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# Performance Evaluation of Islamic Banking Sector: Iranian View

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**Abstract:** The aim of this study is to investigate the level of efficiency for the private banks in Iran during 2011-2013. Listed private banks on the Tehran Stock Exchange are used as the sample for this study. Efficiency measures for the data are estimated employing methods including data envelopment analysis and Malmquist index data. The results indicate that 23 out of the 24 branches included in the sample show growth in the productivity, versus only one branch by (2816) code showing decreases in its productivity due to the inefficient investment and use of banking technology. To the best of our knowledge, this research is the first study that attempts to measure the efficiency performance of Iranian private banks.

**JEL**: G20; G21
**Key words:** Islamic Banking, Iran, data envelopment analysis, efficiency

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## 1. Introduction

In developing countries, economic development depends on improved efficiency and productivity of a country’s economic and social sectors. Besides, efficiency and productivity are very important factors affecting the competitive advantage of each country, which also contributes to the economic development. Banking operations are considered as one of the most important economic activities done inside every economic system (Enoch et al., 2001). These activities require capital and financial resources provided by banks and other financial institutions. Because of the very high importance and crucial role of banks in economic activities, evaluating their performance in terms of efficiency and effectiveness within banking system of a country is important for the government, which provides banks with national and public funds and assistance. However, because of the service characteristic of bank activities and the large variety of services that banks provide, evaluation of their performance poses difficulties, and special methods are needed to choose the most appropriate methods (Wei, 2003). In fact, given recent and future economic conditions, bank managers are always forced to improve banking services, evaluation, budgeting, innovation in services, to meet competition with other banks, and finally they must increase productivity and efficiency among their supervision departments. The existence of an effective network of branches is one of the most essential methods in productivity and efficiency improvement. The remaining of the paper is structured as follows. The next section presents the development of Islamic banking in Iran. Section three views the relevant literature reviews. Section four deals with the research methodology, and the last section presents the conclusion and remarks.

## 2. The Islamic Banking Evolution in Iran

The main reason for having banks includes transferring risks of money, meeting customers' claims for liquidity, and providing safety and security for cash assets. Banking existed and developed during the time of the Sassanids dynasty in Iran. During that period money was passed by the 'Draft' from different points. But the first bank in Iran was 'New East Bank' which was established in 1887. Later on in the year 1889 another bank called 'Imperial Banking' was allowed to operate in Iran. The primary bank of Iran was Sepah Bank. It was established by the noncommissioned Army Pension Fund, and its initial capital was 3.883.950 Rial (Iranian currency). A year after the Islamic Revolution of Iran, the Iranian banks were nationalized in order to protect the rights of holders of deposits and investments to run the wheels of industry and production, and also to guarantee the repayment of deposits and savings. After the merger 37 banks, they were divided into six commercial banks and three specialized banks. Commercial banks include Mellat Bank, Melli Bank, Saderat Bank, Tejarat Bank and Sepah Bank. Specialized banks including: Keshavarzi Bank, Maskan Bank, Sanat o madan Bank (Salehi, Mansouri and Azary, 2008).

## 3. Literature review

Bashir (2000) examined the determinants of Islamic banks' performance. Using income statements and balance sheets for 14 Islamic banks in eight Middle Eastern countries, the study closely examines the relationships between profitability and the banking characteristics. The results reveal that profitability measures of the Islamic banks react positively to the increases in capital and loan ratios, which is intuitive and consistent with previous studies. Secondly, the study highlights that adequate capital ratios and loan portfolios play an explanatory role for the performance of Islamic banks.

Hassan and Bashir (2003) focused on how the performance of the Islamic banks is affected by bank characteristics and the overall financial environment. They utilize cross-country bank level data on Islamic banks from 21 countries to examine the performance indicators of those banks in their sample. In general, they find that a determinant of Islamic banks profitability is consistent with previous studies.

Yudistira (2003) conducts an empirical analysis on efficiency and provides new evidence on the performance of 18 Islamic banks. A panel data set for this time period is extracted from non-consolidated balance sheets and income statements of these Islamic banks with the specific purpose of seeing the impact of the recent financial crises on the efficiency of Islamic banks. This study is different from previous studies in that it utilizes a non-parametric approach, Data Envelopment Analysis, to analyze the technical efficiency, pure technical efficiency, and scale efficiency of Islamic banks. Being in line with the principle of the Islamic financial system, the intermediation approach is used to specify input-output variables of Islamic banks. The study finds several results. First, the overall efficiency results indicate that there is a small (at just over 10%) inefficiency across 18 Islamic banks, which is considerable as compared to many conventional counterparts. Similarly, the global crisis in 1998-1999 badly affected the performance of Islamic banks; however, they performed better afterwards. Second, the results show that small and medium sized Islamic banks faced diseconomies of scale that suggests that M&A should be encouraged. Moreover, as compared to their non-listed counterparts, publicly listed Islamic banks are found to be less efficient.

Saleh and Rami (2006) in order to evaluate the Islamic banks' performance in Jordan examine the experience with Islamic banking for the first and second Islamic bank, Jordan Islamic Bank for Finance and Investment and Islamic International Arab Bank in Jordan. The study also highlights the domestic as well as global challenges being faced by this sector.

The results show that at first, the efficiency and ability of both banks have increased and both banks have expanded their investment and activities. Second, both banks have played an important role in financing projects in Jordan. Third, these banks have focused on short-term investment.

Sufian (2007) performs a study to provide new evidence on the relative efficiency between the domestic and foreign banks Islamic banking by using a non-parametric Data Envelopment Analysis methodology that has been utilized to distinguish between three different types of efficiency: technical, pure technical and scale efficiencies. The results show that efficiency of Islamic banks recovered slightly; further, the domestic Islamic banks are found marginally more efficient than foreign Islamic banks. The results of the study also indicate that profitability is significantly and positively correlated to all efficiency measures.

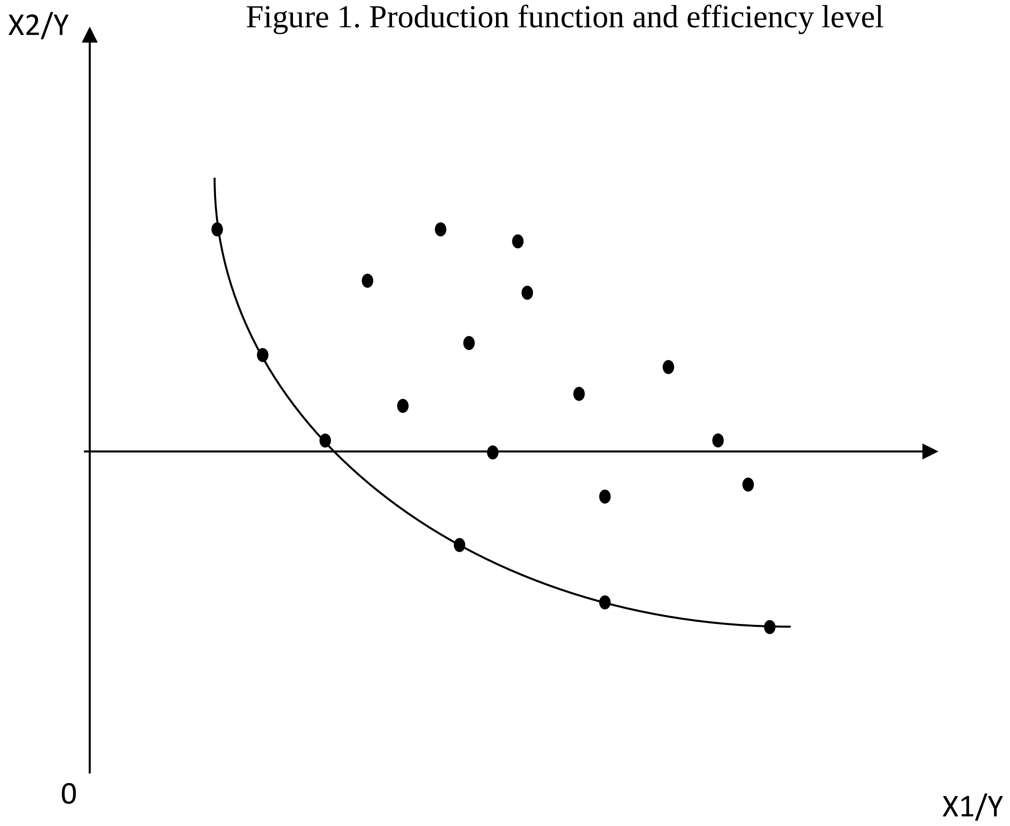
## 4. Data Envelopment Analysis

Data Envelopment Analysis (DEA) is related to the subject of PhD thesis of Rhodes with the guidance of Cooper, who was studying the performance of public schools in United States. This study led to the publication of the first article introducing DEA to the public in 1978 (Mansoury and Salehi, 2011). Comprehensive analysis of data by Charnes, Cooper, and Rhodes (CCR 1978) universalized the Farrell method as the characteristics of production with several factors and products as an addition to the economic literature. This method is mainly known globally as a method of measuring performance. During the measurement of performance, it provides a kind of returns to scale of production for firms separately. With the development and compliment of the above method, the DEA is now one of the active areas of research in performance measurement and has been welcomed by researchers around the World. This method has significant applications for evaluating the performance of government agencies and non-profit departments where price information is not usually available or they are unreliable (Wu, Yang and Liang, 2006).

