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Improving the Banks Shareholder Long Term Values by Using Data Envelopment Analysis Model

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ABSTRACT

Given the rapid development of the banking sector, it is reasonable to expect that the performance of banks has become the centre of attention among bank managers, stakeholders, policy makers, and regulators. In order to maximizing the shareholders' satisfactory level, two bank efficiency measurement approaches, i.e. the production approach and the user cost approach, which are financial evaluations, are employed. The evaluations are done by means of data envelopment analysis method. The proposed methodology is run on the 15 privet bank branches in Markazi province. By using this approach, four regions that show the various performances are obtained. In addition the status of returns to scale for each bank branch is calculated.

1 Introduction

As financial institutions around the world become more internationalized and globalized, the trading activities of the financial industry continue to rise. The market structure is further complicated due to the diversity and innovativeness of products available. Therefore, the risk of investment for financial institutions likewise increases [1]. With such changes in the economic state, banks no longer have the sole role of being the purely monetary intermediary [2]. They must now develop a whole range of investment channels in order to survive under such conditions. The banking industry plays an increasingly critical role in the development of the financial system. The service efficiency and quality provided by banks not only have significant effects on the economic growth of a country but also influence every aspect of people's daily lives [3]. The primary role of a bank is to transform savings efficiently into investments. Successful investments build up the capital in the economy and foster future growth. Although banks are not the only financial institutions, they play a dominant role in the local and regional economy [4]. Berger and Humphrey [5] reported that most of the studies on bank efficiency (about 95%), focused on developed countries and 70% of them are of the US. Many researchers suggest that more research should be done about comparing and measuring efficiency from different countries to provide global financial stability [5-7]. A substantial body of literature has emerged on bank efficiency [8, 9]. Studies dealing with bank efficiency focus on methodological issues (e.g. [10]), estimating bank efficiency by focusing on countries differentiations (e.g. [11-15]) or evaluating

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and analysing the relationship between bank efficiency and shareholder value creation [8, 15] and also the influence of central banks' supervision [16, 17].

The fundamental approaches to the productive efficiency of banks are two; the non-structural understanding that considers the relations between performance indicators and the characteristics of the governance, and the structural perspective, which presupposes theory option around the optimization concept. In concrete, the older bank efficiency literature applies the traditional micro economic theory of production of non-financing companies to banking [18]. It will be focused on technical efficiency. Recent works integrates the theory of financial intermediation with the microeconomics of bank production [19] and they are focused on economic efficiency (e.g. [9]). With the modern frontier efficiency methodologies, including parametric and non-parametric approaches, typically regarded as good instruments for analysing the performance of financial institutions, the growth in bank efficiency research has been explosive. Two different frontier analysis methods are used to measure bank efficiency. These are non-parametric and parametric methods [5]. The principal parametric method is stochastic frontier approach, which uses econometric methods; while the principal non-parametric method is Data Envelopment Analysis, which uses mathematical programming [20]. Both techniques utilize all the information contained in the data [21]. Because the banking system is a multiple-input and multiple-output organization, an appropriate multiple criteria evaluation technique is essential to comprehensively and objectively measures its efficiency. Data envelopment analysis is a well-known approach for measuring the performance of decision making units [22]. This method is also commonly used in the efficiency measures of banking systems [1]. A large number of studies of Chinese bank efficiencies using DEA have been published in Chinese language journals, and there are also many studies in international scholarly journals for non-Chinese readers (e.g., [23-26]). As a result, since DEA has the ability of using multiple inputs and outputs DEA method is preferred in this study. Data Envelopment Analysis is widely used to evaluate bank's efficiency [27, 28] and has become as one of the major research areas in measurement of the relative efficiency of banks [29, 30]. Several studies have been published in the recent years, however, devoted to measurement of efficiency at the branch level. Sherman and Gold [31] were the first to evaluate bank efficiency at the branch level using data from 14 branches of a US bank – that too at a time when using DEA to measure efficiency was itself a novelty. Some of the important papers on branch level efficiency that followed include Parkan [32] and Schaffnit et al. [33] for a Canadian bank; Oral and Yolalan [34] for a Turkish bank; Tulkens [35] for a Belgian bank; Sherman and Ladino [36] for a US bank; Tulkens [35] and Halme et al. [37] used DEA for efficiency analysis. Both of these two studies relaxed the convexity assumption about the technology and performed a Free Disposal Hull (FDH) analysis. Isik and Hassan [38], Casu and Molyneux [39], Ismail et al. [40], Ebrahimnejad et al. [3] and Juo et al. [41] employed DEA method.

