results, based on SFA and DEA are presented in Table 4.12

It was assumed that fertilizer industry in Pakistan is free from core rent seeking. However, the results as per above tell a different situation. The technical efficiency score of Fertilizer industry is higher than the industries associated with rent seeking, but the allocative efficiency score is quite low which is an alarming position.
Table 4.12  T.E. and A.E. Scores of Fertilizer Industry using SFA and DEA for the Years 1981-82 to 2005-06

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>T.E. using SFA*</th>
<th>T.E. using DEA</th>
<th>A.E. using DEAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizers</td>
<td>0.687</td>
<td>1.000</td>
<td>0.056</td>
</tr>
</tbody>
</table>

* Average Technical Efficiency scores calculated over time series

The results in the preliminary analysis of Fertilizer industry in Section 3.4.1 Explained in figure 3.5 could not lead to any conclusion because there was no growth in the industry and a static situation was observed. The number of units in fertilizer industry remained quite low at about 10 units on average. However, in the last 05 years, the existing companies have increased their production facilities. Fauji Fertilizer Company Ltd (FFC) has expanded to three plants, while the second largest Engro Fertilizer Ltd has expanded to two units.

So there are strong chances that fertilizer industry may has an oligopolistic structure rather than to be suspected for collusive rent seeking. Moreover, the fertilizer industry is dominated by multinationals such as Engro Fertilizer and Pak-American Fertilizer by foreign direct investment. Under such circumstances, rent seeking practice by any local fertilizer manufacturer may be pointed out by others and be controlled. According to a report published by IGI Securities (2007), the cost break-up of fertilizer manufacturing is tabulated in Table 4.13 and depicted in Figure 4.6.
Table 4.13  Cost Break-up of Fertilizer Manufacturing

<table>
<thead>
<tr>
<th>Cost Head</th>
<th>%age of Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Material</td>
<td>52</td>
</tr>
<tr>
<td>Fuel &amp; Power</td>
<td>20</td>
</tr>
<tr>
<td>Personnel Expenses</td>
<td>13</td>
</tr>
<tr>
<td>Other costs</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: IGI Securities (2007)

The cost break-up does not appear to be abnormal. The major share in the cost of fertilizer is raw material. Most vulnerable component in the production of fertilizer is Natural Gas (NG) which is used as a fuel as well as in process (feed). An uninterrupted supply of NG is required for smooth operation of fertilizer industry. The other raw materials constitutes mostly of industrial gases such as Nitrogen and Ammonia, and minerals including Sulfur, Potassium, and Phosphorus.

Figure 4.7  Costing Formula of Fertilizer Industry of Pakistan
In Pakistan, there are around seven major groups which are operating 16 plants. The industry has been assumed to be fair in this research with having no apparent signs of rent seeking behavior. This can be supported by the fact that there is no formal association of fertilizer companies in Pakistan. Hence the first suspicion of collusive behavior is cannot be supported. However, the less number of companies in this industry may create oligopolistic market structure with product differentiation. This is depicted in the differentiated price pattern of heterogeneous products available in the market in Table 4.14.

Reportedly, the ex-factory price of fertilizer almost never goes beyond justified levels. This means that any complaints about the high price of fertilizer may primarily be associated to the supply-demand problems. However, the oligopolistic structure of market has its own draw backs. For example, the companies need not to be highly technically efficient to remain in the market. Moreover, pricing policy of each company may be independent of the other. This is reflected in the Table 4.14, wherein each company has set its own price for Urea, the basic and most commonly used fertilizer in Pakistan.

**Table 4.14  Retail Prices of Various Urea Products**

<table>
<thead>
<tr>
<th>Company</th>
<th>Urea Brand Name</th>
<th>Open Market Retail Price per bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engro Chemical</td>
<td>Engro Urea</td>
<td>Rs. 1120/-</td>
</tr>
<tr>
<td>Fauji Fertilizer</td>
<td>Sona Urea</td>
<td>Rs. 950/-</td>
</tr>
<tr>
<td>Dawood Hercules</td>
<td>Babbar Sher</td>
<td>Rs. 1200/-</td>
</tr>
<tr>
<td>Fatima Fertilizer</td>
<td>Urea</td>
<td>Rs. 850/-</td>
</tr>
</tbody>
</table>

Source: Open Market Survey (2011)
However, due to lesser number of firms, entry or exit of any firm affects the pricing policy of the whole industry. The largest firms are usually the price setters. Government regulations and subsidies to farmer prevent these firms from exploiting their market power to fully control the prices (IGI Securities, 2009).