In this method, in order to universalize it, instead of producer term, the decision-making unit (DMU) is used generally. This method (DEA) that uses linear programming techniques is one of the non-parametric estimation of production functions (Salehi and Mansoury, 2011).

It can be shown how the same production function can be described using first a geometric method. The specified points in Figure 1 shows the composition of using each $\underline{X}_1$ and $\underline{X}_2$ factor for production of a single product (Y) in different businesses. The convex function is obtained by the connection of points that are closer to the coordinate axes and origin. However, there is no single point in the curve of this function. The obtained curve is called the efficient function of production. If a good needs more than two factors for production ($X_1.X_2$), drawing the curve of the same function of production will be very difficult to do geometrically, so the comprehensive data analysis was developed to overcome such problems. When firms produce a product by more than two factors in this model, each firm depends on the kinds and amount of production factors that would be considered as a point in space. The dimensions of this space are determined by the number of production factors, the coordinates of points, and by the amount used from any production factors. Then selecting a firm as the studied sample and the location (point) of it is measured in accordance with other firms (the other points in space) with help from linear programming. This act should be repeated for a number of firms (points), and therefore we have a linear programming model for a number of firms.

Figure 1. Production function and efficiency level




In the current model the firms activate in accordance with the principles of least cost (efficient) are tied on the same production function, and its efficiency level is one hundred percent. In order to analysis DEA in estimating the same production, there is no required particular presupposition of the shape of function. This method measures the efficiency of a firm relative to the other firms. This calculation assumes that all firms are equal or above the production curve.

**4.1 Basic Models of DEA**:

**1- Model related to the CCR**: This is the first DEA model. In measuring the relative efficiency of studied units, Farrell focused to the symphonic sum of inputs and outputs and suggested a function for efficiency measurement as follow:

$$Efficiency = \frac{symphonic\ \ sum\ \ of\ \ outputs}{symphonic\ \ sum\ \ of\ \ inputs}$$

An important point in this regard is that this device requires a set of weights, which are used for all of the studied units. In this regard, two points should be noted. First, the value of inputs and outputs can be varied, and their measurements are difficult. On the other hand, different units may organize their operations as their outputs have the different values; thus they require different weights on performance measures. Charnz, Cooper and Rhodes (1978) recognized the above problems and in order to solve this problem they assigned their model to different inputs and outputs. If the $x_i$s are inputs, $y_i$s are outputs and $u_i$s is the weight assigned to inputs and u is the weight assigned to outputs, then CCR model may as follows:

**Model (1)**

$$\max z = \frac{\sum_{i=1}^{n} u_j y_{jr^o}}{\sum_{i=1}^{n} v_i X_i} \qquad (i=1, 2,…., n)$$

$$st{:}\frac{\sum_{j=1}^{n} u_i y_{jr}}{\sum_{i=1}^{n} v_i x_{iro}} \leq 1$$

$$v_i, u_j \geq 0$$

The above fractional programming model can be easily and with assumption of $\frac{1}{\sum_{i=1}^{n} v_i x_i}$ be converted into a linear programming model:

**Model (2)**

$$\max zo = \sum_{j=1}^{n} u_j y_{jro}.t$$

st: (r=1,2,…,n)

$$\sum_{j=1}^{n} u_j y_{jr} - \sum_{i=1}^{n} v_i x_{ir} \le 0$$

$$\sum_{i=1}^{2} v_i x_{ir} t_1$$

$$u_j, v_i, t \ge 0$$

Now, we multiply the variable t in equation 1 and then we apply the following changes:

**Model (3)**

$$tu_j = m_j tv_i = w_i$$

$$\max zo = \sum_{j=1}^{n} y_{jr}.m_j$$

$$st: \sum_{j=1}^{n} y_{jr}.m_j - \sum_{i=1}^{n} x_{ir} - w_1 \le 0$$

$$\sum_{i=1}^{n} x_{ir} w_i = 1$$

$$m_{j,} w_{i\ge} \ge 0$$

Charnz, Cooper and Rhodes (1978) in their model found an empirical relationship between the number of studied units And the number of inputs and outputs as mentioned in following formula, if the above equation did not observe cause that many of these units are on the efficient frontier and lots of units have one efficiency and distinguishing is reduced between the different models of units.

(The number of inputs + outputs) 3 $\le$ the number of evaluated units.

**4.2 Model of the BcC**:

As it was mentioned in previous discussions, the CCR model is a model by constant returns to scale and have more restrictions in comparison with the CCR model. In other words, this includes less efficient units. In Instead, understanding this problem Charnz, Cooper and Rhodes (1978) present a new model with variable returns to scale. This model can represent a constant, increasing or decreasing return to scale and its form is as follows.

**Model (4)**

$$maxz = \frac{\sum_{r=1}^{s} u_r y_{ro} + w}{\sum_{i=1}^{m} v_i x_{io}} \qquad \text{(j=1,2,…,n)}$$

$$\frac{\sum_{r=1}^{s} u_r y_{rj} + w}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1$$

$u_j, v_i \geq 0$**w: free**

The above non-linear model can be converted to a linear model by transferring denominator of objective function equal 1:

**Model (5)**

$$maxz = \sum_{i=1}^{m} u_r y_{r.} + w$$

$$\sum_{i=1}^{m} v_i x_{i.} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} + w - \sum_{i=1}^{m} v_i x_{ij} \leq 0$$

$$u_r, v_i \geq 0$$

(j=1,2,…,n)

**w: free**

As can be seen in the above model, the difference between these models with the CCR model is related to the present w mark, which is a free variable. In fact, w variable shows returns to scale of studied units. If $w\pi_0$returns to scale is increasing, and if W = 0, returns to scale is constant.

**4.3 The comparison between BCC and CCR models:**

For the comparison of returns to scale of different DEA models see the following example:

**Example:** Table 1 shows the values of output and inputs of 6 units $(u_1, \dots \dots., u_6)$ each of them have an input and an output too.

**Table 1. Data example**

| Unit name | Input | Output |
|---|---|---|
| $u_1$ | 3 | 2 |
| $u_2$ | 2 | 4 |
| $u_3$ | 4 | 7 |
| $u_4$ | 7 | 9 |
| $u_5$ | 9 | 8 |
| $u_6$ | 0 | 3 |

In general, DEA models could be divided to two groups. Models with input nature, these are models by constant output and try to minimize input. If in the above BCC model we assume $\sum_{i=1}^{m} v_i x_i = \theta$and variables maintaining with the other restrictions equal$\lambda_i$, total form of BCC model by input nature will be as follows:

**Model (6)** $(i = 1,2, \dots, m)$

$(r = 1,2, \dots, s)$

$(j = 1,2, \dots, n)$

$min\theta$

St:

$\sum_{j=1}^{n} x_{ij}\lambda_i \leq \theta x_i$

$\sum_{j=1}^{n} y_i\lambda_i \geq y_{r0}$

$\lambda_i \geq 0$

According to the above model, if $\theta\lambda_i$of a studied unit equals 1 this unit is called the efficient units. If$\theta\pi_i$, this unit will be inefficient, in other words:

$\theta_0 = 1$

$if\theta_0\pi_0 \leq 1$

In fact, firms seek to minimize its cost and this means obtaining the least possible cost to the available cost.

**4.4 BBC model with output nature:**

The model with nature is a model by fixing inputs tries to maximum outputs. The general form of this model by assuming the $\sum_{i=1}^{n} u_r y_r = \theta_0$and shoes the coefficient corresponding with other restrictions $\lambda_j$ as follow:

**Model (7)** $(r = 1,2, \dots, m)$

$max\theta_0$

$\sum_{j=1}^{n} y_{rj}\lambda_j \geq \theta_0 y_r$

$\sum_{j=1}^{n} x_{ij}\lambda_j \leq x_i$

$\lambda_j \geq 0$

But here $\theta - 1$ and $1 \leq \theta\pi\infty$ by assuming constant rate of production factors, the relative increase in the firm's product is I th and $\frac{1}{\theta}$ is rate of technical efficiency which is between zero and one. If in this case if it will be$\theta = 1$, the investigated unit is efficient and if it will be$\theta\pi_1$, it is inefficient. In other words:

$if\theta_0 = 2$

$if\theta_0 \leq 1$

## 5. Research methodology

The current study contains the following steps:

1 - Identification of goals.

2 - The inputs and outputs.

3 - Characteristics of the DEA model for evaluating goals.

4 - Software Selection for model solves.

