# CHAPTER II

## Literature Review

### 2.1 Concept and Theoretical Background

This section briefly discusses methods of measuring efficiency and empirical evidence for both international and Thai financial institutions. The two methods detailed are financial ratio analysis and frontier analysis, using both parametric and non-parametric frontier approaches.

#### 2.1.1 Methods of Efficiency Measurement

2.1.1.1 Financial Ratio Analysis

Financial ratios are the most commonly tools used for performance assessment in the financial industry. Regulators, industry analysts and management commonly use ratio analysis as a standard in the evaluation of company performance. Ratios measure the relationship between two variables that are chosen to provide insight into different aspects of a company's multifaceted operations, such as liquidity, profitability, capital adequacy, asset quality, risk management, among others. Many different ratios can be obtained, depending on the objective of the analysis. Those ratios are normally comparisons within the same company over different time periods, and make a reference to other companies (Smith, 1990).

While ratio analysis used to be very popular due to its simplicity, there are some limitations that should be factored in. For example, the analysis assumes comparable units, which implies constant returns to scale or CRS (Smith, 1990). Ratio analysis, as a one-dimensional measure, can examine only a part of organization's activities; otherwise, it has to combine the multiple dimensions into one. This also results in an unlimited number of ratios from data from just one financial statement. The ratios thus created always contradict each other and are confusing. Moreover, this approach can never identify inefficient units. All of these factors make ratio analysis inadequate for efficiency evaluations.

2.1.1.2 Frontier Efficiency Methodologies.

Because of the inherent limitations of financial ratio analysis, more advanced tools were devised. Frontier analyses, either parametric or non-parametric, measure the relative efficiency of production units based on the distance from the best-practice frontier. To use these methods, management is provided with a framework that supports the planning, decision-making and control processes.

Frontier techniques can identify the best performance even in complex business operations. These methods can also distinguish between the efficient and inefficient production units. A unit that is determined to be inefficient and then rehabilitated would enable reductions in cost of operations or increase in services without the need of adding more resources. Setting achievable targets for inefficient units and factoring in the effects of environmental variables also provide additional insights and improve overall understanding of production systems.

Several forms of parametric and non-parametric frontier techniques have been developed. The parametric, or economic, frontiers include: the stochastic frontier approach (SFA), the distribution-free approach (DFA), and the thick frontier approach. The most commonly used non-parametric or mathematical programming technique is data envelopment analysis (DEA), which encompasses the free disposal hull (FDH) approach, a special case in the DEA model. The differences between parametric and non-parametric methods include restrictions on the functional form of the efficient frontier, the existence of random error, and the distributional assumption of the efficiencies and random error (Bauer, 1990). Parametric or econometric analyses typically include two error components: an error term that captures inefficiency and a random error. Mathematical methods, on the other hand, require few assumptions when specifying the best-practice frontier and generally do not account for random errors.

As described by Charnes et al. (1978), the efficiency measurement of a production unit when using the DEA technique requires defining its position relative to the frontier of the best performance established mathematically by the ratio of weighted sum of outputs to weighted sum of inputs. This study also referred to the estimated frontier of the best performance as an "efficient frontier" or "envelopment surface". The efficient frontier specifies the efficiency of production units and identifies inefficiencies based on known levels of attainment. Therefore, a production unit attains 1.00 or 100% efficiency only when it is not found to be inefficient in using inputs to generate outputs when compared with other relevant production units.

The DEA model was first introduced by Charnes, Cooper and Rhodes (1978), referred to as "CCR" hereafter. They assume constant return to scale (CRS) and define the production frontier as a piecewise linear envelopment surface. It is given that there are n Decision Making Units (DMUs)[1] to be evaluated. For DMUj the inputs and outputs are represented by vectors $x_{ij}$ (amount of input i for unit j) and $y_{rj}$ (amount of output r for unit j) respectively. It is assumed that these inputs $x_{ij}$ and outputs $y_{rj}$ are not negative, and each DMU has at least one positive input and output value. The productivity of a DMUj can be written as:

$$\text{Maximize:} \quad h_j\{u,v\} = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \tag{1}$$

In this formula, vectors u and vectors v are the weights assigned to each input and output. By using mathematical programming techniques, DEA optimally assigns the weights subject to the following constraints:

$$\text{Maximize:} \quad h_j\{u,v\} = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}}$$

$$\text{subject to:} \quad \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1 \text{ for } j = 1....n \tag{2}$$

$$v_i \geq 0 \text{ for } i = 1....m \text{ and } u_r \geq 0 \text{ for } r = 1....s$$

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[1] The organization under study is called the DMU (Decision Making Unit).

| | | |
|---|---|---|
| Where | $s$ | $= \{1,...,s\}$ is the set of outputs considered in the analysis |
| | $m$ | $= \{1,...,m\}$ is the set of outputs considered in the analysis |
| | $r$ | = Index of outputs |
| | $i$ | = Index of inputs |
| | $y_{rj}$ | = Amount of output r for unit j |
| | $x_{ij}$ | = Amount of input i for unit j |
| | $u_r$ | = Weight assigned to output r |
| | $v_i$ | = Weight assigned to input i |