The extract as per above negates any chances of cartels in the fertilizer industry. So far in this study, collusive rent seeking has been shown to have most adverse effects on the performance of industries as evident in in case of sugar, cement and automobile manufacturing industries where the end users complain about high price and low quality and bear consumer loss. Therefore, there is not any subjective evidence on rent seeking by the fertilizer industry. The variation in prices is due to the difference of supply and demand in the market.

Table 4.15 and Figure 4.8 in preceding section show the big gap between domestic supply and demand of fertilizer which appears to be the reason behind price variation. In fertilizer industry, the other source of variation in price besides supply demand gap, is a fact that each firm is a price setter due to lesser number of firms. Such a case when firms take individual decisions, no firm is in the position to offer inferior product at high cost (thereby creating consumer loss). The demand and supply gap in Pakistan’s domestic market of Urea is tabulated in Table 4.15 and depicted in Figure 4.8 which clearly indicates the reason behind high price of fertilizer products.
Table 4.15  Time Trend of Domestic Demand and Supply of Urea

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Domestic Demand of Urea ('000 Tones)</th>
<th>Average Domestic Supply of Urea ('000 Tones) (Import + Domestic Production)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>2553</td>
<td>910</td>
</tr>
<tr>
<td>1995</td>
<td>3648</td>
<td>749</td>
</tr>
<tr>
<td>2000</td>
<td>4047</td>
<td>462</td>
</tr>
<tr>
<td>2005</td>
<td>5405</td>
<td>1300</td>
</tr>
<tr>
<td>2009</td>
<td>6361</td>
<td>2029</td>
</tr>
</tbody>
</table>

Source: NFDC (2009)

Comparing Figure 4.8 with Figure 4.3 (depicting the gap of domestic and international sugar prices) indicates that the gap of domestic and international fertilizer prices is not as big as that in the case of sugar.

Figure 4.8  Time Trend of Domestic Demand and Supply of Urea
Hence the possibility of fertilizer industry being involved in rent seeking appears to be remote. However, to further examine the possibility of consumer exploitation caused by Fertilizer industry, a comparison of domestic and international prices is made in Table 4.16 and Figure 4.9.

### Table 4.16  Comparison of fluctuation in Fertilizer Prices in Pakistan and International Market

<table>
<thead>
<tr>
<th>Year</th>
<th>Open Market Retail Price of Sugar in Pakistan (Rs. per Ton)</th>
<th>International Retail Price of Sugar Converted to (Rs. per Ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995-96</td>
<td>10,300</td>
<td>7,326</td>
</tr>
<tr>
<td>2000-01</td>
<td>13,380</td>
<td>8,580</td>
</tr>
<tr>
<td>2005-06</td>
<td>21,580</td>
<td>15,720</td>
</tr>
<tr>
<td>2010-11</td>
<td>64,720</td>
<td>48,790</td>
</tr>
</tbody>
</table>

Source: (i) The FMB Group, UK  
(ii) Records of National Development Fertilizer Center

Up to this stage, no evidence of rent seeking could be identified in fertilizer industry. The low score in allocative efficiency does not appear to be associated with increase in costs due to rent seeking. The low allocative efficiency score appears to be associated with input mix only. As the main input is natural gas NG, and since fertilizer industry requires uninterrupted supply of NG as fuel, as well as feed, the use of NG as fuel would definitely has been substituted with other fuels such as furnace oil because of the shortage of NG throughout the country. Shifting from the cheaper NG fuel to very dearer furnace oil or
electricity increase the costs of production thereby reducing the efficiency score of fertilizer industry.

**Figure 4.9** Comparison of fluctuation in Fertilizer Prices in Pakistan and International Market

The above comparison indicates that fertilizer prices in Pakistan are almost at par with international prices. Hence another suspicion of rent seeking breaks here. Other results show that the industry employed around 6,216 employees per day, while the wage paid by this industry is Rs. 319/- per day per labor which reveals that fertilizer industry engages semi skilled and skilled labor (such as supervisors, chemists, etc). The industry had a capital base of Rs. 17.503 million and faced the price of capital at 0.62 percent. The average Price of NG faced by industry is Rs. 3.26 per cubic feet and price of electricity faced by industry is Rs. 4.36 per unit.
4.4.5. Paints and Beverages Industry

These two industries are discussed simultaneously because they have been assumed to be fair, having competitive environment, and no evidence of rent seeking. The results obtained through SFA and DEA approach are presented in Table 4.17. The results are in consonance with the assumption of fairness of these sectors. In the sample of industries selected for this study, these two sectors are best performers. They scored highest on technical and allocative efficiency scale.