The choice of inputs and outputs is perhaps the most important task in employing DEA to measure the relative efficiency of the DMUs [42]. Two approaches are widely used to identify a bank's inputs and outputs: the production approach [43, 44] and the intermediation approach [43, 45, 46]. There is no commonly accepted approach for measuring efficiency in the banking industry, which is why different efficiency scores are obtained using similar data [5]. Under the production approach, banks are treated as a firm to produce loans, deposits, and other assets by using labor and capital. However, banks are considered as financial intermediaries to transform deposits, purchase funds and labor into loans and other assets under the intermediation approach. More specifically, deposits are treated as an input under the production approach and an output under the intermediation approach.

In this paper, we want to analyze the financial performance of 15 privet bank branches in Markazi province. The aim of this analysis is to find the way to maximize the banks shareholder long-term

values. For these purposes two well-known methods, i.e. production approach and user cost approach are applied. In this manner, four categories of branches are determined. These assessments are done based on the modified ERM method that is proposed by [47]. In addition, the status of returns to scale for each bank branch is also calculated. These values help the managers to decide whether try to increase the resources or not.

2 Models and Methodologies

Here, we review some notions and methodologies that are basics of the proposed methodology of analysing bank performance in financial aspects.

2.1 Main roles and functions of banks

Bank behaviour models are discussed in order to examine whether the specification of input and output factors in DEA applications is in consistence with the criteria upon which banks make decisions. Recent banking literature stresses the role of a bank as a financial intermediary. This role can be used to explain the rationale for existence of a bank, as being discussed above. In addition, a bank is a money creator in the macro-economic system: this role distinguishes a banking firm from other financial intermediaries such as insurance companies or mutual funds [48].

2.2 Main bank behaviour models

This section aims to provide an insight into two of four main approaches which are most popularly employed in DEA efficiency studies to specify banks' input factors and output factors. They are production approach and user cost approach.

2.2.1 The production approach

This approach was pioneered by Benston [49]. The study was based on a cost analysis done by the employees of the banks in the First Federal Reserve District in the US in 1957. Therefore, it adopts the view of employees in describing the banking operation. Under the production approach, banking firms are characterized as service producers aiming at minimizing operating costs. Inputs under the production approach thus include only physical variables such as labour, premises and fixed assets, space or information systems and their associated costs. Interest expenses are excluded from this approach since the focus is on operating processes. Outputs are defined in terms of what a bank that incurs operating costs, referring to all banking services. A bank's output factors could be categorized into six groups including demand deposits, time deposits, mortgage loans, instalment loans, business loans and securities. Berger and Humphrey [5] argued that most of banks' operating costs are incurred through the processing of loan and deposit documents as well as transactions. Therefore, output factors are best measured by the number of transactions or loan and deposit documents processed over a given period. However, such detailed flow data are usually only available in the context of an internal evaluation. The stock variables such as the average number of accounts are thus often used with the assumption that flows are proportional to stocks [50]. The production approach gains credit in justifying the significance of deposits in the banking industry when placing deposits on the output side. Benston [49] argued that deposit customers benefit from the banking services such as security, safekeeping and liquidity and are willing to pay for these services in form of interest spread.

2.2.3 The user cost approach

The user cost approach is popularly attributed to the work of Hancock [51-53]. User costs of financial services are constructed as the net price of holding one-dollar unit per period and thereby linking two discrete periods. Other facets of this approach are developed by Christensen and Jorgenson [54] and Fixler and Zieschang [55] with variations in calculating user costs. Under the user cost approach, banking firms are described as producers of financial services with the aim to minimize the user costs of liabilities and assets, or maximize the economic return. The user cost approach is developed owing to the concerns on opportunity costs of holding financial assets or liabilities over a certain period. The user costs of financial services produced from financial liabilities can be calculated as the subtraction of financial costs less opportunity costs of using the funds; the user costs of financial services produced from financial assets can be calculated as the subtraction of opportunity costs less financial return from the assets. Since user costs are considered from the perspective of the producer, the construction of user costs is based upon not only interest rates (either paid out or received) but also reserve requirements, expected capital gains or losses and deposit insurance rates.