5 - Solving model and evaluation of the results (in the fourth chapter will be mentioned).

### 5.1 Identification of evaluation goals:

1- The purpose of this research is a DEA model for evaluating the performance of 22 bank branches in Tehran province in Iran. Helping from virtual units (reference category), which are obtained on base of $\lambda$ s coefficients, we can find how to improve the inefficient units.

Obviously, there is the possibility of adding the number of studied branches because the new branches are more efficient than source branches and will be a replacement for the reference collection (virtual units). After the addition of new branches, it is likely that the amount of the efficiency level in existing branches will be less than the calculated amount determined previously.

2- We must identify the useful parameters and indices of branches and then base on decrease or increase nature of inputs and outputs in model and their efficiency by using from parametric or nonparametric methods.

3- Finally, the firm management goal will be determined in minimizing inputs or maximizing outputs. Because of firm traits, it is necessary to determine its efficiency in the short term by using the variant return to scale option and its efficiency in the long term by using constant return to scale option. It also determines a firm aim to the optimum in the short-term or long term, in order to reduce or increase or fix production levels can be determined.

### 5.2 Feature of input and output variables:

Regardless of the nature of studied units give a general guidance in selection of input and output variables as follows:

1- There was a relationship between inputs and outputs, in this case with increasing an input increasing of one or more output is expected.

2- Input and output values of all variables in all studied units are positive in each period.

3- The discussed variables will be developed based on the recent period data of studied units.

4- The selected input and output variables should be comprehensive enough to check performance of the investigated unit.

5- The chosen Input and output variables must be consistent with the management attitude in evaluating the performance of the units.

6- The values of variables must be controlled because never manipulated so easily.

7– The number of inputs and outputs should not be more than one third of DMU s, in other words: (number of inputs + number of outputs) * 3 is less than the number of studied units.

**5.3 The inputs and outputs determine:**

Selection of the correct inputs and outputs is required for effective interpretation and acceptable results of DEA analysis by management and other parts of the organization.

Inputs include controllable inputs that are under the branches management control.

1- Outstanding receivables:

2- Operating costs: (administrative and staff)

3-The cost of paid interest:

Outputs include:

1- Total income

2- Remained commitment

3- Deposits

*Outstanding receivables (pending claims):*

This index includes those unrecovered remained related to the loans, which were pended, according to bank recipe. A successful branch is a branch that has been reduced outstanding receivables.

*Operation costs (administrative & staff):*

The total of such costs administrative costs include: travel and mission expenses, transportation and personnel services, telecommunications, maintenance and minor repair of buildings and vehicles, office equipment, training, fuel, water and light.

Total personnel costs include: salaries and wages, the costs of the nation, a wonderful (aid benefits) retirement savings and bonuses and festive (gratuity) which is called personnel costs in bank definition. It can be expressed separately as a human resources, managers, experts and non-experts and is calculated in various branches of bank.

*The cost of paid interest*: All payments will be paid as profit of deposits to the customer.

*Total earnings* ($y_1$)*:* Since income and consequently profit is the necessary continuity and survival of any financial institution in the economic area and beside it servicing, support are the ultimate goals of each firm, So here the total revenue of per branch consists of received interest, received revenues cause by late as the output of the model.

*Remained commitment*: This heading includes remained commitment of the customer's loans, which is not paid and consists of different kind of loans based on Islamic contracts.

*Deposits:* This heading includes the customer's funds in their deposits. By attracting these accounts branch uses these deposits in order to provide banking facilities for other customers, as a successful branch.

Because branches are looking for increasing this index, it is defined as the output factor. In other words, the branches tend to increase the savings deposits + short-term deposits + long-term deposits.

**5.4 DEA models for reaching specific goals of evaluating:**

The model is based on method of linear programming based on data envelopment analysis model in order to maximum outputs by assuming variable returns to scale and minimize inputs by assuming constant returns to scale.

**5.5 Mathematical model of linear programming:**

In this study the model with 3 outputs, including: total revenue, the remained obligations and deposits, and 3 inputs include: Pending claims, operating costs (administrative and personnel) and interest of paid expenses by all private banks in Iran. We have formed assuming that the constant and variable returns to scale and based on maximizing output and minimizing inputs, the mathematical models of them are as follows:

A) Assuming variable returns to scale, and maximizing output (VRS-output oriented)

(i=1, 2,…24)

$$Max\ \theta_i$$
$$ST:$$
$$y\lambda \geq \theta y_i$$
$$x\lambda \leq x_i$$
$$\sum_{i=1}^{22} \lambda_i = 1,\ \lambda \geq 0$$

B) Assuming variable returns to scale and minimizing
input (VRS-input oriented).

(i=1,2,…24)

$$Min\ \theta_i$$
$$ST:$$
$$y\lambda \geq y_i$$
$$x\lambda \leq \theta x_i$$
$$\sum_{i=1}^{22} \lambda_i = 1$$
$$\lambda \geq 0$$

C) Assuming constant returns to scale of production and maximizing output (CRS-output oriented).

(i=1,2,…24)

$$Max\ \theta_i$$
$$ST:$$
$$y\lambda \geq \theta y_i$$
$$x\lambda \leq x_i$$
$$\lambda \geq 0$$

D) Assuming constant returns to scale and minimization input (CRS- input oriented)

(i=1,2,…24)

$$\min\ \theta_i$$
$$st:$$
$$y\lambda \geq y_i$$
$$x\lambda \leq \theta x_i$$
$$\lambda \geq 0$$

In the above model $\theta_i$ shows the efficiency amount of the ith firm.

y is vector of 3 for 22 from the three outputs of twenty-two firms.

x is vector 3 for 24 from the three inputs of twenty-two firms and $y_i$ is vector 3 for 1 from three outputs of ith firm $x_i$ is vector 3 for 1 from three input of ith firm and $\lambda$ is vector 24 for 1 from the weight of sets reference and $\sum \lambda = 1$ is convexity constraint which is needed for converting the constant returns to scale to variable returns to scale.

$\lambda \geq 0$ Means that if the ith firms have number one efficiency, $\lambda$ of the other firms is zero. If the ith firm has not number one efficiency, $\lambda$ vector included weight of the virtual unit and the virtual unit will be formed for the inefficient unit. In maximizingoutput mode, $y\lambda \geq \theta y_i$means amount of production in ith firm mast be same as reference firm at least.

$x_i \geq x\lambda$ Means that consuming the inputs of the ith firm could not be less than reference firm could. In minimizing input mode, $\theta x \geq x\lambda$means amount of consuming from x input in ith firm mast be same as reference firm production. $y\lambda \geq y_i$means that production amount of the ith firm must be same as reference firm extremely. After calculation of technical efficiency in different years, with the help of Malm Quist index and using following mathematical model, we will measure the total productivity of production factors over time:

$$Mo(y_w, x_w, y_t x_t) = \frac{d_0^t(y_t, x_t)}{d_0^w(y_t, x_t)} \left[ \frac{d_0^w(y_t, x_t)}{d_0^t(y_t, x_t)} * \frac{d_0^w(y_w, x_w)}{d_0^t(y_w, x_w)} \right]^{\frac{1}{2}}$$

The measured distance functions mentioned above, a combination of data and comprehensive analysis of data method is used in order to calculate the total productivity of production factors based on the constant returns to scale and by method of linear programming as follows:

So:

$$\left[d_0^t(y_t, x_t)\right]^{-1} = \max \theta$$
$$-\theta y_{it} + y_t \lambda \geq 0$$
$$x_{it} - x_i \lambda \geq 0$$
$$\lambda \geq 0$$
$$\left[d_0^w(y_w, x_w)\right]^{-1} = \max \theta$$
$$\theta y_{iw} + y_w \lambda \geq 0$$

$$x_{iw} - x_w \lambda \geq 0$$
$$\lambda \geq 0$$
$$\left[d_0^t (y_w, x_w)\right]^{-1} = \max \theta$$
$$-\theta y_{iw} + y_t \lambda \geq 0$$

So:

$$x_{iw} - x_t \lambda \geq 0$$
$$\lambda \geq 0$$
$$\left[d_0^w (y_t, x_t)\right]^{-1} = \max \theta$$
$$-\theta y_{it} + y_w \lambda \geq 0$$
$$x_{it} - x_w \lambda \geq 0$$
$$\lambda \geq 0$$

For variable returns to scale, adding $\sum_{i=1}^{n} \lambda_i = 1$ is necessary.

One of the important capabilities of the DEA method is detection the variety of efficiency in studied units. In general, the units, which are effective in CRS mode simultaneously have the pure technical performance but units which are effective in VRS mode, but only have pure technical efficiency. So the amount of efficiency in CRS mode will be considered as long- term goal and in VRS mode as the short-time goal; in the case of constant returns to scale, technical efficiency and effects of scale. Therefore, branches shows the unit amount of technical efficiency are efficiency unit according to scale. In case of variable returns to scale, technical efficiency is calculated without scale effects. The company that shows the single technical efficiency may not be efficient in terms of scale.