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>T.E. using SFA*</th>
<th>T.E. using DEA</th>
<th>A.E. using DEAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beverages</td>
<td>0.738</td>
<td>0.735</td>
<td>0.433</td>
</tr>
<tr>
<td>Paint</td>
<td>0.778</td>
<td>1.000</td>
<td>0.909</td>
</tr>
</tbody>
</table>

* Average Technical Efficiency scores calculated over the time series data.

The results show that these industries are not only technically highly efficient but they are also efficient in the selection of inputs. There appears to be no evidence of rent seeking. The main reason behind this is that the internal environment of these industries is competitive. Initial investment is low for establishment of Paint and Beverages, hence there are no barriers to entry and exit. Moreover, no firm’s decision affects the pricing in these sectors because people shift to cheaper substitutes available in market. The products are homogenous but brand preference is still seen which differentiates the products (for example in case of Paints, Berger and ICI are preferred while in case of Beverages, PEPSI and Coca Cola are a preference by consumers).
There appears to be no coalition in the industry, rather these big shareholders hold competitive positions and offer discount packages on special occasions in competition with each other. There are no associations which can create a group of larger firms in both the industries. Therefore, collusive rent seeking cannot be proved as was proved in Cement, Sugar and Automobile Manufacturing sector, and There are no consumer losses due to rent seeking in paint and beverages market. Prices are justified and normal in both the industries.

Other results show that paint industry employed, on average, 1,354 employees per day, at an average wage rate of Rs. 235 per labor per day which means that this industry engaged semi-skilled workers (such as fillers, plant operators etc). The Paint industry had a capital base of Rs. 1.342 M while the industry faced price of capital being 6.01 percent. The price of NG faced by this industry averaged around Rs. 3.48 per cubic feet and price of Electricity remained at about Rs. 5.19 per unit.

These results of Beverages industry reveal that, on average, employed 6,150 employees and faced a wage rate of Rs. Rs. 121.28 per labor per day which means that this industry engaged un-skilled workers (such as labor coolies). The capital base of Beverage industry is about Rs. 5.217 M and the industry faced price of capital being 2.15 The price of NG faced by this industry averaged around Rs. 3.24 per cubic feet and price of Electricity remained at about Rs. 4.55 per unit.
CHAPTER 5

SUMMARY AND CONCLUSIONS

5.1 Summary

Empirical results obtained from the model show that the elasticity of output \( Y_i \) appears highest for natural gas (NG) at 0.559, second to which has been observed for capital (K) at 0.426 and third to come is for labor (L) at 0.414. These results indicate that selected industries are relatively capital intensive while natural gas is used as a primary input. This also implies that, over the time, the industry has switched over to natural gas from electricity to fulfill basic power needs.

The coefficient of electricity (E) appeared with a negative sign at -0.476. The variable for number of firms in an industrial sector (N) also appeared with a negative sign at -0.268. The negative sign of E has been justified as being a result of high prices of electricity and shortage in the supply of electricity. An increase in use of electricity increases the costs and hence reduces the contribution of that industry to economy. Moreover, the short supply of electricity and interruptions in the supply of electricity due to power failures cause a lot of overhead costs to industrial units when the process of production is halted and output is wasted.

The negative sign with number of firms (n) is justified as the output \( Y_i \) is not the physical output of the industry, rather the contribution of that sector to economy which is obtained after adjusting for industrial and non-industrial costs against the physical output. Therefore,
major industries have been suspected for rent seeking, their non-industrial costs are higher and hence an increase in the number of firms reduces the contribution of that industry to economy. The efficiency scores calculated for selected industries conformed to the theory of collusive rent seeking presented in the literature review. The industries suspected for rent seeking which include sugar, cement and automobile manufacturing industry, scored low on technical efficiency and very low on allocative efficiency. This aspect is in consonance with the discussion made in the earlier chapters that rent seeking reduces the economic efficiency of affected industrial sectors and rent seeking entrepreneurs find no charm in economic efficiency as their interest lies to achieve cheaper profits through rent seeking rather than to increase the productivity.

The results of fair sector which includes beverages and paints industries appeared as expected. These industries scored high on technical and allocative efficiency. Fertilizer industry was discussed without any assumption of being fair or rent seeker as it scored low on allocative efficiency but there were no subjective evidences about the presence of rent seeking in that industry. There was no evidence found to be associated with collusive rent seeking because market structure was found to be oligopolistic with product differentiation.