2.2 Data envelopment analysis methodology

Data envelopment analysis methodology is a well-known approach to evaluate the efficiency of a group of homogeneous decision making units [56, 57]. In continue we review some important DEA models and notions that are applied to complete the analysing.

2.2.1 CCR and BCC Models

Assume that there are n DMUs where each $DMU_j (j = 1,...,n)$, uses m inputs, $x_{ij} (i = 1,...,m)$ to produce s outputs, $y_{rj} (r = 1,...,s)$. Also, assume that data set are positive and deterministic. The well-known DEA model CCR proposed by [58] to measure the efficiency of DMUs. The CCR model follows the CRS technology and belongs to the family of radial models. In order to measure the relative efficiency of DMU under evaluation, DMU_p, the CCR model is as Model (1). The value of θ_p^{CCR} lies between zero and one and when θ_p^{CCR} =1 then DMUp is called efficient and otherwise is called inefficient.

$$
\begin{aligned}
&\theta_p^{CCR} = \min\ \theta \\
&s.t. \\
&\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta x_{ip}, \qquad i = 1,...,m, \\
&\qquad\qquad\qquad\qquad\qquad\qquad \text{(CCR Model)} \\
&\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{rp}, \qquad r = 1,...,s, \\
&\lambda_j \ge 0, \qquad\qquad j = 1,...,n.
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
&\theta_p^{BCC} = \min\ \theta \\
&s.t. \\
&\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta x_{ip}, \qquad i = 1,...,m, \\
&\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{rp}, \qquad r = 1,...,s, \\
&\sum_{j=1}^{n} \lambda_j = 1, \\
&\lambda_j \ge 0, \qquad j = 1,...,n.
\end{aligned}
\qquad (2)
$$

(BCC Model)

To measure the efficiency of DMUs under variable return to scale technology [59] presented the BCC model. This BCC model appears in Model (2) and has one more constraint $\sum_{j=1}^{n} \lambda_j = 1$ than the CCR model. Like CCR, the BCC model belongs to the family of radial models and the value of θ_p^{BCC} lies between zero and one and when θ_p^{BCC}=1 then DMUp is called efficient and otherwise is called inefficient. Also, we always have $\theta_p^{CCR} \le \theta_p^{BCC}$.

2.2.2 Modified ERM model

The CCR and BCC models only evaluate DMUs and determine the efficient and inefficient DMUs. While in many situations, usually there is more than one efficient DMU and we have to use some ranking methods to increase the discrimination among DMUs. For this purpose, Izadikhah et al. [47] proposed the modified ERM method. This model is a non-radial DEA model and can distinguish some infeasibility that conventional DEA models do not take them. In addition, this model can provide a complete ranking among DMUs. The modified ERM model is an integer-programming model that is stated as Model (3):

$$R_p^{MERM} = \min \frac{\frac{1}{m}\sum_{i=1}^{m}\theta_i}{\frac{1}{s}\sum_{r=1}^{s}\varphi_r}$$

$$s.t.$$

$$\begin{aligned}
&\sum_{\substack{j=1\\ j\neq p}}^{n}\lambda_j x_{ij} \le \theta_i x_{ip}; && i=1,..,m,\\
&\sum_{\substack{j=1\\ j\neq p}}^{n}\lambda_j y_{rj} \ge \varphi_r y_{rp}; && r=1,..,s,\\
&\theta_i - 1 \le M\delta; && i=1,..,m,\\
&-\theta_i + 1 \le M(1-\delta); && i=1,..,m,\\
&-\varphi_r + 1 \le M\delta; && r=1,..,s,\\
&\varphi_r - 1 \le M(1-\delta); && r=1,..,s,\\
&\delta \in \{0,1\},\\
&\theta_i, \lambda_j \ge 0; && \forall i, j.
\end{aligned} \tag{3}$$

In model (3), the binary variable δ guarantees that only one group of two groups of constrains is held:

$$(I): \begin{cases} \theta_i \le 1; & i=1,..,m,\\ \varphi_r \ge 1; & r=1,..,s, \end{cases} \quad \text{or} \quad (II): \begin{cases} \theta_i \ge 1; & i=1,..,m,\\ \varphi_r \le 1; & r=1,..,s, \end{cases}$$

The value of R_p^{MERM} shows the modified ERM (super) efficiency score for DMUp and can get positive values lower than, equal to or upper than one. Based on the value of R_p^{MERM} we can rank all DMUs.