In this study the technical efficiency of branches has been studied based on both variable and constant returns to scale and according to maximizing output and minimizing inputs.

The values of performance indicators as output and input during the studied period based on remained in the end of year that shows the annual performance of the branches which are collected in Tables 2, 3, and 4 respectively, outputs (output data) are:

1- Total income

2-The remaining commitments

3- Deposits

Inputs are as follow:

1- Pending claims

2- Operating costs (administrative and personnel)

3- The cost of interest paid

Table 2 shows outputs and inputs in 2011 based on final remained at the end of year due to annual performance, figures are based on a billion Rials (Iranian Currency).

**Table 2. Outputs and inputs in 2011 based on final remained**

| Row | Branch code | Inputs | | | Outputs | | |
|---|---|---|---|---|---|---|---|
| | | Paid interest cost | Operational cost | Pending claims | Deposits | The remaining commitments | Total income |
| 1 | 2861 | 1094 | 1350 | 784 | 39897 | 63473 | 7227 |
| 2 | 2826 | 563 | 594 | 163 | 15012 | 32472 | 2179 |
| 3 | 2869 | 508 | 772 | 1410 | 19905 | 41828 | 8712 |
| 4 | 2817 | 1182 | 837 | 1252 | 33037 | 39380 | 5460 |
| 5 | 2816 | 580 | 450 | 1386 | 13229 | 20057 | 2733 |
| 6 | 2881 | 610 | 233 | 1144 | 7651 | 8522 | 1592 |
| 7 | 2811 | 1739 | 559 | 19 | 28418 | 39949 | 5567 |
| 8 | 2867 | 413 | 441 | 239 | 16704 | 13155 | 2628 |
| 9 | 2871 | 166 | 356 | 110 | 20382 | 14369 | 1895 |
| 10 | 2815 | 447 | 293 | 418 | 13458 | 20241 | 2902 |
| 11 | 2814 | 587 | 950 | 30249 | 34464 | 66770 | 8596 |
| 12 | 2812 | 148 | 561 | 509 | 12304 | 15191 | 2496 |
| 13 | 2888 | 426 | 343 | 1250 | 13145 | 11717 | 1596 |
| 14 | 2863 | 411 | 255 | 107 | 11288 | 12648 | 1655 |
| 15 | 2885 | 152 | 184 | 0 | 6338 | 6106 | 891 |
| 16 | 2886 | 222 | 278 | 21 | 9375 | 16727 | 3230 |
| 17 | 2882 | 232 | 237 | 19 | 8776 | 11535 | 1817 |
| 18 | 2920 | 133 | 316 | 20 | 13833 | 7715 | 1390 |
| 19 | 2919 | 120 | 241 | 0 | 9906 | 9284 | 1621 |
| 20 | 2860 | 372 | 336 | 150 | 20274 | 18623 | 1402 |
| 23 | 2925 | 2055 | 356 | 2774 | 30238 | 17580 | 2445 |
| 24 | 2864 | 42 | 284 | 190 | 6597 | 5665 | 1039 |

Table 3 shows outputs and inputs in 2012 based on final remained at the end of year due to annual performance, figures are based on a billion Rials.

**Table 3. Outputs and inputs in 2012 based on final remained**

| Inputs | | | | | outputs | | |
|---|---|---|---|---|---|---|---|
| Row DMU | Branches code | Paid interest cost | Operational cost | Pending claims | Deposits | The remaining commitments | Total income |
| 1 | 2861 | 1330 | 1421 | 1034 | 65533 | 67617 | 7889 |
| 2 | 2826 | 716 | 718 | 519 | 2127 | 32429 | 2994 |
| 3 | 2869 | 629 | 941 | 1173 | 28424 | 52360 | 0 |
| 4 | 2817 | 1542 | 1097 | 3082 | 45004 | 42240 | 5586 |
| 5 | 2816 | 783 | 568 | 781 | 20135 | 20239 | 1032 |
| 6 | 2881 | 764 | 375 | 964 | 10045 | 7822 | 1246 |
| 7 | 2811 | 2625 | 780 | 378 | 41216 | 36789 | 5696 |
| 8 | 2867 | 577 | 621 | 396 | 28883 | 21012 | 1472 |
| 9 | 2871 | 173 | 507 | 119 | 25429 | 14536 | 2023 |
| 10 | 2815 | 5371 | 594 | 362 | 2258 | 16168 | 2391 |
| 11 | 2814 | 1518 | 945 | 32848 | 36699 | 60984 | 5371 |
| 12 | 2812 | 286 | 781 | 806 | 30808 | 13272 | 2330 |
| 13 | 2888 | 515 | 1986 | 18157 | 11086 | 117405 | 687 |
| 14 | 2863 | 505 | 337 | 398 | 13224 | 9790 | 1758 |
| 15 | 2885 | 203 | 292 | 0 | 6988 | 7834 | 893 |
| 16 | 2886 | 229 | 373 | 538 | 9735 | 14955 | 2385 |
| 17 | 2882 | 365 | 317 | 6 | 12517 | 7632 | 1390 |
| 18 | 2920 | 1115 | 468 | 12 | 18050 | 10495 | 1123 |
| 19 | 2919 | 513 | 267 | 51 | 12643 | 9972 | 1374 |
| 20 | 2860 | 611 | 817 | 264 | 23120 | 13934 | 2604 |
| 23 | 2825 | 957 | 574 | 1066 | 25166 | 15411 | 2214 |
| 24 | 2864 | 65 | 382 | 255 | 30110 | 3876 | 649 |

Table 4 shows outputs and inputs in 2013 based on final remained at the end of year due to annual performance, figures are based on a billion Rials.

**Table 4. Outputs and inputs in 2013 based on final remained**

| inputs | | | | | outputs | | |
|---|---|---|---|---|---|---|---|
| Row DMU | Branches code | Paid interest cost | Operational cost | pending claims | deposits | The remaining commitments | Total income |
| 1 | 2861 | 1787 | 2036 | 2225 | 77889 | 805885 | 6685 |
| 2 | 2826 | 1090 | 1060 | 212 | 26108 | 46507 | 3144 |
| 3 | 2869 | 1065 | 1475 | 558 | 32798 | 48646 | 5662 |
| 4 | 2817 | 2001 | 1514 | 2450 | 45262 | 47109 | 4698 |
| 5 | 2816 | 1143 | 866 | 630 | 25843 | 37110 | 2509 |
| 6 | 2881 | 1101 | 521 | 719 | 22973 | 18064 | 1164 |
| 7 | 2811 | 3741 | 943 | 609 | 43787 | 38094 | 3887 |
| 8 | 2867 | 1162 | 829 | 413 | 29113 | 41037 | 2720 |
| 9 | 2871 | 377 | 985 | 151 | 30664 | 11637 | 1505 |
| 10 | 2815 | 889 | 561 | 3162 | 26106 | 37529 | 2112 |
| 11 | 2814 | 1686 | 1210 | 30318 | 59331 | 78120 | 4377 |
| 12 | 2812 | 397 | 1008 | 1085 | 18699 | 11074 | 1243 |
| 13 | 2888 | 1302 | 703 | 834 | 29309 | 14475 | 1229 |
| 14 | 2863 | 719 | 496 | 275 | 22039 | 9971 | 1012 |
| 15 | 2885 | 347 | 375 | 0 | 9830 | 9590 | 958 |
| 16 | 2886 | 334 | 460 | 448 | 12641 | 15054 | 1382 |
| 17 | 2882 | 515 | 517 | 0 | 20205 | 5333 | 732 |
| 18 | 2920 | 1429 | 717 | 567 | 35844 | 15393 | 1269 |
| 19 | 2919 | 717 | 545 | 8 | 17888 | 11359 | 1170 |
| 20 | 2860 | 930 | 1183 | 255 | 32313 | 15246 | 1711 |
| 23 | 2825 | 990 | 1010 | 872 | 42285 | 19621 | 1806 |
| 24 | 2864 | 85 | 542 | 224 | 2449 | 2635 | 385 |

The total results of output from the DEAP software based on data in the years 2011 to 2013 with constant and variable returns to scale and according to maximizing output and minimizing input data have been collected for each year separately, along with efficiency scores of individual branches in Tables 5, and 6. First investigate two tables and then based on latest results of computer calculations in 2013, efficient and inefficient branch are separated, and the situation of inefficient branch will be considered.

Table 5 shows the results of technical efficiency measurement of private banks for the period with constant and variable returns to scale assumption and based on the maximizing output by the DEA method.