Each DMU is assigned a weight subject to the constraint that no other DMU has efficiency greater than 1.00 if it uses the same weights, implying that efficient DMUs will have a ratio value of 1.00

Banker, Charnes and Cooper (1984) ("BCC") take into account the effect of returns to scale within the group of DMUs to be analyzed. The intention is to point out the most efficient scale size for each DMU and to identify its technical efficiency at the same time. To do this, they introduce convexity in order to the envelopment requirements. The reference point on the production function for DMUj will be a convex combination of the observed efficient DMUs. The BCC model or variable returns to scale model (VRS), allow the technical efficiency of DMUs to be investigated without any scale effect.

Models are created to provide input-oriented or output-oriented projections for both CCR and BCC methodologies. An input-oriented model attempts to maximize the proportional decrease in input variables while remaining within the envelopment space, while an output-oriented model maximizes the proportional increase in the output variables while remaining within the envelopment space.

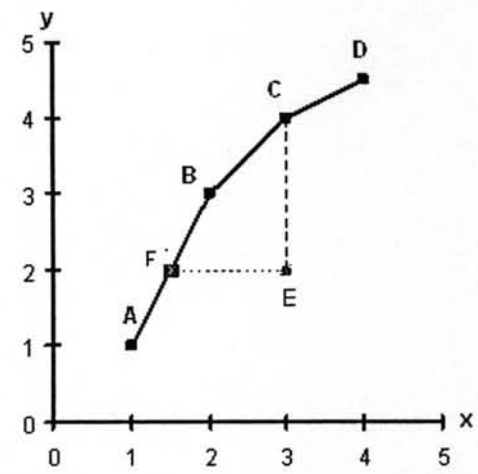


Figure 2.1 Variable Returns to Scale (VRS) Frontier

Consider Figure 2.1 where we have 5 DMUs that have one input and one output. The VRS frontier consists of DMUs A, B, C, and D. AB exhibits increasing return to scale (IRS), B exhibits constant return to scale (CRS), and BC and CD exhibit decreasing return to scale (DRS). DMU E is inefficient and is compared to F (a convex combination of A and B) on the VRS frontier. E should reduce its input to F, or F is the efficient target for E. If we use an output-oriented model, E is compared to C by increasing output.

## 2.2 Empirical Efficiency

### 2.2.1 Analyzing Bank Efficiency using Parametric Analysis

Berger et al (2000) consider home field advantage and global advantage to determine whether foreign banks are relatively more efficient than domestic banks. The results indicated that there is a home field advantage, with domestic banks relatively more efficient because operating diseconomies for foreign banks increase with distance from the home market. Operating costs rise because of difficulties associated with persuading managers to work overseas and with monitoring the behavior and measuring the performance of overseas managers. Information asymmetries in overseas markets make it difficult for foreign banks to develop local market relationships in specific product segments.

There are problems associated with operating in a different cultural, linguistic, and regulatory environment. The global advantage hypothesis holds that foreign banks are more efficient because they can reduce costs by spreading best practice policies over more resources and increase revenues through superior risk management and diversification skills. A limited form of the global advantage hypothesis suggests that foreign banks from countries with a strong regulatory and supervisory environment, a high level of competition that forces banks to become more efficient, plus well-developed markets and an educated labor force, are best able to carry their efficiency advantage with them as they move overseas. Tests of the these hypotheses support the limited version of the global advantage hypothesis since domestic (US) banks are more profit efficient than foreign banks and US banks then take this efficiency advantage with them into European markets, making them generally more profit efficient than domestic European banks

Claessens et al (2001) examined whether foreign bank entries affect domestic banks between 1988 to 1995. They found that increased foreign bank entry brought a change in domestic bank behavior with significant reductions in profitability and operating costs. This is consistent with the argument that foreign bank entry increases competition between foreign and domestic banks. The result is that domestic banks' economic rents are eroded and they have to improve the quality of bank management if they are to compete. Foreign bank entry encourages domestic banks to target best practices in order to control costs; entry of foreign banks can also lower the probability of agency costs rising by reducing incentives domestic bank managers may have for a quiet life.

In addition, Denizer (2000) investigates the Turkish banking sector between 1980 and 1997; the results show that retail banking operations of foreign banks in Turkey are extremely limited, and they compete seriously only in the trade finance, corporate finance and derivatives markets. In Colombia, foreign bank entry significantly lowered domestic banks' operating costs and profitability. Another interesting point is that financial planning, credit evaluation, marketing and human capital in the Turkish financial sector began to improve along with the more prominent level of foreign bank entries.