2.2.3 Return to scale

In fact, RTS can provide useful information on the optimal size of DMUs, [60]. It is used to determine whether a technically efficient DMU can improve its productivity by resizing the scale of its operations, [61]. In economics, RTS are sometimes defined using the notion of elasticity that exhibits the rate of proportional variation of outputs with respect to the proportional variation of inputs in a local sense, [61]. However, DEA categorizes decision-making units into three classes according to their RTS: Constant RTS (CRS), Increasing RTS (IRS), and Decreasing RTS (DRS). The RTS classification of DMUs can be used to improve the operation of the units. Fare et al. [62] proposed a two stages methodologies for measuring the return to scale. In the first stage, the models CCR and BCC should

be solved. If $\theta_p^{CCR} = \theta_p^{BCC}$ then the DMUp have constant return to scale. Otherwise, the following CCR-BCC Model (4) should be solved for DMUp:

$$\begin{aligned}
&\theta_p^{CCR-BCC} = \min\ \theta \\
&s.t. \\
&\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta x_{ip}, \qquad i = 1,...,m, \\
&\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{rp}, \qquad r = 1,...,s, \\
&\sum_{j=1}^{n} \lambda_j \le 1, \\
&\lambda_j \ge 0, \qquad j = 1,...,n.
\end{aligned} \tag{4}$$

Based upon the Model (4), and the results of Models (1) and (2), the type of RTS regarding the DMUp is determined by the following classification:

a) Increasing RTS $\Leftrightarrow\ \theta_p^{CCR} = \theta_p^{CCR-BCC} < \theta_p^{BCC}$

b) Constant RTS $\Leftrightarrow\ \theta_p^{CCR} = \theta_p^{BCC}$

c) Decreasing RTS $\Leftrightarrow\ \theta_p^{CCR} < \theta_p^{CCR-BCC} = \theta_p^{BCC}$

3 Evaluating Privet Bank Branches

Efficiency evaluation of commercial banks is an important application area of DEA. Seiford and Zhu [63] by means of data envelopment analysis evaluated the efficiencies of listed commercial banks of US. The first stage is the profitability performance, while the second stage is the market performance. The primary role of a bank is to efficiently transform savings into investments. In this paper, we decided to evaluate 15 branches of some privet banks, which are located in Markazi province. The data are belonging to the period 2015 to 2016 and are obtained from a direct survey of the banks.

3.1 Inputs and outputs

The main focus of evaluating the privet bank's performances is to maximizing shareholder values in the long term and in order to achieve this goal the bank branches are supposed to minimizing operating costs and user costs of holding such liabilities and assets. For this reason we assess the performance of bank branches by means of Production approach, User cost approach separately, and then we cluster the banks based on the shareholder values of satisfaction. So, here three variables x_1: Number of (full time equivalent) employees; x_2: Fixed assets and x_3: Physical capital are considered as inputs. Also, four variables y_1: Number of loan accounts; y_2: Number of deposit accounts; y_3: Loans and y_4: Demand deposits are considered as outputs. The variables are shown in Table 1.

Table 1: The selected variables

Methods	Inputs	Outputs
Production approach	x_1 : Number of (full time equivalent) employees	y_1 : Number of loan accounts
	x_2 : Fixed assets ($)	y_2 : Number of deposit accounts
User cost approach	x_1 : Number of (full time equivalent) employees	y_3 : Loans ($)
	x_3 : Physical capital ($)	y_4 : Demand deposits ($)

These variables have been selected from the two above mentioned bank behaviour models, i.e. Production approach and User cost approach. Table 2 provides the data set.