**Table 5. Results of technical efficiency measurement of private banks**

| Item | | Technical efficiency score by constant return to scale assumption | | | Efficiency score by variable return to scale assumption | | |
|---|---|---|---|---|---|---|---|
| Row | Branch code | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 |
| 1 | 2861 | 1 | 1 | 1 | 0.80 | 1 | 1 |
| 2 | 2826 | 1 | 0.97 | 1 | 0.89 | 0.95 | 1 |
| 3 | 2869 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4 | 2817 | 1 | 0.84 | 0.86 | 0.78 | 0.80 | 0.85 |
| 5 | 2816 | 0.72 | 0.76 | 0.93 | 0.67 | 0.73 | 0.92 |
| 6 | 2881 | 0.83 | 0.50 | 1 | 0.67 | 0.48 | 0.97 |
| 7 | 2811 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8 | 2867 | 0.80 | 0.88 | 1 | 0.76 | 0.88 | 1 |
| 9 | 2871 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 | 2815 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11 | 2814 | 1 | 1 | 1 | 1 | 0.93 | 1 |
| 12 | 2812 | 1 | 0.94 | 0.75 | 0.98 | 0.70 | 0.75 |
| 13 | 2888 | 0.68 | 1 | 0.86 | 0.68 | 1 | 0.86 |
| 14 | 2863 | 0.98 | 0.80 | 1 | 0.84 | 0.75 | 1 |
| 15 | 2885 | 1 | 1 | 1 | 0.86 | 1 | 1 |
| 16 | 2886 | 1 | 1 | 1 | 1 | 1 | 0.99 |
| 17 | 2882 | 0.99 | 1 | 1 | 0.91 | 1 | 1 |
| 18 | 2920 | 1 | 1 | 1 | 1 | 0.97 | 1 |
| 19 | 2919 | 1 | 1 | 1 | 1 | 1 | 1 |
| 20 | 2860 | 1 | 0.81 | 0.97 | 1 | 0.63 | 0.77 |
| 23 | 2925 | 1 | 0.74 | 1 | 1 | 0.72 | 1 |
| 24 | 2864 | 1 | 1 | 1 | 1 | 1 | 0.86 |
| | | 0.95 | 0.92 | 0.97 | 0.90 | 0.89 | 0.95 |

**5.6 Solving the model and evaluating the results of technical efficiency during the period of study**

As shown in Table 5, results of computer calculations with the Deap software and by technical efficiency and their changes for the private banks with a constant return to scale assumption and based on maximizing outputs,14 branches are on the curve of efficient board, and 10 branches have varying degrees of technical inefficiency. Among them branches by (2812) and (2860) codes have the most technical inefficiency, respectively 75 percent and 77 percent.

In the maximizing output with variable returns to scale assumption in 2008, as shown in Table 5, there are 17 efficient branches and 7 inefficient branches, among them there is a branch with code of (2812) has the highest inefficiency rate that is about 75 percent.

During the study period, some branches success to increase their efficiency and the other have been reduced their efficiency. In both modes, fixed and variable returns to scale on the basis of maximizing output.

However, in Table 6 the time is the only goal of minimizing inputs, by variable returns to scale assumption, eventually there are 17 efficient branches and 7 inefficient branches, among them there is a branch by code (2812) has the most technical inefficiency rate which is about 77 percent. Assuming constant returns to scale outcome of the calculations results in the both mode by maximizing output or the minimizing input is the equal. Although the λ coefficients in, the total sum of reference can be different. Table 6 shows the results of the technical efficiency measurement of private bank branches by constant and variable returns to scale assumption and based on input minimizing DEA method.

**Table 6. Results of the technical efficiency measurement**

| Item | | Technical efficiency score by constant return to scale | | | Technical efficiency score by variable return to scale | | |
|---|---|---|---|---|---|---|---|
| Row | Branch code | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 |
| 1 | 2861 | 1 | 1 | 1 | 0.80 | 1 | 1 |
| 2 | 2826 | 1 | 0.98 | 1 | 0.89 | 0.95 | 1 |
| 3 | 2869 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4 | 2817 | 1 | 0.84 | 0.85 | 0.78 | 0.80 | 0.85 |
| 5 | 2816 | 0.67 | 0.77 | 0.94 | 0.67 | 0.73 | 0.92 |
| 6 | 2881 | 0.92 | 0.71 | 1 | 0.67 | 0.48 | 0.97 |
| 7 | 2811 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8 | 2867 | 0.76 | 0.90 | 1 | 0.76 | 0.88 | 1 |
| 9 | 2871 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 | 2815 | 1 | 1 | 1 | 1 | 1 | 1 |
| 11 | 2814 | 1 | 1 | 1 | 1 | 0.93 | 1 |
| 12 | 2812 | 1 | 0.87 | 0.77 | 0.98 | 0.70 | 0.75 |
| 13 | 2888 | 0.77 | 1 | 0.87 | 0.68 | 1 | 0.86 |
| 14 | 2863 | 0.99 | 0.87 | 1 | 0.84 | 0.75 | 1 |
| 15 | 2885 | 1 | 1 | 1 | 0.86 | 1 | 1 |
| 16 | 2886 | 1 | 1 | 1 | 1 | 1 | 0.99 |
| 17 | 2882 | 0.99 | 1 | 1 | 0.91 | 1 | 1 |
| 18 | 2920 | 1 | 1 | 1 | 1 | 0.97 | 1 |
| 19 | 2919 | 1 | 1 | 1 | 1 | 1 | 1 |
| 20 | 2860 | 1 | 0.70 | 0.83 | 1 | 0.63 | 0.77 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 23 | 2925 | 1 | 0.73 | 1 | 1 | 0.72 | 1 |
| 24 | 2864 | 1 | 1 | 1 | 1 | 1 | 0.86 |
| | | 0.96 | 0.93 | 0.97 | 0.90 | 0.89 | 0.95 |

The other changes in technical efficiency in the courses of study are as follows:

A) In both cases maximizing output or minimizing by variables return to scale assumption in following branches are number one and they also fixed (maintaining) their level of efficiency during the studied period.

Branch codes: 2861, 2869, 2811, 2871, 2815, 2814, 2885, 2886, 2920, 2919, 2864.

followed branches success to increase their efficiency and reach to the level number one of technical efficiency:

Branch codes: 2826,2881,2867, 2863,2882, 2925.

B): In the both mode, maximizing output or minimizing input with constant returns to scale assumption, followed branches by fixing (maintaining) their efficiency level also have efficiency equal number one during the studied period.

Branch codes: 2869, 2811, 2871, 2815, 2919.

Also followed branches success to increase their efficiency during the courses of study and achieved to number one level of technical efficiency.

Branch codes: 2861, 2826, 2867, 2814, 2863, 2885, 2882, 2920, 2925.

In order to provide an appropriate policy for increasing the efficiency of inefficient branches, the $\lambda$ coefficients and the reference collection must be specified. In the following tables, the $\lambda$ coefficients amount for inefficient branches have been defined and then the appropriate strategy for achieving efficient status is determined for inefficient branches.

In this part after changing main tables during 2011-2013 period, based on the calculations of Deap software, we analysis the efficient and inefficient branches according to the latest state of financial year in 2013. We layaway the branches which have number one level of efficiency and consider the inefficient branches status. Best Solution is transferring branches from inefficient state to efficient state based on either fixed or variable returns to scale and will be written as follows. Branches as reference (virtual units) will be introduced with the input or output values and the $\lambda$ coefficients for each branch. In the third row of each table (in opposite to values of inefficient branch) the current functional values (inefficient state) has indicated. In order to achieve number one level of efficiency, inefficient branch must change its status from the current state to the virtual status and transfer rate along with its change in each input or output has been mentioned at the end of each table. In fact, using this method we will reach to the research objectives and will answer to research questions that are separating branches to efficient and inefficient one, considering reference set and determine the performance scores of branches.

Table 7 shows branches and their share in determining the reference firms by fixed return to the scale and base on of the maximizing output.