2.2.2 Analyzing Bank Efficiency using DEA

Al-Faraj et al. (1993) applied the basic formulations of DEA to assess the performance of 15 bank branches in Saudi Arabia. They used eight inputs and seven outputs, and subsequently identified all but three branches as relatively efficient. They illustrated one of the limitations associated with the DEA approach: its inability to effectively discriminate between efficient and inefficient units when using a limited number of observations relative to the number of input/output variables. The efficiency scores obtained by Haag and Jaska (1995) were achieved using an additive model on 14 branches operating in the U.S. Sherman and Ladino (1995) reported that the implementation of their DEA results in the restructuring process of the 33 branches belonging to a U.S. bank led to actual annual savings of over USD6 million. However, both studies were potentially biased because of the insufficient number of branches.

Clarke et al (1999) examine the effect of foreign bank entry in Argentina between 1994 to 1997 when the domestic authorities worked to facilitate increased competition between foreign and domestic banks. They found that foreign bank entry in specific product markets is accompanied by lower interest margins and profitability and higher operating costs for domestic banks. In product markets where foreign bank activity is minimal, domestic banks experience little change in margins, profitability and operating costs. An interesting finding is that whereas the incidence of domestic bank failure increased between 1994 and 1997, bank failures were 'not heavily concentrated in the types of lending favored by foreign banks'.

In addition, Kim (2004) studies the merger-related productivity growth in a Canadian bank using non-parametric frontier techniques. By employing Data Envelopment Analysis, banks were able to gain technical efficiency via a merger of retail banking. The newly merged bank was in addition able to capitalize on the opportunity to reduce operating costs, optimally re-allocate staff and realize synergies.

2.2.3 Analyzing Bank Efficiency in Thailand

William and Intarachote (2002) employed stochastic frontier analysis (SFA) and found that the rate of technical progress at the frontier increases at a diminishing rate before starting to regress at an increasing rate whereas bank efficiency decreases at an increasing rate over time. The empirical evidence implies that deregulation-induced expansion of banking activity in the end increases financial fragility. Though they found that domestic and foreign bank efficiency is comparable, Japanese-owned banks were significantly more efficient, supporting the limited version of the global advantage hypothesis that foreign banks from strong home environments are likely to carry efficiency advantages overseas.

Herberholz (2002) investigates the impact of foreign bank entry on the Thai domestic banking sector using bank-level data for twenty consecutive calendar quarters from the second quarter of 1997 onwards. This revealed that foreign-owned banks incorporated in Thailand are more efficient than domestic-owned banks in terms of profitability and that foreign bank entry reduces the net interest margin and profitability in the domestic banking system and thus leads to greater efficiency in the sector.

In addition, Chunhachinda and Li (2007) study the efficiency of Thai commercial banks pre- vs. post- 1997 financial crisis. They employed the parametric (SFA) and non-parametric (DEA) approaches to assess the efficiency scores. The results showed that both average profit and cost efficiency levels of the post crisis are found to be significantly lower than those of pre-crisis periods. The evidence also indicates that some macroeconomic factors, general and financial characteristics are correlated with the efficiency level of Thai commercial banks.

2.2.4 Analyzing Life Insurance Company Efficiency using DEA

Yong (2002) employed the DEA method to study the efficiency of Korean life insurance companies in Korea from 1997 to 2000. The overall results showed that the efficiency and productivity of the Korean life insurance industry improved during 1997-2000, but that productivity slightly deteriorated during 1999-2000. It was also found that foreign insurers and joint ventures increased efficiencies for the final four years while domestic insurers decreased continuously except in 1998. This implies that the flow of capital and advanced management technology from foreign insurers affected the efficiency and productivity of the Korean life-insurance industry after the 1997 negotiations.

Mazsor and Radam (2000) investigated the productivity and efficiency performance of the Malaysian life insurance industry by employing the DEA approach. They used three variables as output (new policies issued, premiums and policies in force) and five inputs (claims, commission, salaries, expenses and other costs). The study showed that despite the growth in productivity in the insurance industry, it was relatively low compared to the real economic growth experienced by Malaysia. Like the manufacturing sector, the future growth of this industry depends on its ability to compete efficiently. Being able to provide service in an efficient way is an important source of comparative advantage in this era of globalization. The results also suggest that both technical efficiency and technical progress contribute to the overall productivity growth of the industry.

Cummins et al. (1998) examined the relationship between mergers and acquisitions, efficiency, and scale economies in the US life insurance industry. They found that acquired firms achieve greater efficiency gains than firms that have not engaged in mergers or acquisitions. They also find evidence that firms operating with non-decreasing returns to scale are more likely to be acquisition targets that firms operating with decreasing returns to scale.

Lin (2002) investigated efficiency in the Taiwan life insurance industry after deregulation; the results indicate that there was no change after deregulation; this was seen as well in the three sub hypotheses that there was no overall efficiency change, no pure technical efficiency and no scale efficiency change after deregulation. The statistical results indicate that after deregulation, measured overall efficiency and scale efficiency declined but pure technical efficiency measure increased. Efficiency comparison among new entrants and incumbents indicated that incumbent insurers have the highest overall efficiency scores. The new foreign insurers had the highest pure technical efficiency scores.