Table 2: Data set

	Inputs			Outputs			
DMU	**Employee**	**Fixed assets ($)**	**Physical capital ($)**	**Deposit**	**Loan**	**Number of Deposit Account**	**Number of Loan Account**
P1	10	6053951465	6053951465	88805878901	1993007803	785	196
P2	11	2311200000	2568000000	80331044539	1055807557	1435	263
P3	9	5431216733	4937469757	54096733976	2690841517	892	201
P4	12	11567153830	3770421226	15955300000	2355221657	2531	506
P5	10	1410916000	1640600000	17683400000	482208907	2611	261
P6	12	5658855476	5602827204	78190486757	5208690656	2026	304
P7	12	2694760350	2961275110	64369886355	2747849141	1574	157
P8	9	2386722448	2566368224	69637198068	2828669697	2485	334
P9	12	2231200000	2231200000	11692900000	1328500591	1084	121
P10	10	4699132537	6102769529	60218928210	1680887461	1553	830
P11	11	9153960299	1888260128	12410400000	5280591962	1799	165
P12	9	4097826724	5122283405	66308613647	1778579540	2155	187
P13	10	2878580958	3943261586	69911601153	4375465213	1246	208
P14	10	3649892232	4451088088	46755501501	1988945346	2768	136
P15	11	3789750437	4075000470	28471320966	3160433116	710	178

Table 3 provides descriptive statistics on the inputs and outputs of 15 bank branches in 2015-2016, and involves the Mean, Standard Deviation, Minimum and Maximum of all inputs, intermediate products and outputs.

Table 3: Descriptive statistics of 15 privet bank branches

Variable	Employee	Fixed assets ($)	Physical capital ($)	Deposit	Loan	Number of Deposit Account	Number of Loan Account
Mean=	10.53	4534341299	3860985079	50989279605	28863720220	1710.266	269.8
Std. Dev. =	1.125	2770692295	1503868238	26911872765	14033030838	694.998	182.847
Min =	9	1410916000	1640600000	11692900000	10558075569	710	121
Max =	12	11567153830	6102769529	88805878901	52805919623	2768	830

The wide variation in fixed assets and Physical capital and in Deposit and Loan indicated inefficient management of resources and outcomes between branches, implying a great scope for improving the performance in the banking system.

3.2 Results and analysis

Main reasons why DEA, an efficiency measurement technique for organizations with multiple inputs and outputs [64, 65], is used frequently are:

- The fact that non-inclusion of constraints on the functional form of the production relationship between the inputs and outputs and the non-existence of a theoretical constraint in the selection of variables make the results more reliable,
- The fact that the input-output relationship explains the multifaceted aim (the fact that it produces the total factor productivity which is defined as the structural indicator aimed towards the sector on controllable variables and has the technical efficiency indicator which is defined as the management performance on the plane of controllable variables),
- It allows for the efficiency analysis of decision-making bodies without assigning any weight to the input and output values,
- It combines the preferences of decision-makers with its simultaneous implementation on multiple inputs and multiple outputs,
- It allows for an evaluation related to how much reduction must be made in the input amount and how much increase must be made in the output amount of inefficient decision-making bodies.

The results of the modified ERM model based on the two viewpoints, i.e. Production approach and User cost approach are presented in Table 4. Results shows that based on the Production approach five privet banks are recognized as efficient and the privet bank "P8" has gained the first rank in this issue. The remaining 10 branches are inefficient. In addition, Table 4 indicates that based on the User cost approach four privet banks are recognized as efficient and the privet bank "P10" has gained the first rank in this issue. The remaining 11 branches are inefficient. It is notable to see only two bank branches i.e. "P5" and "P8", are performed efficiently in both two viewpoints.

Table 4: Results of Efficiency and Ranking

	Production approach		**User cost approach**	
	Score	**Rank**	**Score**	**Rank**
P1	1.0688	4	0.2647	13
P2	1.071	3	0.5404	6
P3	0.6499	9	0.3236	11
P4	0.2571	14	0.5632	5
P5	1.077	2	1.3316	2
P6	0.8852	6	0.4781	8
P7	0.7359	7	0.4086	10
P8	1.1224	1	1.0573	3
P9	0.235	15	0.321	12
P10	0.4315	13	1.3652	1
P11	0.7316	8	0.2447	15
P12	0.5505	10	0.4973	7
P13	1.0531	5	0.4448	9
P14	0.4982	11	1.0012	4
P15	0.4334	12	0.2491	14
Average=	0.72004		0.606053	
Std. Dev. =	0.312888		0.387056	
Min=	0.235		0.2447	
Max =	1.1224		1.3652	

Statistical measures for the Production approach and User cost approach are summarized in the last four rows of Table 4. The average value of Production approach score was 0.72 and varies from 0.24 to 1.12 with the standard deviation of 0.31. The results become worth in User cost approach that indicates a substantial inefficiency between the branches in User cost criteria.