**Table 7. Branches and their share in determining return to the scale**

| Row | Branch code | reference branches and Lambda coefficients | No | Efficiency Score |
|---|---|---|---|---|
| 1 | 2861 | $\lambda_1 = 1$ | 1 | 1 |
| 2 | 2826 | $\lambda_2 = 1$ | 1 | 1 |
| 3 | 2869 | $\lambda_3 = 1$ | 1 | 1 |
| 4 | 2817 | $\lambda_1 = 0.266,\ \lambda_2 = 0.350,\ \lambda_7 = 0.192,\ \lambda_{10} = 0.489$ | 4 | 0.85 |
| 5 | 2816 | $\lambda_8 = 0.863,\ \lambda_3 = 0.28,\ \lambda_{10} = 0.80,\ \lambda_7 = 0.11$ | 4 | 0.92 |
| 6 | 2881 | $\lambda_{10} = 0.104,\ \lambda_1 = 0.69,\ \lambda_{18} = 0.279,\ \lambda_7 = 0.130$ | 4 | 0.97 |
| 7 | 2811 | $\lambda_7 = 1$ | 1 | 1 |
| 8 | 2867 | $\lambda_8 = 1$ | 1 | 1 |
| 9 | 2871 | $\lambda_9 = 1$ | 1 | 1 |
| 10 | 2815 | $\lambda_{10} = 1$ | 1 | 1 |
| 11 | 2814 | $\lambda_{11} = 1$ | 1 | 1 |
| 12 | 2812 | $\lambda_1 = 0.56,\ \lambda_9 = 0.597,\ \lambda_3 = 0.67$ | 3 | 0.75 |
| 13 | 2888 | $\lambda_1 = 0.27,\ \lambda_{21} = 0.16,\ \lambda_{18} = 0.807,\ \lambda_{10} = 0.96$ | 4 | 0.86 |
| 14 | 2863 | $\lambda_{14} = 1$ | 1 | 1 |
| 15 | 2885 | $\lambda_{15} = 1$ | 1 | 1 |
| 16 | 2886 | $\lambda_3 = 0.130,\ \lambda_1 = 0.105,\ \lambda_{11} = 0.05$ | 3 | 0.99 |
| 17 | 2882 | $\lambda_{17} = 1$ | 1 | 1 |
| 18 | 2920 | $\lambda_{18} = 1$ | 1 | 1 |
| 19 | 2919 | $\lambda_{19} = 1$ | 1 | 1 |
| 20 | 2860 | $\lambda_3 = 0.15, \lambda_8 = 0.34, \lambda_1 = 0.71, \lambda_9 = 0.365, \lambda_{17} = 1.11$ | 5 | 0.77 |
| 23 | 2925 | $\lambda_{21} = 1$ | 1 | 1 |
| 24 | 2864 | $\lambda_3 = 0.76,\ \lambda_9 = 0.12$ | 2 | 0.86 |
| | | | | 0.95 |

Branches which the degree of their efficiency by constant returns to scale assumption and on the basis of the maximizing output is equal number one introduce as efficient branches and branches that their efficiency degree are lower than one are inefficient branches. To reach to efficiency degree level one, they must follow the reference patterns based on a maximizing output and increase their output up to the efficient frontier. Branch codes: 2814, 2815.2871, 452, 2811, 2869, 265, 2861, 705, 2885, 2882, 2920, 2919, 2925 have number one degree of efficiency and branch codes: 2864, 2860, 2886, 2888, 2812, 2881, 2816, 2817 with a degree of efficiency that is less than one. A branch with a separate tables its reference branches and its process is indicated.

The strategy of increasing the outputs branch by code (2881) to reach to the complete efficiency by the maximizing output assumption and constant returns to scale is shown in Table 8.

**Table 8. Strategy increasing the outpour branch**

| **Outputs** | | | **Efficiency score** | **Branch code** |
|---|---|---|---|---|
| Deposits | The remaining commitments | Total income | 0.97 | 2881 |
| 22973 | 18064 | 1164 | Amount of outputs in inefficient branch | |
| | | | Weight | Reference Branches codes |
| 26106 | 37529 | 2112 | 0.104 | 2815 |
| 77889 | 80585 | 6685 | 0.69 | 2861 |
| 35844 | 15393 | 1269 | 0.279 | 2920 |
| 43787 | 38094 | 3887 | 0.130 | 2811 |
| 23767 | 18688 | 1538 | Reference Branches process | |
| 794 | 624 | 40 | Increasing outputs for transferring desirable situation | |

Branch by (2881) code and an efficiency score of 0.97 is known as inefficient branch with constant returns to scale and on the basis of the maximizing outputs. In order to reach number one efficiency level, this branch must follow reference branch, number of them are shown in table.

Because efficiency is along with maximizing outputs therefore inefficient branches must increase their outputs as metric outputs, which have been mentioned at the last row of Table 9.

**Table 9. Branches and their share in the reference firm's appointment with variable returns to scale and based on the maximizing output**

| Row | Branch code | Reference branch and Lambda coefficients | No. | Efficiency score |
|---|---|---|---|---|
| 1 | 2861 | $\lambda_1 = 1$ | 1 | 1 |
| 2 | 2826 | $\lambda_2 = 1$ | 1 | 1 |
| 3 | 2869 | $\lambda_3 = 1$ | 1 | 1 |
| 4 | 2817 | $\lambda_3 = 0.332, \lambda_7 = 0.245, \lambda_1 = 0.359, \lambda_{11} = 0.41, \lambda_{10} = 0.23$ | 5 | 0.86 |
| 5 | 2816 | $\lambda_8 = 0.857, \lambda_{16} = 0.32, \lambda_{10} = 0.77, \lambda_3 = 0.22, \lambda = 0.012$ | 5 | 0.93 |
| 6 | 2881 | $\lambda_6 = 1$ | 1 | 1 |
| 7 | 2811 | $\lambda_7 = 1$ | 1 | 1 |
| 8 | 2867 | $\lambda_8 = 1$ | 1 | 1 |
| 9 | 2871 | $\lambda_9 = 1$ | 1 | 1 |
| 10 | 2815 | $\lambda_{10} = 1$ | 1 | 1 |
| 11 | 2814 | $\lambda_{11} = 1$ | 1 | 1 |
| 12 | 2812 | $\lambda_3 = 0.35,\ \lambda_1 = 0.008,\ \lambda_9 = 0.606,\ \lambda_{16} = 0.352$ | 4 | 0.75 |
| 13 | 2888 | $\lambda_1 = 0.19, \lambda_{21} = 0.03, \lambda_{18} = 0.767, \lambda_{10} = 0.103, \lambda_{14} = 0.109$ | 5 | 0.86 |
| 14 | 2863 | $\lambda_{14} = 1$ | 1 | 1 |
| 15 | 2885 | $\lambda_{15} = 1$ | 1 | 1 |
| 16 | 2886 | $\lambda_{16} = 1$ | 1 | 1 |
| 17 | 2882 | $\lambda_{17} = 1$ | 1 | 1 |
| 18 | 2920 | $\lambda_{18} = 1$ | 1 | 1 |
| 19 | 2919 | $\lambda_{19} = 1$ | 1 | 1 |
| 20 | 2860 | $\lambda_9 = 0.827,\ \lambda_7 = 0.158,\ \lambda_1 = 0.15$ | 3 | 0.97 |
| 23 | 2925 | $\lambda_{21} = 1$ | | 1 |
| 24 | 2864 | $\lambda_{22} = 1$ | | 1 |
| Mean | | | | 0.97 |

Branches that their efficiency score is number one are efficient branches, with variable returns to scale and based on the maximizing outputs. Branches that their efficiency scores less than number one are considered as inefficient branch, branches by following codes: 2861, 2826, 2869, 2881, 2811, 2867, 2871, 2815, 2814, 2863, 2885, 2886, 2882, 2920, 2919, 2925, and 2864. Have number one efficiency score, we take away them and branches by following codes: 2817, 2816, 2812, 2888, and 2860. The efficiency scores for above branches are less than one, a table is formed as a sample and the reference branches has been introduced so the inefficient branch in order to reach number one level of efficiency will follow these subsidiaries. Finally by variable returns to scale assumption and base on the maximizing outputs, they must increase their outputs as metric has been mentioned in the last row of the table.

The strategy of increasing the outputs of branch by code (2817) to reach to the complete efficiency by the maximizing output assumption and variable returns to scale is shown in Table 10.

**Table 10. Strategy increasing the outpour branch**

| Outputs | | | Efficiency score | Branch code |
|---|---|---|---|---|
| Deposits | The remaining commitments | Total Income | 0.86 | 2817 |
| 45262 | 47109 | 4698 | | |
| | | | Weight | Reference code |
| 26106 | 37529 | 2112 | 0.023 | 2815 |
| 59331 | 78120 | 4377 | 0.041 | 2814 |
| 77889 | 80585 | 6685 | 0.359 | 2861 |
| 32798 | 48646 | 5662 | 0.332 | 2869 |
| 43787 | 38094 | 3887 | 0.245 | 2811 |
| 52600 | 58472 | 5459 | Reference Branches Resultant | |
| 7338 | 7637 | 761 | Increasing outputs for transferring desirable situation | |

Branch by (2817) code and an efficiency score of 0.86 is known as inefficient branch with constant returns to scale and on the basis of the maximizing outputs. In order to reach number one efficiency level, this branch must follow reference branch, number of them are shown in table.

Because efficiency is along with maximizing outputs therefore inefficient branches must increase their outputs as metric, which have been mentioned at the last row of Table 11.

Table 11 shows the branches and their share in the reference firm's appointment with constant returns to scale and based on the minimizing output.