Low scores in allocative efficiency appeared to be associated with input mix problems. The main input is natural gas and since fertilizer industry uniquely required un-interrupted supply of NG as fuel as well as feed, the industry had to switch over to alternative fuel such as furnace oil or electricity because of the shortage of NG throughout the country (which adversely affected fertilizer industry more than any other industry in the study). Shifting
from cheaper NG to dearer furnace oil or electricity appeared to be main reason for wrong input mix thereby reducing the allocative efficiency score of the industry.

The results also prove third hypothesis as true that establishment of cartels leads to rent seeking behavior. In all the industries having cartels, namely Sugar, Cement, and Automobile Manufacturing, collusive rent seeking practices have been found badly effecting their efficiency scores.

Some other results were also obtained from the data collected. Sugar industry in the selected manufacturing sector is providing highest employment and is composed of broadest capital base. Cement Industry is next to sugar industry in employment as well as in capital. Automobile manufacturing industry comes at third place in employment but fourth place in capital. Fertilizer industry comes at fourth place in employment but third place in capital. While the beverages and paint industry comes fifth and sixth in employment as well as in capital, respectively.

The fourth hypothesis has also been proved as true that industries requiring huge capital investment tend to rent seekers as compared to those requiring small capital investment. In this study, Sugar, Cement and Automobile Manufacturing industries possess broader capital base. These results are calculated from the pooled data of selected manufacturing sector over a period from 1981-82 to 2005-06.
5.2 Conclusions

The study made a valuable contribution by observing many aspects of the theory of rent seeking. The use of two approaches to calculate the scores of economic efficiency made the results reliable. The econometric results obtained from the model show that on the whole, the selected industries appeared to be capital intensive and depended upon NG as the basic fuel.

The efficiency scores calculated through SFA approach and DEA analysis proved that the sectors suspected for rent seeking score low on technical and allocative efficiency. It is due to the reason that rent seeking costs disturb the conventional input factor mix and hence allocative efficiency is reduced. Once the sector is infected with rent seeking, the profit maximization approach is replaced by rent maximization. Therefore, the entrepreneurs lose interest to develop the industry technically to increase productivity. Hence, the scores of technical efficiency also come down.

It has also been observed that an industry which is not infected with rent seeking (Fertilizer) may still have lower allocative efficiency score due to wrong input factor mix and oligopolistic market conditions. Moreover, presence of rent seeking also reduces score of technical efficiency. Therefore, an industry may be fair in the absence of subjective evidence of rent seeking, even with low allocative efficiency score if high technical efficiency scores are observed and a significant reason for low allocative efficiency is observed.
In Pakistan, there have been no significant studies which captured the effect of rent seeking in industrial sector, or have proven the subjective judgments to be empirically true about rent seeking. However, the study at hand, based on the subjective and suggestive arguments, empirically identified the presence of collusive rent seeking practices, by calculating the impact of rent seeking on the performance of affected sectors. Therefore, the study developed a method to analyze the performance of manufacturing sector on the basis of subjective judgments proven empirically about collusive rent seeking practices by various industries.

5.3 Policy Recommendations

Many studies have been conducted on the productivity and efficiency framework. However, the study in hand has brought to front the many aspects related to economic efficiency of selected industries. Based on these aspects, the following recommendations are made:

1. Pakistan’s protection policy for local industries need to be adjusted carefully. According to Kemal (1978), there is positive relationship between effective protection rate and inefficiency. This means it is a tricky tradeoff between protection of local industry and efficiency of the manufacturing sector on the whole. It has been observed in the current study that too much protected industries involve in rent seeking while weak industries vanish in unprotected environment. Hence
Pakistan needs to classify its industries and then carefully fine-tune the protection policy in order to achieve highest levels of productivity.

2. Likewise, privatization is a popular approach in current era however it is again a risky decision to privatize essential industries and service sectors because for some industries and service sectors, public intervention is necessary to regulate monopolistic sectors. It has also been proven that privatization leads to higher efficiency only if done in competitive market configuration (Kemal, 1996). Hence Pakistan, if needs to privatize some of its inefficient industries or service sectors, ought to ensure that it is done in competitive environment so that public intervention would not be required later on to regulate the market.