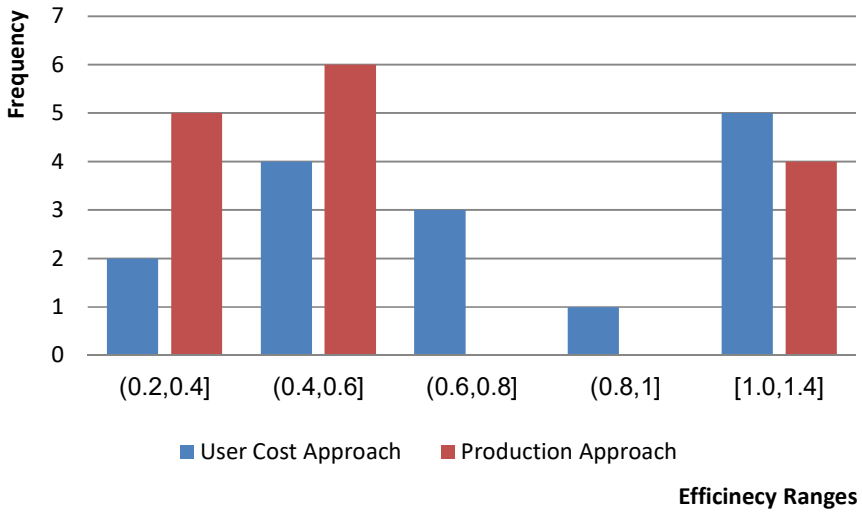

Fig. 1: The distribution of obtained efficiencies

The distributions of the obtained efficiencies are shown in Fig. 1. The more bank branches in higher efficiency ranges in user cost approach shows that the banks are more successful in this viewpoint and they should try more to improve their performance in the production approach. There are some big differences between the rank positions in two approaches. For example, consider "P14" that has gained the rank 11 and 4 in two approaches. We can conclude that, "P14" has had a good performance in dealing with small number of customers but with a huge amount. In average, bank branches have a better performance in Production approach than in User cost approach.

Now, we can find the branches that maximize the shareholder values in the long term. As we said, the branches that have good performances in Production approach and User cost approach can maximize the shareholder values in the long term. For this purpose, we cluster the branches based on their performances.

Fig. 2 shows the obtained categories by means of proposed models on data set. In Fig. 2, the value of 0.72 for user cost approach and 0.61 for production approach are considered as thresholds. These values are the average of efficiency scores. By this manner, four regions are calculated. The branches in the region 1 have the best performance in both Production approach and User cost approach. We can see two branches, i.e. branch 5 and branch 8, are belong to the region 1 and they maximize the shareholder values. Two next regions, i.e. region 2 and 3, have the next degree of importance. The branches

In these regions perform relatively well at one of two mentioned viewpoints. Two out of all branches belong to region 2 while 6 of them belong to region 3. Finally, five of them have a weak performance in both two approaches. The results also show that 27% of branches have a relatively acceptable performance in production approach. Therefore, the branches should improve the number of deposit and loan accounts along with their amounts.