**Table 11. Input oriented DEA with CRS assumption**

| Row | Branch code | Reference branch and Lambda coefficients | No. | Efficiency score |
|---|---|---|---|---|
| 1 | 2861 | $\lambda_1 = 1$ | 1 | 1 |
| 2 | 2826 | $\lambda_2 = 1$ | 1 | 1 |
| 3 | 2869 | $\lambda_3 = 1$ | 1 | 1 |
| 4 | 2817 | $\lambda_3 = 0.297, \lambda_7 = 0.163, \lambda_1 = 0.226, \lambda_{10} = 0.414$ | 4 | 0.85 |
| 5 | 2816 | $\lambda_8 = 0.797, \lambda_3 = 0.26, \lambda_{10} = 0.73, \lambda_7 = 0.10$ | 4 | 0.92 |
| 6 | 2881 | $\lambda_1 = 0.66, \lambda_{10} = 0.10, \lambda_{18} = 0.270, \lambda_7 = 0.126$ | 4 | 0.97 |
| 7 | 2811 | $\lambda_7 = 1$ | 1 | 1 |
| 8 | 2867 | $\lambda_8 = 1$ | 1 | 1 |
| 9 | 2871 | $\lambda_9 = 1$ | 1 | 1 |
| 10 | 2815 | $\lambda_{10} = 1$ | 1 | 1 |
| 11 | 2814 | $\lambda_{11} = 1$ | 1 | 1 |
| 12 | 2812 | $\lambda_1 = 0.42,\ \lambda_9 = 0.449,\ \lambda_3 = 0.051$ | 3 | 0.75 |
| 13 | 2888 | $\lambda_1 = 0.23, \lambda_{21} = 0.14, \lambda_{18} = 0.692, \lambda_{10} = 0.82$ | 4 | 0.86 |
| 14 | 2863 | $\lambda_{14} = 1$ | 1 | 1 |
| 15 | 2885 | $\lambda_{15} = 1$ | 1 | 1 |
| 16 | 2886 | $\lambda_{11} = 0.005, \lambda_3 = 0.129, \lambda_1 = 0.104$ | 3 | 0.99 |
| 17 | 2882 | $\lambda_{17} = 1$ | 1 | 1 |
| 18 | 2920 | $\lambda_{18} = 1$ | 1 | 1 |
| 19 | 2919 | $\lambda_{19} = 1$ | 1 | 1 |
| 20 | 2860 | $\lambda_3 = 0.39, \lambda_8 = 0.26, \lambda_1 = 0.55, \lambda_9 = 0.282, \lambda_{17} = 0.860$ | 5 | 0.77 |
| 23 | 2925 | $\lambda_{21} = 1$ | 1 | 1 |
| 24 | 2864 | $\lambda_9 = 0.10, \lambda_3 = 0.65$ | 2 | 0.86 |
| | | | | 0.95 |

Branches that their efficiency score is number one are efficient branches, with constant returns to scale and based on the minimizing inputs as follow: 2861, 2826, 2869, 2811, 2867, 2871, 2815, 2871, 2815, 2814, 2863, 2885, 2882, 2920, 2919, 2925. Branches that their efficiency scores less than number one are considered as inefficient Branch, branches by following codes: 2860, 2886, 2888, 2812, 2881, 2816, and 2817. A table is formed as a sample for a branch among inefficient branches and also reference branches has been introduced so the inefficient branch in order to reach number one level of efficiency will follow these subsidiaries. Finally by constant returns to scale assumption and base on the minimizing inputs, they must increase their inputs as metric has been mentioned in the last row of Table 12.

Table 12 shows the strategy of decreasing the inputs of branch by code (2817) to reach to the complete efficiency by the minimizing inputs assumption and constant returns to scale.

**Table 12. Strategy increasing the outpour branch**

| **Inputs** | | | **Efficiency score** | **Branch code** |
|---|---|---|---|---|
| The paid cost of interest | operating costs | pending claims | 0.85 | 2817 |
| 2001 | 1514 | 2450 | Amount of input in inefficient branch | |
| | | | Weight | Reference branches code |
| 889 | 561 | 3162 | 0.414 | 2815 |
| 1787 | 2036 | 2225 | 0.226 | 2861 |
| 1065 | 1475 | 558 | 0.297 | 2869 |
| 3741 | 943 | 609 | 0.163 | 2811 |
| 1669 | 1283 | 2077 | Reference Branches Resultant | |
| 304 | 230 | 372 | decreasing inputs for transferring desirable situation | |

Branch by (2817) code and an efficiency score of 0.85 is known as inefficient branch with constant returns to scale and on the basis of the minimizing inputs. In order to reach number one efficiency level, this branch must follow reference branch, numbers of them are 4,their amount and their coefficients has been mentioned in table and because efficiency is along with minimizing inputs therefore inefficient branches must decrease their inputs as metric have been mentioned at the last row of Table 13.

**Table 13. Branches and their share in the reference firm's appointment with variable returns to scale and based on the minimizing inputs**

| Row | Branch code | Reference branch and Lambda coefficients | number | Efficiency score |
|---|---|---|---|---|
| 1 | 2861 | $\lambda_1 = 1$ | 1 | 1 |
| 2 | 2826 | $\lambda_2 = 1$ | 1 | 1 |
| 3 | 2869 | $\lambda_3 = 1$ | 1 | 1 |
| 4 | 2817 | $\lambda_{11} = 0.15, \lambda_1 = 0.260, \lambda_3 = 0.292, \lambda_7 = 0.183, \lambda_{10} = 0.250$ | 5 | 0.85 |
| 5 | 2816 | $\lambda_8 = 0.783, \lambda_{10} = 0.64, \lambda_{15} = 0.13, \lambda_7 = 0.15, \lambda_{16} = 0.125$ | 5 | 0.94 |
| 6 | 2881 | $\lambda_6 = 1$ | 1 | 1 |
| 7 | 2811 | $\lambda_7 = 1$ | 1 | 1 |
| 8 | 2867 | $\lambda_8 = 1$ | 1 | 1 |
| 9 | 2871 | $\lambda_9 = 1$ | 1 | 1 |
| 10 | 2815 | $\lambda_{10} = 1$ | 1 | 1 |
| 11 | 2814 | $\lambda_{11} = 1$ | 1 | 1 |
| 12 | 2812 | $\lambda_3 = 0.02,\ \lambda_9 = 0.448,\ \lambda_{22} = 0.201,\ \lambda_{16} = 0.349$ | 4 | 0.77 |
| 13 | 2888 | $\lambda_{10} = 0.106, \lambda_{14} = 0.398, \lambda_{18} = 0.495$ | 3 | 0.87 |
| 14 | 2863 | $\lambda_{14} = 1$ | 1 | 1 |
| 15 | 2885 | $\lambda_{15} = 1$ | 1 | 1 |
| 16 | 2886 | $\lambda_{16} = 1$ | 1 | 1 |
| 17 | 2882 | $\lambda_{17} = 1$ | 1 | 1 |
| 18 | 2920 | $\lambda_{18} = 1$ | 1 | 1 |
| 19 | 2919 | $\lambda_{19} = 1$ | 1 | 1 |
| 20 | 2860 | $\lambda_1 = 0.04, \lambda_2 = 0.08, \lambda_9 = 0.873, \lambda_7 = 0.115, \lambda_8 = 0.01$ | 5 | 0.83 |
| 23 | 2925 | $\lambda_{21} = 1$ | 1 | 1 |
| 24 | 2864 | $\lambda_{22} = 1$ | 1 | 1 |
| | | | | 0.97 |

Branches that their efficiency score is number one are efficient branches, with variable returns to scale and based on the minimizing inputs as follow: 2886, 2885, 2863, 2814, 2815, 2871, 2867, 2811, 2881, 2869, 2826, 2861, 2882, 2920, 2919, 2925, 2864. Branches that their efficiency scores less than number one are considered as inefficient Branch, branches by following codes: 2817, 2816, 2812, 2888, and 2860. Table is formed as a sample for a branch among inefficient branches and reference branches has been introduced so the inefficient branch in order to reach number one level of efficiency will follow these subsidiaries. Finally by variable returns to scale assumption and base on the minimizing inputs, they must increase their inputs as metric has been mentioned in the last row of Table 14.

The strategy of decreasing the inputs of branch by code (2817) to reach to the complete efficiency by the minimizing inputs assumption and variable returns to scale.

**Table 14. Strategy of decreasing input**

| **Inputs** | | | **Efficiency score** | **Branch code** |
|---|---|---|---|---|
| The paid cost of interest | Operating costs | Pending claims | 0.85 | 2817 |
| 2001 | 1514 | 2450 | | |
| | | | | |
| 1686 | 1210 | 30318 | 0.151 | 2814 |
| 1787 | 2036 | 2225 | 0.260 | 2861 |
| 1065 | 1475 | 558 | 0.292 | 2869 |
| 3741 | 943 | 609 | 0.183 | 2811 |
| 889 | 561 | 3162 | 0.250 | 2815 |
| 1706 | 1291 | 2090 | Reference branches resultant | |
| 249 | 222 | 359 | decreasing inputs for transferring desirable situation | |

Branch by (2817) code and an efficiency score of 0.85 is known as inefficient branch with variable returns to scale and based on the minimizing inputs. In order to reach number one efficiency level, this branch must follow reference branch, numbers of them are 5,their amount and their coefficients has been mentioned in table and because efficiency is along with minimizing inputs therefore inefficient branches must decrease their inputs as metric have been mentioned at the last row in Table 15.

