CHAPTER V

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5.1. SUMMARY:

This study decomposed economic efficiency into the product of price efficiency and Farrell cost efficiency.

\[ \frac{Q(u_0, p^{\text{min}})}{\sum_{i=1}^{m} p_{i0} x_{i0}} = \frac{Q(u_0, p^{\text{min}})}{Q(u_0, p_0)} \cdot \frac{Q(u_0, p_0)}{\sum_{i=1}^{m} p_{i0} x_{i0}} \]

Economic Efficiency = Price Efficiency X Farrell Cost Efficiency

\( Q(u_0, p_0) \) and \( Q(u_0, p^{\text{min}}) \) are obtained solving linear programming problems. \( \sum_{i=1}^{m} p_{i0} x_{i0} \) is the observed cost of the target DMU.

Farrell (1957) introduced a graphical method to measure efficiency of production units. He assumed that the reference technology is provided by unit output isoquant where such an isoquant is taken as piecewise linear determined by the most efficient production unit. His efficiency measure is radial and inputs required to produce one unit of output are contracted radially in the direction of origin. Since this measure does not take input mix changes into consideration, the radial measure was named as ‘Technical Efficiency’. The Farrell measure was originally constructed for one output and two inputs case.
Charnes, Cooper and Rhodes (CCR, 1978) defined an engineering ratio for which numerator was weighted sum of outputs and the denominator was weighted sum of inputs. The weights were called multiplier weights and the numerator and denominator were named as virtual output and input respectively. Such ratios were conducted for each production unit and ratio that belongs to target production unit was maximized forcing the ratio of virtual output produced per unit of virtual input foregone not exceeding unity. The problem constructed in terms of engineering ratios was maximized in multiplier space. But, the problem proposed turns out to be a fractional programming problem. However, employing the Charnes - Cooper transformation it could be transformed into a linear programming problem. The efficiency measure of CCR (1978) lies between 0 and 1. An efficient production unit attains 100 percent efficiency score.

Another efficiency measure introduced by Farrell is cost efficiency. Unlike technical efficiency, the cost efficiency measure takes into consideration changes in input mix also. The Farrell cost efficiency measure was extended by Fare et.al (1984) for the case of multiple inputs and outputs. Solving one linear programming problem for one production unit the factor minimal cost can be calculated which is called in this study as ‘Farrell Cost Efficiency’. This is a very restrictive measure since it requires the knowledge of input prices and these prices are assumed to be constant. But, in many cases input prices are unknown, even if these prices are known they change very often. This measure takes into consideration own prices but neglects the input prices of other production units, input prices even if these prices are known.
FARRELL COST EFFICIENCY:

\[
FCE = \frac{Q(u_0 \cdot p_0)}{\sum_{i=1}^{m} P_{io} x_{io}}
\]

Where \( u_0 \) and \( p_0 \) are input and output price vectors of the target production unit respectively. \( x_{io} \) is \( i^{th} \) input employed by the target unit.

\[0 \leq FCE \leq 1\]

In the present study Indian Commercial Banks are the decision making units (DMUs). Owing to ownership, geographical location, strengths and weaknesses of employees unions, accessibility to new technological inventions the input prices vary from one commercial bank group to another. It is interesting to find minimum price in each input market and to compute factor minimal cost for each unit at these prices. Such a cost is divided by the factor minimal cost of Farrell. The consequent ratio emerges to be the measure of economic ratio. This measure monitors not only input price changes but also input mix changes.
ECONOMIC EFFICIENCY:

\[
\text{Economic Efficiency} : \frac{Q(u_0, p_{\text{min}})}{\sum_{i=1}^{m} p_{i0} x_{i0}}
\]

It often interesting to know how for a production units input prices deviate from the efficient (minimum) market prices. \(Q(u_0, p_0)\) and \(Q(u_0, p_{\text{min}})\) measure factor minimal cost at observed and minimum prices respectively. Both measures are functions of output vectors \(u_0\) but vary in terms of prices, one employing actual prices and the other efficient prices. The price efficiencies measure is the ratio of \(Q(u_0, p_{\text{min}})\) to \(Q(u_0, p_0)\).

PRICE EFFICIENCY:

\[
PE = \frac{Q(u_0, p_{\text{min}})}{Q(u_0, p_0)}
\]

The above methodology is applied to Indian Commercial Banks comprised of the banks operating on Indian soil under three ownerships, the public, private and foreign sector. The methodology solves linear programming problems to arrive at the multiple decomposition of economic
efficiency into Farrell cost and price efficiency. The linear programming problems are called as Data Envelopment Analysis (DEA) models. The first step in DEA is selection of inputs and outputs. This study employed a stepwise method to choose DEA outputs, treating number of employees and fixed capital as DEA inputs. To selects DEA outputs a stepwise method is used. Out of six output variables five are selected according to their influence. These variables according to their influence on the model are,

(i) Number of Branches,
(ii) Deposits,
(iii) Advances,
(iv) Profit per employee and
(v) Business per employee.

There are 77 commercial banks comprising three ownerships;

(i) Public Sector
(ii) Private Sector and
(iii) Foreign Sector Banks

Adding too many inputs and outputs to a DEA problem increases the proportion of efficient commercial banks to the total number of commercial banks. Consequently, DEA looses its discriminatory power. Therefore, the analyst has to exercise parsimony while inputs and outputs are selected.
5.2. **CONCLUSIONS**

The data are collected from the Reserve Bank of India Bulletins for the year 2008.

Farrell cost efficiency mean values are alike for public, private and foreign sector banks. When variability is taken into consideration cost efficiency variations are more in foreign sector banks than private and public sector banks. Standard deviation per unit mean expressed as percentage is 44 per public sector banks, 54 for private sector banks and 66 percent for foreign sector banks. This reveals that capital – labour substitutions are plenty for foreign sector banks when compared with public and private sector banks. Between public and private sector banks capital – labour substitutions are more for private sector banks than public sector banks. Thus, public sector banks not only experience more input losses due to cost inefficiency but more restrictive in the choice of technique.

The most economic efficient commercial banks is one for which,

$$Q(u_0, p_{\text{min}}) = 1$$

All the 77 commercial banks under different ownerships are economic inefficient. Due to economic inefficiency public, private and foreign sector banks on the average experienced 78, 76 and 89 percent losses of inputs.
respectively. To attain economic efficiency, the banks of all the three sectors shall strive very hard, in particular the foreign sector banks. Mean price efficiency compares the measure of economic efficiency with Farrell cost efficiency. Observed prices deviations from the efficient prices ($= p^{\text{min}}$) are found more in foreign sector banks than in public and private sector banks. Among public and private sector banks observed price deviations from efficient prices are more in private sector than public sector banks.