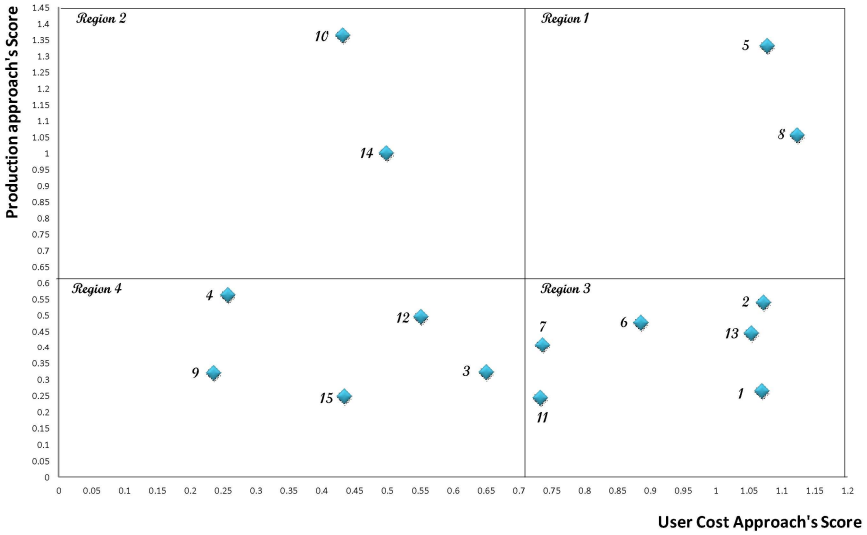

Fig. 2: Obtained Categories

In order to determine the status of DMU's return to scale (RTS), the models (1), (2) and (4) are applied. The results of the return to scale for the User cost approach, as seen in Table 5, showed that from the total of 15 studied privet bank branches: 6 branches, i.e. 40%, are operating at constant returns to scale, showing the optimum scale of their practices. 8 branches, i.e. 53.3%, are operating at increasing returns to scale; and one branch, i.e. 6.7%, are operating at decreasing returns to scale. This indicates that, based on the user cost approach, most privet banks in the studied area are operating above their optimal scale. Therefore, the more proportionate increase in all inputs, the more proportionate increase in the output.

Table 5: The returns to scale status for User cost approach

DMU	CCR Score	BCC Score	CCR-BCC Score	RTS Status
P1	1	1	1	CRS
P2	1	1	1	CRS
P3	0.8012356	1	0.8012356	IRS
P4	0.4217415	0.75	0.4217415	IRS
P5	1	1	1	CRS
P6	0.9848123	1	1	DRS
P7	0.8119248	0.8217005	0.8119248	IRS
P8	1	1	1	CRS
P9	0.2853186	0.816937	0.2853186	IRS
P10	0.7082458	0.9	0.7082458	IRS
P11	1	1	1	CRS
P12	0.8547909	1	0.8547909	IRS
P13	1	1	1	CRS
P14	0.6003587	0.9	0.6003587	IRS
P15	0.6269084	0.8333118	0.6269084	IRS

The results of the return to scale for the production approach, as seen in Table 6, showed that from the 15 studied privet bank branches. 4 branches, i.e. 26.7%, are operating at constant returns to scale, showing the optimum scale of their practices. 10 branches, i.e. 67.7%, are operating at increasing returns to scale; and one branch, i.e. 6.7%, are operating at decreasing returns to scale. This indicates that, based on the production approach, most privet banks in the studied area are operating above their optimal scale. Therefore, the more proportionate increase in all inputs, the more proportionate increase in the output.

Table 6: The returns to scale status for production approach

DMU	CCR Score	BCC Score	CCR-BCC Score	RTS Status
P1	0.3480367	0.9	0.3480367	IRS
P2	0.6284765	0.856184	0.6284765	IRS
P3	0.4224245	1	0.4224245	IRS
P4	0.8612014	1	1	DRS
P5	1	1	1	CRS
P6	0.6300692	0.75	0.6300692	IRS
P7	0.4836587	0.7753847	0.4836587	IRS
P8	1	1	1	CRS
P9	0.3389313	0.8011677	0.3389313	IRS
P10	1	1	1	CRS
P11	0.5915796	0.8181818	0.5915796	IRS
P12	0.8659977	1	0.8659977	IRS
P13	0.4828167	0.9	0.4828167	IRS
P14	1	1	1	CRS
P15	0.288897	0.8181818	0.288897	IRS

In addition, the results show that, in seven bank branches the statuses of returns to scale remain unchanged in both two approaches.

4 Conclusion

Evaluating the overall performance and monitoring the financial condition of commercial banks has been the focus of numerous research studies. The banking industry plays an increasingly critical role in the development of the financial system. The service efficiency and quality provided by banks not only have significant effects on the economic growth of a country but also influence every aspect of people's daily lives. A large and growing body of literature has focused on bank efficiency. Data Envelopment Analysis is widely used to evaluate bank's efficiency. As a result, in this paper we applied the modified ERM model to evaluate 15 privet bank branches in Markazi province. For this purpose, we followed the primary goal that was maximizing the shareholders' satisfactory level and chose two financial bank efficiency measurement approaches, i.e. the production approach and the user cost approach. These approaches led to find four regions for all branch performances. In addition, the status of the returns to scale for each bank branch that help manager to decide about the future of the bank is calculated.

The subject of banking efficiency is a wide subject and for future work, one can measure the financial

congestion of resources by using DEA models. For another work, one can compare the performance of privet and governmental banks.

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