**Table 15. Mean of Malm Quist index for the private branches during 2008-2009**

| Row | Branch code | Total Productivity change Tfpch | Scale productivity change Sech | Management productivity change Pech | Technology evolution Techch | Total Technical efficiency Effch |
|---|---|---|---|---|---|---|
| 1 | 2861 | 0.857 | 1.121 | 1 | 0.765 | 1.121 |
| 2 | 2826 | 0.883 | 1.062 | 1 | 0.831 | 1.062 |
| 3 | 2869 | 0.765 | 1 | 1 | 0.765 | 1 |
| 4 | 2817 | 0.791 | 1.127 | 0.928 | 0.757 | 1.045 |
| 5 | 2816 | 1.009 | 1.034 | 1.134 | 0.860 | 1.173 |
| 6 | 2881 | 0.967 | 1.094 | 1.098 | 0.805 | 1.201 |
| 7 | 2811 | 0.643 | 1 | 1 | 0.643 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8 | 2867 | 0.984 | 1.029 | 1.115 | 0.857 | 1.148 |
| 9 | 2871 | 0.742 | 1 | 1 | 0.742 | 1 |
| 10 | 2815 | 0.804 | 1 | 1 | 0.804 | 1 |
| 11 | 2814 | 0.790 | 1 | 1 | 0.790 | 1 |
| 12 | 2812 | 0.554 | 1.009 | 0.869 | 0.632 | 0.877 |
| 13 | 2888 | 0.784 | 1.001 | 1.120 | 0.700 | 1.121 |
| 14 | 2863 | 0.780 | 1.077 | 1.012 | 0.716 | 1.089 |
| 15 | 2885 | 0.770 | 1.077 | 1 | 0.714 | 1.077 |
| 16 | 2886 | 0.558 | 0.997 | 1 | 0.559 | 0.997 |
| 17 | 2882 | 0.852 | 1.045 | 1.004 | 0.812 | 1.049 |
| 18 | 2920 | 0.740 | 1 | 1 | 0.740 | 1 |
| 19 | 2919 | 0.628 | 1 | 1 | 0.628 | 1 |
| 20 | 2860 | 0.624 | 0.895 | 0.983 | 0.879 | 0.879 |
| 23 | 2925 | 0.746 | 1 | 1 | 1 | 1 |
| 24 | 2864 | 0.547 | 0.929 | 1 | 0.929 | 0.929 |
| | | 1.032 | 0.730 | 1.010 | 1.021 | 0.753 |

Table 16 shows brief mean of Malm Quist index for the bank branches by minimizing assumption.

**Table 16. Mean of Malm Quist index for the private branches during 2009-2010**

| Row | Branch code | Total Productivity change Tfpch | Scale productivity change Sech | Management productivity change Pech | Technology evolution Techch | Total Technical efficiency Effch |
|---|---|---|---|---|---|---|
| 1 | 2861 | 0.857 | 1.121 | 1 | 0.765 | 1.121 |
| 2 | 2826 | 0.883 | 1.062 | 1 | 0.831 | 1.062 |
| 3 | 2869 | 0.765 | 1 | 1 | 0.765 | 1 |
| 4 | 2817 | 0.791 | 1.32 | 0.924 | 0.757 | 1.045 |
| 5 | 2816 | 1.009 | 0.994 | 1.180 | 0.860 | 1.173 |
| 6 | 2881 | 0.967 | 1.152 | 1.043 | 0.805 | 1.201 |
| 7 | 2811 | 0.643 | 1.152 | 1 | 0.643 | 1 |
| 8 | 2867 | 0.984 | 1.001 | 1.146 | 0.857 | 1.148 |
| 9 | 2871 | 0.742 | 1 | 1 | 0.742 | 1 |
| 10 | 2815 | 0.804 | 1 | 1 | 0.804 | 1 |
| 11 | 2814 | 0.790 | 1 | 1 | 0.790 | 1 |
| 12 | 2812 | 0.554 | 1.001 | 0.875 | 0.632 | 0.877 |
| 13 | 2888 | 0.784 | 1.052 | 1.066 | 0.700 | 1.121 |
| 14 | 2863 | 0.780 | 1.081 | 1.007 | 0.716 | 0.089 |
| 15 | 2885 | 0.770 | 1.077 | 1 | 0.714 | 1.077 |
| 16 | 2886 | 0.558 | 0.997 | 1 | 0.559 | 0.997 |
| 17 | 2882 | 0.852 | 1.047 | 1.002 | 0.812 | 1.049 |
| 18 | 2920 | 0.740 | 1 | 1 | 0.740 | 1 |
| 19 | 2919 | 0.628 | 1 | 1 | 0.628 | 1 |
| 20 | 2860 | 0.624 | 0.963 | 0.912 | 0.710 | 0.879 |
| 23 | 2925 | 0.746 | 1 | 1 | 0.746 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 24 | 2864 | 0.547 | 0.929 | 1 | 0.558 | 0.929 |
| | | 1.032 | 1.026 | 1.005 | 0.730 | 1.032 |

## 6. Conclusion and Remarks

The MalmQuist index and with the minimizing, if each of its components is less than number one cause to improve of performance over time, and if its value is greater than number one indicates decreasing in performance over time.

Now, by maximizing production in Malm Rehnquist index tries to reach the total changes of productivity factors. If changes of total productivity is greater than number one cause to performance reduction over time. In this study based on values which is calculated by Malm Rehnquist index as shown in 4-10 table, according to maximizing outputs, indicate branches situation and its performance during the studied period, among 24 branches of private bank only a branch by (2816) code shows positive growth of productivity during this period averagely and the 23 remaining branches show decreasing productivity growth.

The values listed based on Malm Quist index and minimizing of inputs during the study period indicate that among the 24 branches, 23 ones show positive growth in productivity averagely, and only a branch by (2816) code shows decreasing in productivity growth. One of the affecting factors in decreasing productivity growth of branches is inefficiency of used technology. So most of branches have not used the modern equipment and facilities to improve the quality of services which is offered to their customers.

## References

Bashir A. (2000). "Assessing the Performance of Islamic Banks: Some Evidence from the Middle East", Paper presented at the ERF 8th meeting in Jordan.

Charnes, A., Cooper, W. W., Rhodes, E. (1978). "Measuring the Efficiency of Decision Making Units", *European Journal of Operational Research*, Vol. 2, No. 6, pp 429-444.

Giokas, D., (2008). "Assessing the efficiency in operations of a large Greek bank branch network adopting different economic behaviors," *Economic Modeling*, Vol. 25, pp. 559-574.

Hassan, M.K. Bashir, A.H.M. (2003), "Determinants of Islamic Banking Profitability." International

Seminar on Islamic Wealth Creation. University of Durham, UK, 7-9 July.

Mansoury A., Salehi M (2011). "Efficiency Analysis and Classification of Bank by Using Data Envelopment Analysis Model: Evidence of Iranian Bank," *International Journal of the Physical Sciences*, Vol. 6, No. 13, pp. 3205–3217.

Saleh, A. S. Rami Z. (2006), “Islamic Banking Performance in the Middle East: A Case Study of Jordan.” Working Paper 06-21, Department of Economics, University of Wollongong.

Salehi M, Manouri, A., Pirayesh R (2009). "Banking Crisis: Empirical Evidences from Iranian Banks," *Pakistan Journal of Commerce and Social Science*, Vol. 2, pp. 25-32.

Salehi M, Mansouri, A., Azary Z (2008). "Islamic Banking Practice and Satisfaction: Empirical Evidence from Iran," *ACRM Journal of Business and Management Research*, Vol. 3, No. 2, pp. 35-41.

Salehi M, Yousefi Z (2011). "Factors Affecting to Entrepreneurship in Banking Sector: Empirical Evidence of Iran," *International Journal of Academic Research*, Vol. 3, No. 2, pp. 916-921.

Salehi M., Alipour M (2010). "E-banking in Emerging Economy: Empirical Evidence of Iran," *International Journal of Economic and Finance*, Vol. 2, No. 1. pp. 201-209.

Salehi M., Mansoury A (2011). "An Evaluation of Iranian Banking System Credit Risk: Neural Network and Logistic Regression Approach," *International Journal of the Physical Sciences*, Vol. 6, No. 25, pp. 6082-6090.

Sufian, Fadzlan (2007), “The efficiency of Islamic banking industry in Malaysia: Foreign vs. domestic banks.” *Humanomics*, Vol. 23, No. 3, pp. 174-192.

Wei Q (2001). "Data Envelopment analysis” *Chinese Science Bulletin*, Vol. 46 No. 16, pp. 1321-1332.

Wu, D., Yang, Z., Liang, L., (2006). "Using DEA–neural network approach to evaluate branch efficiency of a large Canadian bank", Expert Systems with Applications, Vol. 31, pp. 108-115.

Yudistira, Donsyah (2003), “Efficiency of Islamic Banks: an Empirical Analysis of 18 Banks,” Finance No. 0406007, Econ WPA.