3. There is a strong need to re-structure and neutralize the Competition Commission of Pakistan and Monopoly Control Authority. These two bodies can (i) protect the basic consumer rights which are being severely exploited by major industries of Pakistan and (ii) control the adverse impacts on economy due to non-maximizing behavior of rent seeking industries. Involvement in corruption and polarized behavior on part of regulatory bodies gives a free hand to mal-practice industries which take control of the price and supply line of essential (as well as luxury) goods, and also control the entry and exit barriers in the manufacturing sector. Regulations should be done to improve competitiveness rather than being restrictive.
4. There is no significant body for consumer rights protection and no forum for the consumers to highlight and complain about the exploiting practices of an industry. The consumers have to pay the demanded price, and yet have to compromise on quality of the purchased product. Access to imported substitutes has also been blocked by the law making authorities in lobbying with the rent seeking industrialists. Hence it is re-iterated that the regulatory bodies need to be re-structured, depolarized, and non-politicized to monitor and control the price, volume of supply and quality of finished product of major industries in Pakistan.

5. On production side, the industries also face troubles required to be cleared. The results show that the industry is heavily relying on natural gas for its fuel needs. This is a vulnerable situation and any cut or shortage in the supply of NG badly affects the production. This not only affects the performance of the industry, but also creates unemployment problems currently being seen CNG sector and woolen mills. A critical need is felt to provide cheaper and abundant uninterrupted electric power to industrial as well as domestic sector.

Currently, the results show that use of electricity in industry lowers their efficiency score due to very high per unit cost. There are various alternative sources of electricity production such as solar power, wind mills, hydropower, and coal. Scope for all these alternative sources is vast in Pakistan yet the country badly suffers from energy crisis. There should be at least two substitutable sources of fuel and energy
readily available in abundance if the industrial sector is desired to flourish and take the country to the take-off stage.

6. The country is abundant in labor supply. However, due to various reasons, such as politics, rent seeking, and others, the industry remained capital intensive as is shown in the results. There is a need to make the industry labor intensive as is being observed in the emerging economy of China. Maximum use of labor be made in industries. This will have a two-tier effect (i) it will reduce the heavy import bill on account of machinery and equipment and their spares which consume a lot of resources currently, and (ii) the intensive use of labor will solve the un-employment problem that is threatening the country and is a cause of many internal disturbances. In a nut shell, it is recommended that robots need to be replaced by humans as the country is rich in labor.

7. The policy recommendations by Planning Commission of Pakistan need to be considered at government level before approving an overall industrial policy. Planning Commission of Pakistan acts as the eyes of the country and already comprises of highly trained and seasoned technocrats. However, performance of Planning Commission cannot be witnessed due to the fact that public policies are made by neglecting the recommendations of the commission. Moreover, the policies made by commission for improvement in industrial sector are not implemented due to political interference and lobbying of rent seekers with law
making authorities. This needs to be resolved for the better interest of the country and development of a sustainable economy.

8. There is a strong need to re-engineer public sector manufacturing industries and service providers. Industrial performance of the economy cannot be improved by the performance of private sector alone. A competition is required to be developed between public and private sector industry on fair basis. This competition will not only expand the industries but will also help to improve their efficiency and will help to protect the consumers from monopolistic exploitation.

9. To increase the efficiency of industrial units, human resource development and research facilities at industrial level need to be improved. These HRD and R&D activities will help to bring down high cost of production which is a result of number of factors such as overhead costs, wastage, and un-trained manpower, leading to inefficient operation and hence unjustly exhausting the scarce resources.

10. There was a great difficulty faced in the collection, editing and uploading of the old data collected from Federal Bureau of Statistics Pakistan (FBS). Measurement and record of production is essential to record the industrial performance. Easy access to error free data in electronic form may be provided by FBS to all stakeholders and research institutions.
11. As a final word, it is hoped that if the policies recommended above are implemented, inefficiency and rent seeking will not persist long and a free, fair and competitive environment will develop in the industrial sectors of Pakistan.

5.4 Suggestions for further Research

The instant study has served as a proto-type to identify and capture the efficiency leakages due to collusive rent seeking practices in some of the industries. However, this task needs to be taken further and the following suggestions are made for future researchers:

1. Due to change in the Industrial Classification Chart published by Federal Bureau of Statistics Pakistan, it became very difficult to track the identical industries over a period of 25 years. However, since the study has served its purpose, any further exploration on this path may be made to cover more industrial sectors after getting clarification and rectification from FBS.

2. The research may also be applied to services sector, such as communications sector, focusing extensively on the performance and efficiency measurement of public sector service providers such as Pakistan International Airlines, Pakistan Railways, etc., for an in-depth identification and measurement of rent seeking infecting these sectors.
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